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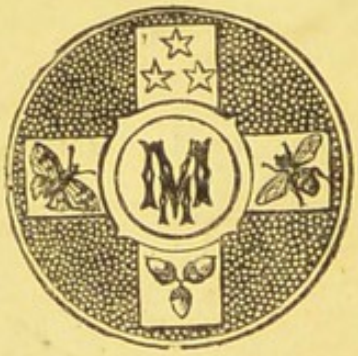
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A

HANDBOOK OF VACCINATION.



A HANDBOOK

OF

VACCINATION.

BY

EDWARD C. SEATON, M.D.

Medical Inspector to the Privy Council.

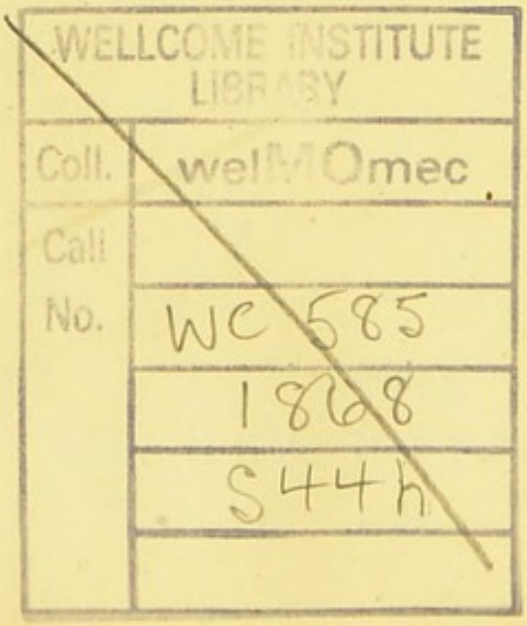
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PREFACE.

In planning this book I had two purposes mainly in view—intimately associated with each other.

The first of these was to provide a text-book on the science and practice of Vaccination for the use of my younger professional brethren, and of medical students.

In the constant intercourse which, from the nature of my office, I have for many years past had in reference to this subject with medical friends who are interested in it, and of course especially with that large part of the profession who are engaged as Public Vaccinators, I have been repeatedly asked for advice on various points connected with the practice and use of Vaccination, and have many times heard the wish expressed that there existed some book in which the whole subject could be found fully treated.

It is a curious fact that since the publication, in 1809, of the enlarged edition of Bryce's "Prac-

tical Observations on the Inoculation of the Cow-pox," there has been no separate work published in the United Kingdom which treats completely of Vaccination. To the different branches of the subject contributions of the utmost value have been made—to the natural history of Cow-pox, to its affinities with diseases in other animals and with Small-pox in man, to the practice of Vaccination, to the determination of the hygienic value of that practice and the circumstances by which this is affected: but no book giving a full but concise view of the whole subject. And although, of course, a general view of Vaccination has been presented in systematic works on medicine, in medical dictionaries, cyclopædias, &c. it was impossible that so large a subject could be considered with the requisite fulness in the necessarily limited space that in such works could be allotted to it.

I was moreover particularly induced to attempt this work from noticing that by many practitioners *the operation* of Vaccination was not, as it appeared to me, regarded at its real value. Seemingly so simple in itself, many of the niceties and cautions which so greatly influence success, and the value of which is so well known to the practised vaccinator, have been unheeded in general practice, and I could not but deem it of very great im-

portance that attention should be called, or recalled, to them. I had this object especially in view in the practical section of an Article on Vaccination which I contributed to Reynolds's "System of Medicine:" and in the larger treatment of this part of the subject in the present work, I have taken great pains in the same direction.

My other purpose had reference to such assistance as I thought I might be able to give to those engaged in the administration of the system of Public Vaccination established in England. In this part of the book I have had to treat of matters partly professional, and partly administrative. The administrative sections of the work might at first sight appear to concern only a portion—itself, however, not an inconsiderable portion—of the medical practitioners of the kingdom, yet it is clear that the principles on which a public system of Vaccination should be based are of interest and importance to the whole profession. There are, besides, very many others than professional men to whom a right understanding of these principles is indispensable, and notably to the Guardians of Unions on whom it devolves to make the local arrangements. It is always a difficult matter to present a technical subject so as to make it thoroughly intelligible to those who

have had no professional training; but the principles are broad principles, and I trust I may have explained them with sufficient clearness.

Each division of the United Kingdom has its own Vaccination law. It is the system in use in England to which this book refers: but England in legal phraseology includes always the principality of Wales, and throughout the book, whenever I have mentioned "England," I must be taken to have said "England and Wales." Desirous that the book should include all that a Public Vaccinator or any other person interested in our public system might wish to refer to, I have reprinted in an Appendix the Vaccination Act, together with all the Regulations, &c. in force relative to Public Vaccination. I have also appended to the General Index, an Index to the Act, which I trust may be found useful, and in the preparation of which I have to acknowledge the kind assistance of Mr. J. B. Hutchins, of the Privy Council Office.

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HANDBOOK OF VACCINATION.

CHAPTER I.

Of the Natural Cow-Pox.

1. Cow-pox in the Cow.—VACCINIA, OR THE COW-POX—the Variolæ Vaccinæ of Jenner—is never met with in the human subject but as the result of inoculation. It is only in the cow and in the horse that we have any certain or definite knowledge of it as a natural disease, though it probably does occur as such in some other animals.

2. General description.—The natural history of Vaccinia in the cow has been studied more or less by various observers, but by none so accurately or so comprehensively as by our distinguished countryman, ROBERT CEELY; and it is his account of the disease which I shall chiefly follow. It is a specific eruptive disease, of the vesicular order, the eruption not being general over the body, but limited (except as the result of accidental or casual inoculation) to the udder and teats. It is met with from time to time, either sporadically, or (less commonly) as an epizöotic. It particularly attacks

milch cows: indeed, as a spontaneous disease, it occurs almost, if not quite, exclusively when the animal is in that condition.[1] Young cows and milch heifers appear to be more subject to it than older cows. In its earliest stages it is attended with so little general, or obvious local, disturbance that, in the animals first attacked in a dairy, these stages seldom come under skilled observation; and, as the fluid of the vesicles is very infective, and the disease is thus readily conveyed from animal to animal by the milkers, it is difficult to distinguish, in animals subsequently attacked, between those exhibiting the natural disease and those who have been infected casually by inoculation. The distinction, indeed, is not of any practical moment: the course of the affection is in either case essentially the same, and such difference as is believed to exist has reference only to the duration, longer or shorter by a day or so, of certain stages in the one case than in the other. These differences, so far as they have been ascertained, will be pointed out in the following description, which, otherwise, may be taken to represent both the

1 "It is considered that the disease is peculiar to the milch cow—that it occurs primarily while the animal is in that condition—and that it is casually propagated to others by the hands of the milkers. But considering the general mildness of the disease, the fact of its being at times in some individuals entirely overlooked, and that its topical severity depends almost wholly on the rude tractions of the milkers, it would perhaps be going too far to assert its invariable and exclusive origin under the circumstances just mentioned; yet I have requently witnessed the fact that sturks, dry heifers, dry cows, and milch cows milked by other hands, grazing in the same pastures, feeding in the same sheds and in contiguous stalls, remain exempt from the disease." (Ceely in Trans. Provincial Medical and Surgical Assoc., vol. viii. p. 299.) Ceely subsequently saw what appeared to be a case of primary infection in a sturk. (See Trans. Prov. Med. and Surg. Assoc., vol. x. p. 223.)

natural disease and the disease as conveyed by casual inoculation.

3. Course of local phenomena.—There is first a period of incubation; but, from the extreme slightness of the earliest symptoms, it is very difficult to say how soon after infection has been received these may manifest themselves. In the *natural* disease the incubative period is probably three or four days, though Ceely thinks there is reason to believe it may in some cases be prolonged to from five to eight days. The earliest symptoms noted are heat, swelling, and tenderness of the udder, soon followed by irregularity of surface and development of hard papules, about the size of a vetch or pea, especially on that part of the udder which adjoins the bases of the teats, and on the bases of the teats themselves. There is not generally, at this stage, any loss of appetite, manifestation of fever, or other sign of constitutional disturbance. In the *casual* disease, or that which arises from infection by the unintentional inoculations of the milkers, it is very rare for any indications of contagion to manifest themselves till the sixth or seventh, sometimes they do not appear till the eighth or ninth, day after undoubted exposure; but in thin-skinned animals with cracks and chaps in the teats, small red tender papules may often be found by vigilant observation as early as the fifth day. The papules increase in size as the disease goes on, and in three or four days from their first appearance, many of them will be found to have acquired a distinct vesicular character, with more or less of central depression. The first change from papule to vesicle is indicated by the appearance of a dull or dusky yellowish point at the apex of the pimple, the circumference then increases in substance and extent, and the centre becomes wider and deeper, till at last the

flattened vesicle with depressed centre is formed. As with the papules, so with the vesicles, there is gradual increase of size, until in three or four days more their full development is attained. The number, size, shape, and colour of the vesicles differ much in different animals, as well as in different parts of the same animal. There may be only one or two of them, but much more frequently there are ten, twenty, or more:[1] they are most common on the base, neck, and body of the teats, often exist on the udder, occasionally at the apex of the teats. Their size varies from that of a large pin's head[2] to that of a sixpence, or bigger, but is most ordinarily that of a vetch, pea, or horse-bean: in general, the more numerous the vesicles are, the smaller they are. Their shape is determined chiefly by their position: around the base and neck of the teats, they are almost invariably circular; on the body of the teats generally oval, but oval vesicles may be seen also on the udder; and the vesicles on the teats are often interfluent. The colour of the vesicles varies according to the period of their progress, and according to the colour and texture of the animal's skin; but they have always a metallic glistening aspect. By the time that the vesicle is completely formed, it is frequently seven or eight lines wide; has a solid, uniform, tense, and shining

[1] The amount of eruption, and consequently the severity of the disease, depends greatly on the state of the teats and udder. With a short, compact, hairy udder, and thick, smooth, tense, unchapped, or scarcely cracked teats, the affection is often very mild, and sometimes there is only a single vesicle. An animal with a voluminous, flabby, naked, pendulous udder, and loose long teats, the skin of which is thin, fissured, rough, and unequal, scarcely ever escapes a copious eruption. (Ceely, Transact. &c. vol. viii. p. 303.)

[2] These very small vesicles are no doubt of later origin than the others, the results of accidental auto-inoculation from pressure when the animal lies down, or of inoculations by the milkers.

margin, a glistening white, pinky, or silvery hue, and a bluish or slate-coloured centre; it contains a clear viscid lymph, which, however, is even at this period generally in small quantity and often difficult to obtain; and around its base there is a narrow, pale rose, or light-damask areola, not more than a line or two wide, and sometimes scarcely so much, though subsequently extending, with circumscribed induration of the adjacent skin and subjacent connective tissue. The colour of the areola, like that of the vesicles, is greatly influenced by the hue and texture of the skin, and in some skins—as in dark, thick ones—the areola is scarcely to be seen, or is entirely absent; but the induration is always palpable. Between the tenth and eleventh days the disease has generally reached its acme; the areola has extended, though seldom to more than a width of from four to five lines, and there is deep induration of the underlying integument. The vesicles, such as have not been broken, are at their fullest development; lymph, which two days before was hard to get from them, is now so copious that it raises the cuticle, destroying the central depression and forming a globular or conoidal vesicle, or it bursts the cuticle and flows freely out;[1] it has already acquired, or soon acquires, a pale straw-coloured or light amber hue, and speedily becomes more serous, turbid, and opaque. While this is taking place in some vesicles, in others the process of incrustation will already have begun at the centre, and in others it may even have extended to the circumference.[2] On and after

[1] This acumination of the vesicle, however, is not uniform either as to its presence, or as to its time of appearance. It may take place at an earlier or later period, or it may not occur at all.

[2] Unequivocal cases of the natural disease—the first cases in a dairy—seldom or never come under the notice of any one competent to judge of the nature of the ailment, until it has arrived at this stage, when almost invariably considerable disturbance of the

the twelfth day, nearly all is passive; the incrustation-process continues steadily to advance, and by the thirteenth or fourteenth day the crusts have usually acquired their greatest magnitude, are of a brownish black colour, adhering more or less tenaciously to the epidermis or skin beneath, the marginal induration and intumescence at the same time subsiding. The crusts after this go on drying and shrinking, and they fall off usually from the twentieth to the twenty-third day, by which time the induration has nearly, but seldom wholly, disappeared. The cicatrices left after the falling of the crusts, are shallow, *smooth*, oval or circular, and of pale rose, white, or whitish colour, according to the contrast of the surrounding pigment. The vesicles on the teats are attended generally with less areola and less induration of circumference than those on the udders, but in other respects, in so far as they are undisturbed and out of the way of the milkers, they exhibit exactly the same phenomena and undergo precisely similar changes.

4. The local affection as disturbed by handling.—Such is the course of the *undisturbed* eruption: but from the tractions of the milkers it seldom happens that the vesicles, where they are most numerous, viz. on the base, neck, and bodies of the teats, escape disturb-

vesicles has taken place from traction in milking. Many broken vesications will then be found, having evidently a central depression with marginal induration; if any be found unbroken they will be usually acuminated, and full of amber-coloured fluid, more or less viscid, but on being punctured will collapse, and *at once indicate the same kind of central and marginal character.* With these there will be mingled smaller vesicles, evidently of later date, either acuminated or depressed, and crusts circular or ovoid on the udder, circular, oval, or irregular on the teats; the appearance of the disease at different stages, or at least the formation of a few vesicles at different periods, being very evident. (Ceely, Transact. &c. vol. viii. p. 306.)

ance. By the eighth or ninth day, when the uninjured vesicles are the most perfect, injured ones will be found exuding lymph from their centres, the cuticle being loose or partially detached. Raw surfaces and brown or black crusts will be intermingled, and here and there will be seen a conoidal vesicle, often with slightly depressed apex, distended with pellucid lymph. Two or three days later, the appearances on the teats will exhibit crusts, large, black, and solid, often more than an inch or two long, some firmly adherent to a raw and elevated base, others partially detached from a raw, red, and bleeding surface; many florid red ulcerated surfaces secreting pus and exuding blood; the teats excessively tender, hot, and swollen, not unfrequently one or more forming a tumid mass of black crusts and naked red sores, the discharge from which imparts to the finger an odour very closely resembling that of the last stage of small-pox. In some animals this state will continue for a week or two, but in others the process of healing will go regularly on, crusts being continually formed and renewed, till at last they fall off, and leave cicatrices generally regular, smooth, circular or oval, but occasionally deep and irregular.[1]

5. Duration of the various stages of Cow-pox.—Thus the normal course of the disease occupies from twenty to twenty-three days, which may be divided into four stages, viz.: "a," about four days of early symptoms, during which papulation takes place; "b," six or seven days to the full development and perfect maturation of the vesicle; "c," five or six of decline of the vesicle and formation of the crusts; and "d," five or six more from the completion of incrustation to the spontaneous separation of the crusts. Stages "a" and "b" are often materially abridged in the natural disease; while in

[1] See Ceely, Transact. &c. vol. viii. p. 308–312.

the casual disease "a" is sometimes prolonged, "b" being proportionally abridged, or "a" is prolonged, "b" and all subsequent stages occupying the normal duration. These variations, however, in the early stages of the disease are often more supposed than real, the earliest symptoms being so extremely slight in many cases that they are overlooked. Both in the natural and casual cow-pox, "c" is sometimes prolonged, often abridged. The whole of the cow-pox eruption is not by any means always simultaneously developed. Papules, depressed vesicles, acuminated or globular vesicles, and vesicles more or less desiccated, varying in size from a pin's head to a diameter of eight or ten lines, may be seen on the same subject at the same time: but all, whatever their date of appearance, terminating together. No doubt these apparent anomalies are due either to self-vaccination of the cow from pressure, as in the act of lying down, or, still more frequently, to the manipulations of the milkers.

6. Structure of the Cow-pox vesicle.—If we examine the anatomical structure of the cow-pox vesicle, when completely formed, we find it to consist of a number of cells, which appear to be arranged in two concentric rows, and are separated from each other by whitish radiating partitions united at their converging extremities by a central membranous band. In these cells is secreted and contained a clear viscid lymph. "The dusky central spot, which marked the first change of the pimple into the vesicle, and which has now become darker and more distinct, seems to be caused by a greater or less degree of separation of the epidermis, stretched over a crypt-like recess, which contains a small quantity of semi-concrete lymph-like matter, occasionally a turbid opaque fluid." This cellular conformation of the vesicle is essential and diagnostic. It is by the

bursting and breaking up of the cells and their connecting band, as the lymph becomes more abundant and less viscid, and by separation of the epidermis from its attachment to the subjacent adventitious membranæ, that the vesicle in its further progress loses its distinctive central depression, and acquires the acuminate or conoidal form which has been described.[1]

7. **Constitutional symptoms.**—The local symptoms of cow-pox in the cow are seldom accompanied by any material constitutional disturbance: in the great majority of animals, feeding and grazing go on apparently as usual. The secretion of milk is sometimes diminished; and, in most instances, the amount artificially obtained is greatly lessened from the trouble and difficulty of milking. In some cases the cow exhibits in the course of vaccinia a peculiar vesicular eruption very like vesicular varicella. It occurs generally about the ninth or tenth day, commencing with erythemato-papular elevations, which in twenty-four hours have become vesicles full of pellucid serous fluid. Next day this fluid is straw-coloured, and it becomes speedily turbid, the cuticle collapses or bursts, turns yellowish-brown, and before the fifth day from their origin, the vesicles desiccate with brown or black thin flimsy crusts, which soon fall off.[2]

8. **Spurious Pocks, &c.**—The description of cow-pox above given will, it is trusted, enable the practitioner always to recognise the natural disease in the cow, when it is presented to his observation; but the cow is liable to other diseases, which more or less resemble cow-pox, and from which it is important to distinguish it—a distinction all the more necessary that some of these diseases may, and in fact not uncom-

[1] See Ceely, Transact. &c. vol. viii. p. 317. [2] Ibid. p. 329.

monly do, either co-exist with it, or immediately precede or follow it. Besides certain cutaneous, sub-cutaneous, and follicular inflammations and suppurations on the udders and teats, which are liable to affect occasionally the hands of the milkers, warty growths and even warty vesicles (that can scarcely, however, be confounded with vaccinia), and eczema, or other superficial vesicular eruptions, Ceely particularly notices three kinds of spurious pock :—"*The Yellow Pock*, a pustular eruption resembling ecthyma on the teats and udders, succeeded by thin, dirty-brown, or black irregular crusts ; *the Bluish or Black Pock*, bluish or black or livid vesications on the teats and udders, followed by thin dirty-brown or black irregular crusts, and some degree of impetigo on the interstices, near the bases of the teats ; and *the White Pock*, a highly contagious disease among milch cows and to the milkers, quickly causing vesications and deep ulcerations, often or almost always confounded by them with the true vaccine, and certainly not readily distinguishable in all its stages by better-informed persons than milkers."[1] In 1838-9, Ceely saw a number of animals in a shed, which had scarcely recovered from the vaccine disease, affected with white-pock, in consequence of the introduction from another shed of a cow who was suffering with it, and several of these animals continued under its influence for two or three weeks.[2]

9. **Diagnosis of true Cow-pox.**—Although the careful observer will find broad and palpable grounds of distinction between vaccinia and white-pock, in the character of the genuine vaccine eruption, its cellular structure, its hard and knotty feel, its glistening aspect, its tardy and progressive changes to the vesicular form, its central depression and its late acumination, the

[1] See Ceely, Transact. &c. vol. viii. p. 297. [2] Ibid. p. 329.

necessity for caution and accuracy of diagnosis must be borne in mind. Jenner himself pointed out that milkers were very liable to contract infection from spurious pocks, and to acquire in consequence false and delusive ideas as to their having immunity from small-pox; and Ceely informs us that he has also, in several instances, known milkers who undoubtedly had made this mistake suffer afterwards from small-pox, while in other instances he has discovered the mistake they had made in time to save the subjects of it from small-pox, by performing successful vaccination in the ordinary way. The white or blister-pock in the human subject exhibits sometimes in fact an appearance exceedingly like that of real cow-pox, so that, as is the case with the two diseases in the cow, some care may be necessary to distinguish them. It is communicable by inoculation from one human subject to another,[1] and may be communicated repeatedly to the same subject.[2]

[1] Mr: Ceely has been kind enough to show me drawings of three cases of casual blister-pock on the hands of milkers, in one of which the appearance of the vesicles singularly resembles that of true vaccine, and he tells me that some attention was needed for a correct discrimination. He has also shown me a drawing exhibiting the progress of blister-pock on a man experimentally inoculated with it from a milker. Complete vesicles were formed, with some areola, by the second day; the vesicles and areola were fully developed by the third day, and had then very considerable resemblance to cow-pox at its full, or eighth-day, development; by the fifth day desiccation had taken place, and the areola was declining.

[2] Mr. Ceely informs me that he has experimentally inoculated himself successfully three or four times with the virus of white or blister-pock. Other diseases of the cow besides white-pock may be contracted by milkers and communicated from them to other human subjects. A case is related by Ceely in which a whole family (a wife and five children) laboured under a *pustular* disease of the character of ecthyma, from infection by the father, who had himself caught the disease from a cow, described as being in a terrible condition. (Trans. Prov. Med. and Surg. Assoc., vol. x. p. 235.)

10. Supposed origin of Cow-pox from 'Grease.' —Singularly enough, the cow-pox was not considered by Jenner to be a natural disease of the cow at all, but was regarded by him as invariably induced from an analogous disease on the heels of the horse (the horse-pox, see Chap. II.), which, however, at first he confounded with the grease. It so happened that all the cases of cow-pox—all the *first-infected* cases in dairies—which had presented themselves to his observation, or concerning which he had been able to inform himself, had been in animals milked by men who had sores on their hands contracted from dressing the heels of horses affected with this so-called 'grease;' and that, so far as he could learn, the cow-pox never appeared in dairies in which women were exclusively employed in milking. He found, too, that the sores contracted by these men from horses were in appearance like the sores induced in milkers by cow-pox, and that, when the matter of them was inoculated on the human subject, it produced effects exactly analogous to those resulting from the inoculation of the cow-pox. And he concluded that the source of infection in the cow was always "a peculiar morbid matter arising in the horse," expressing himself as well convinced "that it (the cow-pox) never appears among cows (except it can be traced to a cow introduced among the general herd which had been previously infected, or to an infected servant), unless they have been milked by some one who, at the same time, has the care of a horse affected with diseased heels."[1] Undoubtedly he was so far right, that the cow-pox and the horse-pox have a common specific infection, and it is equally unquestionable that the disease in the cow must

[1] An Inquiry into the Causes and Effects of the Variolæ Vaccinæ, p. 46.

in very many of the instances in which it has been met with have had the origin which Jenner pointed out; but the disease (for whether we call it cow-pox or horse-pox it is the *same* disease) has also been met with in each of these classes of animals independently of the other on so many occasions, that we cannot deny it to be as much a natural or spontaneous disease in the one class as it is in the other.[1]

11. Geographical distribution of Cow-pox, and circumstances affecting its appearance and spread.—The cow-pox has been met with in every climate—all over Europe, in Asia, in North and in South America. Jenner found that the oldest farmers in Gloucestershire had been familiar with it in their earliest days, and the disease had not passed unnoticed on the continent of Europe, though previous to his great discovery no particular interest attached to it. But soon after this interest had been awakened by his publications cow-pox was found either actually existing, or to have been of recent occurrence in the dairies of London, in various counties of England, in different parts of Germany, in the plains of Lombardy, in Massachusetts, in

[1] Pearson, in 1798, pointed out that the cow-pox had been met with in farms where the milkers had nothing to do with horses, where no horses had grease, and even where there were no horses on the farm at all. Sacco found it in cows quite isolated, who had been in no communication at all with horses, sound or ill. Hering says that in Wirtemberg (where cow-pox has been so frequently seen) the cows are (except in very large dairies) exclusively milked by women, as the horses are exclusively tended by men; and in most cases where cow-pox was found, there were no horses on the cow-farms. (Ueber Kuhpocken an Kühen, p. 9.) And Ceely says, "For many years the spontaneous origin of the Variolæ Vaccinæ in the cow has not been doubted here. In all the cases that I have noticed, I never could discover the probability of any other source." (Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 300.)

Connecticut, and in Peru. After the first ardour of search had relaxed, there were for many years but few recorded instances of the disease being found, and it was believed to have become much rarer; in great measure, no doubt, because it was less sought for. Since 1824, interest in the search having in the meanwhile been renewed, numerous outbreaks—sporadic or epizöotic—have been reported; and, without by any means endorsing the statements of Sacco and Hering, as to the extent to which, wherever there are large herds of cows, diligent search may be expected to discover cow-pox, there can be no doubt that much more would be found than really is found, if it were only looked for. Still the balance of evidence seems to be that, in England at all events, the disease is not so common now as it at one time was; and there is one obvious reason, I think, why this should be so. Undoubtedly, infected milkers were great agents in conveying the disease from herd to herd, from dairy to dairy: but milkers now a days, from having been vaccinated, are not themselves susceptible of the infection of cow-pox to the extent that their predecessors were, and only occasionally, in fact, contract the disease. Another reason also, as will presently appear, may be the much less diffusion now than formerly of the variolous poison. But under any circumstances we must allow that the cow-pox of the cow, like small-pox and other epidemics in man, has its periods of prevalence and of comparative absence.[1]

In some localities cow-pox is noticed to recur again and again, while in others we have no account of it except as being occasionally seen. This does not appear to depend on any conditions that can be traced. Soil and elevation have apparently no influence. In the Vale of

[1] See Appendix I. Note A.

Aylesbury, where the disease has been long known and recurs at irregular intervals, it is met with as much on the hills as in the valley. It is found frequently recurring in the broad pastures of the Bridgewater level, and in the very vale in which Jenner's own observations of it were first made—the Vale of Gloucester.[1] The period of the year in which it has been most frequently noticed to manifest itself, is the spring, especially in the months of May and June. Of sixty-nine discoveries of the disease made in eleven years in Wirtemberg, no fewer than thirty-one were made in one or other of these two months. The practitioners who have noticed it in the Vale of Gloucester, &c. state that it usually appears in April, May, or June. Ceely has met with it at all periods of the year from August to June, but rarely in the height of summer. It may occur under any condition of feeding, though Hering attributes much to the change from dry to moist food, from stall-feeding to pasturage, which takes place in the spring-time. It very much more often occurs sporadically or in solitary instances, than as an epizöotic: but when the disease has found its way into a dairy, it will often, unless precautions be taken, rapidly spread, so that in ten or twelve days many animals will be found to have been affected in succession; and in a dairy of, say, twenty-five cows, few will have escaped the disease by the end of the third week. Although the hands of the milkers are generally the great agents of this extension, where it occurs, by conveying the disease from animal to animal, there is every reason to believe that the *natural* form of the disease exhibits itself on more than one animal in different parts of the same dairy. Animals differ from one another in their degree of susceptibility to cow-pox, and Ceely states that he never remembers to have seen

[1] Sixth Report of Medical Officer of the Privy Council, p. 10.

a dairy in which two or three cows, equally exposed with the others to casual infection, had not escaped. One attack of the disease is believed to confer, as a rule, immunity from further attacks.

12. Artificial production of Cow-pox in the Cow.—The vaccine disease may be designedly induced in the cow by inoculation in various ways: (*a*) with lymph taken *direct from other cows* suffering from the natural, casual, or inoculated form of the disease; (*b*) with the lymph of the horse-pox—by *equination;* (*c*) with lymph which, derived originally from cow or horse, has passed through the human system and become for a longer or shorter time humanized—*by retro-vaccination;* (*d*) with the matter of human variola—*by variolation.* In all these forms of inoculation, however, the production of vesicles is limited entirely, or almost exclusively, to the points of inoculation. In other respects the course of the disease is essentially the same as that of the natural or casual disease: but usually the papular stage is not well marked, and the local phenomena, especially in the case of inoculation with humanized lymph, or with cow-lymph that (as stated) has been passed through the bodies of several cows successively,[1] are less active. Though in the ox tribe the female alone exhibits the *natural* cow-pox, that disease is producible in the male as readily as in the female by *inoculation.*

(a) By inoculation with Cow-lymph.—Our best account of inoculation with lymph taken from the natural or casual form of cow-pox is that given by Ceely, who, with lymph taken from milch cows at a time when the variolæ vaccinæ were prevailing in many of the dairies, inoculated some young heifers about ten months old. The parts selected for experiment were the

[1] See note 2, p. 17.

inside of the ear, the teats, and the soft and vascular structure on and near the vulva. The punctures inflamed early, as early as the second day, but the papular stage was not well marked, and was apparently retarded ; the vesicles were normal in character, but they declined by the eleventh day : much tumefaction, however, of the integuments on the teats remained till the thirteenth day. When the crusts fell spontaneously at the proper time, they left a moderately deep smooth scar, but if prematurely removed a deep erosion of the skin ensued. There was slight acceleration of the pulse, but no other sign of general indisposition. Lymph taken from the vesicles thus induced and inserted in the human subject produced the effects ordinarily noticed from the use of primary cow-lymph, except that the induration and inflammation of the base of the vesicles were less considerable, and the resulting scars less deep, though remarkably well defined and extending through two-thirds of the substance of the corium.[1] When primary cow-lymph has been transmitted through several cows in succession, the affection it produces in the animals appears, according to the accounts given, to be much less active, and to run a more rapid course.[2] There is at the end of thirty hours

[1] Ceely in Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 352.

[2] "Rapport de l'Académie Impériale de Médecine sur les Vaccinations pendant l'Année 1864." Notwithstanding the positive and repeated assertions of M. de Paul, the reporter of the Vaccine Commission of the Académie, that the lymph, the effects of which are above described, was cow-lymph, *passed from animal to animal without having ever gone through the human system*, I apprehend there can be no doubt that it was, as repeatedly urged by numerous members of the Académie, lymph of retro-vaccine origin. It was lymph which had been passed through animals since 1858; the original lymph, it was said, being lymph direct from the cow obtained at that time, by the then Neapolitan Ambassador in England, from her Majesty

slight inflammatory action; on the third day, well-marked redness and inflammation; on the fourth day, the formation of an elevated papule, very recognisable by the touch; on the fifth day, development of a vesicle with an inflammatory areola; the vesicle and areola extend on the sixth day; and by the seventh day desiccation begins. The crust falls from the fourteenth to the twentieth day. From these vesicles, lymph, which is most intense on the fifth or sixth day and comparatively of little value afterwards, is more or less difficult of attainment. Some, in order to get it, even resort to cutting away the whole of the vesicle and then scraping its inner surface strongly, so as to get a magma of lymph and dermal tissue: others content themselves with opening the vesicle superficially and *squeezing the base with forceps* and collecting the liquid which exudes.

Queen Victoria (!) and sent by him to M. Negri, at Naples. What is meant is, I presume, that it was procured from the National Vaccine Establishment. Anyhow, there was no cow-pox among the royal herds in 1858, nor, as I have ascertained, has that disease ever occurred among them at any time since they have been under their present management, which dates back as far as 1852. Neither was any cow-lymph whatever sent out from the establishment in 1858; nor is there any record of the natural cow-pox having been seen in that year in England at all. Still, with this explanation, I have retained the description in the text, as it is at all events an account of the effects of lymph which (whatever its origin) has made a great number of transits through animals. In the spring of last year the natural cow-pox having been met with at Beaugency, in the department of Loiret, in France, the lymph derived from that source has been continued through animals, and I was in great hopes that I might have found somewhere a description of the effects which *this* lymph produced on cows after a number of continuous inoculations, but I have searched in vain for such account in all the ordinary channels of information which were accessible to me. Probably the effects after several transmissions are much the same as those of humanized lymph, and no special description has been thought necessary.

The effects produced by this lymph, when transferred to the human subject, will fall to be subsequently stated (§ 45).

(b) **By Equination.**—The casual equination of cows must have taken place hundreds of times, as already stated, producing what was regarded as natural cow-pox; and several successful experimental inoculations have also been made. The phenomena of one of these inoculations with lymph taken directly from the primary equine vesicle, and inserted in a young heifer, by M. Lafosse of Toulouse, in the spring of 1860, are thus stated by him. Four punctures having been made, one on each dug, there was, on the sixth day, only slight redness on the punctured spots, and a fresh puncture on each nipple was made: on the ninth day from the original inoculation, without any general symptoms other than a slight cough and diminution of appetite, there were noticed four vesicles, each of the size of a lentil, firm, circular, flattened, slightly umbilicated at the centre, which was of a reddish colour, the circumference being silver-grey. Each vesicle had round it a delicate red areola with distinct induration. By the next day the vesicles had extended and were more completely formed, and three of them being opened yielded lymph, two in very minute quantity, but the other in sufficient amount to serve for further experiments. The day following, the eleventh, the appetite had returned, the cough was gone, and the vesicles were undergoing desiccation. In ten days more, by the twenty-first day, all the scabs, of genuine mahogany colour, had fallen, either spontaneously or from friction, and had left red-coloured depressed cicatrices. From the vesicles that had been opened on the tenth day, another heifer, a horse, and some children were inoculated, and all of them with the

result of producing the genuine vaccine or equine disease.[1]

(c) **By retro-vaccination.**—Retro-vaccination, or inoculation of cows with vaccine lymph that has been passed through the human body, or humanized, has been performed times innumerable. Generally, when the operation is successful, there are early local symptoms, and the vesicle begins to form by the third or fourth day, and is distinctly formed so as to yield lymph for use by the seventh ; occasionally very little result of any kind is perceptible before the seventh day, and no evidence of the presence of lymph can be got before the ninth day ; but, in either case, the vesicles reach their acme by the tenth day and then decline, the detachment of the crusts taking place from the seventeenth or eighteenth, to the twenty-third or twenty-fourth day. Ceely made various discriminative experiments, using (α) some very long humanized lymph ; (β) some lymph of a stock which had been derived direct from the cow about two years before ; (γ) some variola-vaccine lymph, or humanized lymph, which had been originally produced in the cow by the process of variolation, and which was then at the nineteenth remove ; (δ) some retro-vaccine lymph, or humanized lymph that had been passed through the cow, then retransferred to the human subject, and taken again from the human subject at the fifth remove ; but whatever the source of the lymph and whatever its age, he found that, if it were only good lymph, it succeeded equally often, and excited equally perfect and productive vesicles. Only in the experiment with variola-vaccine lymph it happened that there was, in the particular case detailed, early rupture of the vesicles (by the eighth day), and a

[1] Rapport de l'Académie Impériale de Médecine sur les Vaccinations pendant l'Année 1861, p. 13, seq.

much less perfect crust than in the other cases, with absence of that marginal induration which is ordinarily met with from the period when the vesicle is fully developed up to the fourteenth or sixteenth day.[1] The most conflicting statements have been made as to the facility with which cows may be infected with humanized vaccine lymph. According to Heim, Hering, and Hausmann, it is an experiment only rarely successful, perhaps once out of ten or a dozen trials; Fiard met with only six or seven very doubtful successes in seventy experiments; Viborg and Ritter were quite unable to succeed: on the other hand, Caqué at Rheims, Husson and Tenier at Paris and Versailles, Sacco at Milan, and Hellwag at Eutin, in the early days of vaccination, and more lately, Neumann at Utrecht, Billing at Stockholm (in 1832), Lentin in Weimar (in 1835), Prinz at Dresden (in 1838), and others, have experienced no great difficulty. Carganico of Darkehmen succeeded every spring for several successive years; Magleari of Naples professes to succeed "journellement;" while that excellent and justly distinguished authority, M. Bousquet, says that to him "c'est un jeu que de transmettre," &c. Much, no doubt, depends on the lymph employed, and much, as Bousquet justly observes, *on choosing the animals to be experimented on.* Young cows, and particularly heifers, should be selected. No doubt, even then, it has been generally found more difficult to infect the cows with humanized than with cow-lymph: but the results of the extensive vaccinations of cattle carried on in England in 1865-6, during the short time that a hope was entertained that vaccination might prove a prophylactic against cattle-plague — a very large number of which vacci-

[1] Ceely in Trans. Prov. Med. and Surg. Assoc., vol. viii. pp. 354-365.

nations were done with lymph collected from children, and others with retro-vaccine lymph carried on from cow to cow—showed that in either way with due care successful results might be very frequently attained. In Mr. Ceely's original experiments it was distinctly made out that the *age* of the lymph, the length of time that it had been humanized, made not the slightest difference as to its taking power when re-transferred to cows; and the same has been observed in some experiments recently made by M. Chauveau and others at Lyons.[1] M. Chauveau and his colleagues, in the course of these experiments, took occasion also to compare the effect on cows of long-humanized lymph directly transferred to them, and of unhumanized cow-lymph (as they supposed it to be) which had undergone a series of transmissions through the bodies of animals,[2] and were unable to detect any difference either as to the facility of taking or as to the local effects induced. When lymph raised in cows by retro-vaccination is vaccinated back to the human subject, it produces, though with less infectiveness during the first two or three removes,—that is, until it has again become humanized,—the results of ordinary vaccination (§ 46).

(d) **By Variolation.**—The variolation of the cow, or production of vaccine by inoculation with the lymph of human variola, will be considered in Chapter IV.

[1] Vaccine et Variole: Rapport par MM. Chauveau, &c. Mémoires et Comptes Rendus de la Société des Sci. Méd. de Lyon, tome v.

[2] The lymph they used, however, was really lymph of retro-vaccine origin, but which had undergone a large number of transits through animals. It was the lymph referred to in note 2, p. 17.

CHAPTER II.

Of the Horse-Pox.

13. **Horse-pox; its relations to Cow-pox.**—The horse is subject, like the cow, to a specific eruptive fever resulting in the development of a pock, the material of which has the same property as the fluid of cow-pox, of protecting the human system, when inoculated with it, from small-pox. This pock has the outward appearance and the anatomical structure which distinguish the vesicles of cow-pox. The chief points in which the disease, as seen in the horse, differs from that in the cow are, (1) the locality of the eruption—which is chiefly on the heels, and on the naso-labial mucous membrane; (2) the tendency of the eruption in some cases to become *generalized* over the body; and (3) its appearance in the male as well as in the female, horses being subject to it as well as mares.

14. **Its relations to "Grease."**—I have already stated (§ 10) that this disease was at first confounded by Jenner with that familiarly called "the Grease," an affection with which it may, and very frequently does co-exist, but with which it has nothing in common, except that both diseases manifest themselves as discharging sores on the same part of the animal, viz. the heels. From

the want of the necessary discrimination between the two diseases, and the much greater frequency with which the grease occurs than does the horse-pox, it happened that most of the experimental inoculations made with the view of infecting the cow with grease, were unsuccessful. Several successes, however, were met with in cases in which the true equine matter had chanced to be got hold of. Mr. Tanner, a veterinary surgeon at Rockhampton, so early as 1800, raised a perfect vaccine vesicle on the teat of a cow, by first removing a scab from the surface of an accidental sore, and then rubbing over the sore the limpid matter taken from the heels of a horse afflicted with what he regarded as grease; lymph taken from the vesicle thus raised was successfully transferred to the human subject, and a stock of vaccine thus obtained, some of which was sent to Jenner, and through him to the Small-pox Hospital.[1] The year following, Loy, amongst many futile attempts, succeeded in infecting four cows, by inoculation with lymph from a "greasy" horse which, with considerable indisposition, had a *generalized* eruption, while the horses "that did not communicate the disease had a local affection only;" and he was led by the result of his experiments to distinguish two forms of grease, the acute and the chronic, the former of which alone he regarded as capable of imparting the cow-pox to the cow or to man, and then only in case the matter were taken at the proper period

[1] This experiment of Tanner could not have been regarded as conclusive if it had stood alone, for he had *first* applied to the sore some *cow-pox* matter on a thread. This cow-pox matter had been so long kept that it was not thought possible by the surgeon who gave it him for it to be effective, and, in fact, at the end of five days not the smallest result was perceptible. It was then that the matter of grease was used, with the effects stated in the text. (See Ring, Treatise on the Cow-pox, p. 336.)

of the vesicle.[1] In 1803, Dr. La Font, a French physician established at Salonica, though he failed in infecting a cow, was successful in producing the perfect vaccine vesicle in two young children, with lymph taken direct from a horse suffering from a disease which was known to the Macedonian farriers as "grease," but which they distinguished from ordinary grease by the epithet, "the variolous."[2] Coleman, whose early attempts had failed, at a subsequent period succeeded in infecting a cow with matter taken direct from the heels of a horse, and in propagating vaccine from the vesicles thus induced. Further experiments, with two or three exceptions only,[3]

[1] Loy, Experiments on the Origin of the Cow-pox, 8vo. Whitby, 1801. Before this distinction had been made by Loy, Mr. Lupton, of Thame, in Oxfordshire, had in 1800 (see Med. and Phys. Journal, vol. iv. Nov. 1800) more correctly pointed out that the disease of the horse, which was analogous to cow-pox, and was communicable to the cow, was *not* "the grease" nor any form of grease, but a disease regarded by the farriers of his neighbourhood as widely different from it, and to which they gave the name of the "scratchy heel." The distinction also, according to Mr. Grose, of Winslow, was known in Buckinghamshire, where the vaccigenous complaint in the horse, *from the singularity of making the hair erect*, was called a 'scratchy heel.'" (Ring, *op. cit.* p. 237.) Compare this observation as to the distinctive character of the disease, with the description of horse-pox subsequently given in the text (§ 15).

[2] De Carro in letter to Jenner, June 21, 1803. (See Baron's Life of Jenner, vol. i. p. 432.)

[3] The *direct* inoculations from horses' heels, made by Viborg and by Kählert on cows, and by Steinbeck both on cows and children, though exception has been taken to them, will be admitted, I apprehend, *now* to have been genuine successes. Sacco and several others succeeded in producing on human subjects perfect vaccine vesicles with lymph taken from sores (vesicles) on the hands of individuals, which sores they were quite satisfied had been derived from the horse; but the difficulty here was to convince the sceptical that the origin ascribed by them to these sores was correct. Bousquet, reviewing in 1848 the whole of the experiments and observations up to that time, declared himself unsatisfied as to

gave negative results. But the experiments that *had* succeeded, and the almost familiar fact that lymph taken directly from vesicles on the hands of farriers, which had been contracted by them from the heels of horses, was productive of effects exactly the same as those of vaccine lymph—whether as regarded the phenomena induced, or the protection against small-pox imparted—left no sort of doubt in England as to the horse being subject to a disease identical with cow-pox.[1] The merely accidental relation of this disease to grease, was longer of being generally understood. Jenner himself, though not at first, was fully aware of it, as his description of the disease shows: "The skin of the horse is subject to an eruptive disease of a vesicular character, which vesicle contains a limpid fluid, showing itself most commonly in the heels. The legs first become œdematous; and *then* fissures are observed. The skin contiguous to these fissures, when accurately examined, is seen studded with small vesicles, surrounded by an areola. These vesicles contain the specific fluid. It is the ill-management of the horse in the stable that occasions the malady to appear more frequently in the heel than in other parts; I have detected it connected with a sore on the neck of the horse, and on the thigh of a colt;"[2] and again, "The matter which flows from the fissures in the heels will do nothing. It is contained in vesicles on the edges and the surrounding

whether cow-pox had ever been derived from the horse or not. (Nouveau Traité de la Vaccine, p. 436.)

[1] Jenner largely employed and diffused equine lymph for vaccinating. (See Baron's Life of Jenner, vol. i. pp. 254, 428, and vol. ii. pp. 226–7 and 388.) At first he had a notion that this lymph needed to be passed through the cow before it became protective against small-pox, but this idea he soon abandoned.

[2] Baron's Life of Jenner, vol. i. p. 242. The *date* of this description, apparently taken from Jenner's MS., is not given.

skin."[1] The distinct nature of the two diseases was afterwards generally recognised;[2] and, at least thirty years ago, the horse-pox was distinguished by the appropriate name "Variolæ Equinæ,"[3] but no minute description of it was given by any English observer. In France, from the general negative results of repeated inoculations from horses' heels, doubts as to the existence of an equine pox seem to have been largely entertained up to a very recent period; but within the last few years these doubts have been completely set at rest. Two outbreaks of the disease among horses—one near Toulouse in 1860, and one at Alfort in 1863—gave rise to inoculations, the results of which were acknowledged to be entirely unequivocal. These outbreaks were carefully observed, and the phenomena of horse-pox may be considered as now well made out.

15. **Character and course of the Disease.**—The disease differs so little in its course from the cow-pox in the cow, that very minute description will scarcely be called for. The chief distinction is as to the part of the body affected, which in the horse is principally the legs, particularly the hind-legs; the eruption being generally more copious there than anywhere else, and seldom extending beyond the hocks, except as the result of auto-inoculation.[4] It is, no doubt, from its great exposure to

[1] Letter of Jenner to Moore, Oct. 1813: Baron's Life, &c. vol. ii. p. 390.

[2] Kählert of Prague, referred to in note 3, p. 25, describing the horse-pox as he met with it in Bohemia, insists on the distinction between the febrile and constitutional equine disease and the grease. A French translation of his paper will be found in the *Almanach de Karlsbad*, 1833. It is entitled "Du Javart Préservatif;" and in it he suggests for the disease he describes (the vaccigenous disease) the title of "Equin Préservatif." [3] Baron's Life, &c. vol. ii. p. 456.

[4] Of more than 100 mares affected in the epizöotic at Rieumes, near Toulouse, there were only two in whom the eruption extended

this kind of inoculation that, after the heels, the naso-labial mucous membrane is the chief seat of eruption.[1] In some cases the vesicles seen on this membrane may be primary; and there are said to have been cases in which this membrane was the sole seat of eruption. Occasionally, especially in certain epizöotics, the eruption has been seen extending over the body, in greater or less abundance, from the heels to the belly, and from the head to the tail. This general eruption, when it occurs, may come on in the course of the disease, and after the usual local symptoms have manifested themselves; or the generalization may be noticed from the very outset. The course of the disease is this: there is a period of invasion, sometimes accompanied with fever, which, if it occur at all, is in the great majority of instances very trifling; then, on the pasterns and other parts about to develop the eruption, points are felt, or seen, which soon acquire prominence and take the form of pimples, becoming rapidly flattened and umbilicated at the centre. These by the eighth or ninth day are fully developed, mostly circular, and of the size of a big lentil, notably elevated above the skin, resisting pressure, and having a well-marked surrounding induration. They have absolutely the same structure as the vaccine or

to the thighs and vulva, and one in whom it manifested itself (but probably from self-inoculation) on the nostrils and lips. But in the outbreak at Alfort, affection of the buccal and nasal mucous membrane was much more frequently noticed, and a general eruption observed in many cases.

[1] As the first inoculations at Alfort were made from some vesicles about the mouth, at a time when the real nature of the disease from which the horse was suffering was not made out, and when, in fact, he was considered as having an "aphthous stomatitis," this familiar disease of cattle was for a short time put down as a new source of cow-pox! But this error received its correction far more speedily than the similar error with regard to grease.

variolous vesicle, and yield, though generally in small quantity, a viscid and slightly yellowish lymph. By the ninth, tenth, or eleventh day, many of them burst, exuding, often copiously, a viscid serous or sero-purulent fluid; incrustation going on progressively and forming scabs or crusts, which from the fifteenth to the twenty-fifth day detach themselves, leaving whitish superficial cicatrices. Varieties are observed, as in cow-pox, some of the vesicles being smaller and later than others, some less markedly umbilicated, some not umbilicated at all. They are most developed in the parts that are naked or have little hair, and where the skin is fine. If the hair be long and close, they are smaller and less regular, and attentive observation is often necessary to make out their existence; little pencils of hair will be seen standing up here and there,[1] and if the finger be lightly moved over these spots, slight indurations will be felt, corresponding to pimples or vesicles, which may be brought to light by cutting the hair away. Just as the cow-pox among cows in dairies, the horse-pox is communicated from animal to animal by casual inoculations, immediate or mediate, and these inoculations are the main cause of the spreading of the disease.

It is evident from the observations already made that the disease has to be distinguished from Grease on the one hand, and Aphtha epizöotica on the other.

16. Artificial production of Horse-pox by inoculation.—The horse-pox has been designedly induced in the horse, and other animals of the horse tribe, by inoculation, (*a*) with equine lymph directly transferred from horse to horse; this was done on numerous occasions and with great success, in 1863, by M. Bouley:[2]

[1] See the description of the "scratchy heel," note 1, p. 25.

[2] Bulletin de l'Académie, tome xxix. p. 236.

(*b*) with equine lymph that had been passed successfully through a cow, producing in that animal all the phenomena of the genuine inoculated cow-pox; this was done both in 1860 at Toulouse, by M. Lafosse,[1] and in 1863 at Alfort, by M. Bouley, and at the Jardin d'Acclimatisation at Paris:[2] (*c*) with lymph, supposed to be unhumanized cow-lymph, not primary, but the product of a series of transmissions of primary lymph through animals of the ox tribe; this was done by M. Chauveau and his colleagues:[3] and (*d*) with ordinary humanized vaccine lymph; an experiment thus made in 1862 by MM. Rayer and De Paul, at Alfort, resulted in the production of eight well-characterised vesicles, perfectly circular, with central depression and induration of the whole surrounding thickness of the dermis—a description which fully justifies us in regarding the inoculation as successful, notwithstanding that the fluid obtained from the vesicles, tried on *a single* baby, produced no effect;[4] and since then, M. Chauveau appears to have used this kind of lymph in several successful inoculations.[5]

Although *primary* cow-lymph has not, so far as I am aware, been used on any occasion for inoculating horses, it may be taken as quite certain that such inoculation would be productive of the equine pox. And there is every probability, I think, that if sufficient trials were made, the same result might be obtained from inoculating

[1] Rapport de l'Académie Impériale de Médecine sur les Vaccinations pendant l'Année 1861.

[2] Bulletin de l'Académie, tome xxix. pp. 131–3 and 199.

[3] Vaccine et Variola, &c., *op. cit.* See, however, note 2, p. 17, where the origin of this lymph is referred to.

[4] Rapport de l'Académie Impériale de Médecine sur les Vaccinations pendant l'Année 1861.

[5] Chauveau, Des Conditions qui président au développement de la Vaccine dite primitive: Bull. de l'Acad., tome xxxi.

horses, under favourable conditions, with the matter of human variola; although the few experiments that have hitherto been made with this object, have either given negative results,—as those reported by Badcock,[1] by Lalagade,[2] by Bouley,[3] and by Le Blanc and De Paul,[4] —or have afforded results such as those obtained by M. Chauveau and his colleagues, which will be described hereafter, and which lead, in their opinion, to an opposite conclusion. This subject will be considered in Chapter IV.

In the horse-pox induced by the ordinary process of inoculation, eruption is limited, with rare, if any, exceptions, to the points of inoculation. The local phenomena are less active than in the natural disease, but the course of the disease is essentially the same.

17. **Artificial production of Horse-pox by injection of lymph.**—A *variety* of inoculation, viz. that of *injecting* the liquid vaccine lymph into the blood-vessels or lymphatics of horses, has recently been attempted by M. Chauveau with the most interesting results. It occurred to him that it might be possible by this method of proceeding to produce the more extended or generalized eruption, which in this tribe of animals frequently attends the natural, or, as it is called, spontaneous disease. Accordingly, he inoculated four old horses by injecting some vaccine lymph into a blood-vessel, and four more by injection into a lymphatic vessel, just before its entrance into a ganglion. The

[1] Badcock, Detail of Experiments confirming the Power of Cow-pock, &c. p. 15.

[2] Rapport de l'Académie Impériale de Médecine sur les Vaccinations pendant l'Année 1863, p. 102.

[3] Bulletin de l'Académie, tome xxix. p. 236.

[4] Ibid. p. 370.

first series of experiments (those in which the injection was into a blood-vessel) failed. But of the animals in the second series (those inoculated through the lymphatics) the inoculation succeeded in three out of the four, producing a fine eruption of vaccine, which had all the characters of the spontaneous horse-pox. One, a horse, had a full eruption, commencing at the end of eleven days, and completely developed in three or four days more, on the nostrils and lips, as well as on the hind heels; the second, a mare, injected from the preceding, had isolated vesicles disseminated over the body, except the neck and pasterns, but chiefly on the mammary region and on the lips, the eruption commencing on the eighth day, and continuing to appear up to the fourteenth; and the third, a mare, had, on the twelfth day, an eruption chiefly on the genital organs and the inner surface of the thighs. And virus taken from the eruption on *each* of these animals produced, it is said, regular vaccine both on the cow and on children. M. Chauveau, in a later course of experiments, succeeded in inoculating a young colt by two injections of vaccine lymph, at intervals of two days, direct into the sanguineous system through the jugular vein; vesicles beginning to appear, principally in the naso-labial region, in twelve days, and continuing to appear for four days more, the lymph of which was found to produce regular vaccine both on a child and on animals of the ox tribe. Following out still further the same idea, M. Chauveau, by injecting vaccine into a pouch formed in the subcutaneous cellular tissue on the left side of the neck of a colt, but with great care that the lymph should not touch the wounded skin, obtained no local vesicle, but an eruption, commencing on the tenth day, of a few vesicles on the naso-labial

region. From these results, in connexion with the fact that, in nearly thirty successful inoculations of horses with vaccine lymph in the ordinary way, no general eruption followed, M. Chauveau concludes the one essential condition of a *generalized* eruption to be that the virus should not pass through the membrane which is the anatomical seat of the vaccine eruption. M. Le Blanc, however, states that he has seen *general* eruption to occur in a case in which inoculation had been done in the ordinary way, and that he proved the vaccinal character of the vesicles secondarily developed by equinating successfully from them both horses and ruminants. It is exceedingly desirable that these interesting experiments of M. Chauveau should be repeated. Young colts appear more adapted for the purpose than old horses.[1]

[1] Chauveau, Des Conditions qui président au développement de la Vaccine dite primitive: Bulletin de l'Acad. Imp. de Méd. tome xxxi. Also, Comptes Rendus de l'Acad. des Sciences, tome lxii. p. 1118, and tome lxiii. p. 573.

CHAPTER III.

Of Pocks in other Animals which have been considered analogous to Cow-pox and Horse-pox.

18. Sheep-pox.—By far the most interesting and important of these is the sheep-pox, "le claveau," or "la clavelée," of the French—the Variola Ovina, as it has been termed—a disease frequently met with in various parts of the Continent, but which has made its appearance in England on three occasions only, viz. in 1710-11, in 1847-50, and in 1862. It so far resembles the diseases already treated of in the cow and horse that it is an infectious febrile disease, characterised by a vesicular eruption. But the vesicles have neither the appearance nor the structure of the vesicles of cow-pox or horse-pox. Their surface is flat and not umbilicated, and their structure is simple and unreticulated, a single puncture with a lancet serving to empty a whole vesicle. A further important difference to be noted is in the severity of the general symptoms which attend sheep-pox, and the very great fatality of that disease; in these respects it more resembles natural small-pox in the human subject. It has a period of incubation not very different from that of human variola. It is transferable from sheep to sheep by inoculation or "clavelization." The disease produced

by this clavelization is very considerably milder than the natural disease, and imparts security to the animal against a natural attack of the sheep-pox.

19. **Ovination of the Human subject.**—The question of the relation, if any, which this disease holds to cow-pox and horse-pox—whether its material inoculated on the cow or horse, or on man, will produce the effects, local and general, of the vaccine or equine affection—and whether, conversely, the cow-pox or horse-pox can be imparted to sheep—is one of considerable scientific interest. Its practical importance is limited entirely to the effect which inoculation of the latter kind might have in protecting sheep from sheep-pox. Of the very numerous attempts that have been made to communicate the sheep-pox to man, the inoculations of one experimenter alone appear to have been successful; but the success with which *he* met was, according to accounts, as constant as have been the failures of other observers. Sacco, of Milan, when passing through Capua in 1804, saw accidentally some sheep affected with sheep-pox, a disease which at that time he had not before met with. He took virus from the finest vesicles; and with this he, in conjunction with Dr. Legni, of Cattolica, inoculated six children, vaccinating two others at the same time with ordinary vaccine lymph. He did not stay to watch the results, but Dr. Legni reported to him a month afterwards that the ovination had been successful, and that no marked differences had been observable between the vesicles produced by the ovine and those produced by the vaccine lymph. Dr. Legni added, that he had continued to propagate the ovine lymph on children. Sacco, on his return to Milan, used what he had remaining of the ovine virus (it had been collected in tubes), but unsuccessfully. Two years afterwards, how-

ever (in 1806), sheep-pox again prevailing in Italy, he inoculated five children with virus taken from a lamb —inserting, in two out of these five children, the ovine lymph on one arm and vaccine lymph on the other. Two of the three children in whom the vaccine lymph had not been inserted, and one of the two in whom it had, had each one *ovine* vesicle : the *vaccine* took effect in both the children in whom it was employed, raising in one of them a single vesicle, and in the other two vesicles. When the three vesicles, the products of each lymph, the three vaccine and the three ovine, were compared together, Sacco says he was unable to detect any difference of character between them. Moreover, the two children who had ovine vesicles *only*, were tested some days afterwards by small-pox inoculation, but no effect was produced. He inoculated afterwards with ovine virus some children at Fosdinovo, and found the results in all to be the production of vesicles exactly like vaccine ; and he inserted ovine virus also in some children and a cow at Barbarasco. As he was unable to stay and watch the effects in this last series of inoculations, he left some of the cases in care of a surgeon, Dr. Magnani, who reported to him that out of four children the ovination had taken in two, producing in one of them four vesicles, and in the other a single vesicle only ; that the vesicles were like those of vaccine and surrounded by a red circle, but containing a liquid which was not limpid, but serous and yellowish ; that this liquid, inoculated on two children, produced vesicles which on the seventh day were full of limpid fluid, with which three others were inoculated ; and that in all the children of this last inoculation vesicles arose, the contents of which on the eighth day were limpid and crystalline, like the true vaccine lymph. He further reported that on examination of the cow he

had found a single vesicle on the udder, distended with yellow and turbid fluid, which was inoculated on two children with the usual effects of vaccination. Sacco says that ovine virus was inoculated afterwards at Lucca, and that stocks of lymph of this origin were employed like vaccine lymph for vaccinating purposes, producing exactly the same effects.[1] In other hands—in France as in England—every attempt to produce the vaccine disease by ovination has (save in a single doubtful instance) failed; and this, though the number of experiments has been very great, and though a large number of them have been conducted by men singularly versed in experiments of the kind. Mr. Marson and Mr. Ceely have, between them, performed not less than 250 inoculations on human subjects with the virus of sheep-pox, and with the single equivocal exception, the particulars of which will be afterwards stated, they failed to induce anything like a vaccine vesicle. The following is the account Ceely gives of the result of some of his endeavours: "I ovinated twenty-five subjects whose ages ranged from three to fifteen years, some twice and thrice over; in none were there fewer than *six punctures* each time, making not less than 180 punctures: no specific disease resulted; but a prompt and devious papular or diffuse inflammation, or, more rarely, a common local pustular. In the majority of these twenty-five individuals the virus employed was liquid. When very recently charged points were used, subsequent re-inoculation with liquid virus was had recourse to, but with no other effect. Nearly all the above subjects were shortly afterwards vaccinated with current vaccine lymph, which in each case exhibited the normal effects. I may as well add, also, that the same kind of ovine virus which did not succeed on children, took

[1] Sacco, Trattato di Vaccinazione, pp. 145–148.

promptly on sheep."[1] Such uniformity of failure in the hands of the best of experimenters, and when every pains were certainly taken to produce success, suggests the possibility of fallacy in Sacco's experiments, and suggests it all the more for the very facility with which he succeeded; for I agree with M. Bousquet that where one person succeeds so uniformly that his experiments appear to be but an amusement to him where everybody else's fail, there cannot but be some ground for hesitation in accepting his conclusions.[2] A doubt certainly suggests itself to the mind, whether, in Sacco's experiments, done at the same time with two viruses—the ovine and the real vaccine—some accident might not have occurred by which the two may have become inadvertently mixed, or inadvertently substituted for one another. Similar accidents, it is well known, not unfrequently happened in England with variolous and with vaccine lymph in the early days of vaccination (when the variolous and the vaccine inoculations were carried on by the same practitioners, at the same time, and often on the same subjects), giving rise to phenomena which, till the cause of them was found out, greatly complicated and confused our understanding the real characters of the vaccine disease in the human subject. The facility with which mistakes of this kind might occur when tubes and points are used (and we know that Sacco was greatly in the habit of using tubes to collect and convey his lymph for experimental and other inoculations) is obvious.[3]

[1] Simonds, Practical Treatise on Variola Ovina, p. 154.

[2] Bulletin de l'Académie, tom. xxix. p. 585.

[3] It is impossible to mention the name of Sacco without an expression of gratitude and respect for the vast services he rendered in the diffusion of vaccination in Italy. The interest he took in the subject led him to the performance of innumerable experiments on all sorts of animals: but the very variety and multiplicity of these

Still, among the constant failures that have attended the attempts of all other experimenters to ovinate the human subject, there has been *one* apparently successful inoculation which was not Sacco's; and as this case occurred to so singularly cautious and able an experimenter as Mr. Marson, if *he* had been satisfied with the result we might have been prepared to allow this positive to outweigh the many negative observations that have been accumulated. But Mr. Marson was *not* satisfied, and his account of the circumstances illustrates admirably, as it appears to me, the caution which should be used in drawing deductions from experiments made to determine doubtful issues: "When small-pox appeared in this country in the sheep in 1847," he says, "we tried to communicate it, by inoculation, to the human subject, and thought we had succeeded in doing so, and the virus was carried on from one to another for several weeks in succession. The pock produced was very like cow-pox, having only, as we thought, a bluer tinge, and was protective against small-pox, as we ascertained by inoculating the patient afterwards with the lymph of human variola; but we had unfortunately used for the original *ovination* the same lancet, instead of having a new one, as we ought to have had, that we had previously used for vaccinating; and although it was, as we believe, perfectly clean, and free from vaccine lymph, nevertheless, as the

experiments, and the evidently casual way in which many of them were done, are suggestive of a state of hurry which is not favourable to good experimentation. His account of the experiments, and of his manner of conducting them, is given in very general terms, and it is impossible to read it without feeling how many details are wanting to make it satisfactory and conclusive. And his conclusions with regard to the constitutional effects of vaccination on animals were certainly very hastily drawn, for he not only found vaccination to save sheep from sheep-pox, and dogs from distemper and other diseases besides, but also horses from glanders!

disease could not be produced again in the human subject, either by Mr. Ceely, of Aylesbury, who made repeated trials with the lymph of sheep-pox, or by ourselves, the experiment was never brought before the medical profession." [1]

20. Ovination of Cows, &c.—The most careful endeavours made on various occasions by Professor Simonds, Mr. Ceely, and Mr. Marson to impart the sheep-pox to the cow,[2] wholly failed; and the French veterinarians, whose acquaintance with sheep-pox is extensive, are all of opinion that it cannot be communicated to the ox tribe either by inoculation or by infection. M. Hurtrel d'Arboral also informs us that attempts to inoculate it on other animals—deer, pigs, dogs, monkeys, &c.—have been alike unsuccessful.[3] Marson found the goat, though an animal in many respects so like the sheep, equally unsusceptible.

21. Vaccination of Sheep.—But whatever uncertainty may still be considered to exist as to the production of the vaccine disease in the human subject by ovination, there is none whatever that the phenomena induced in sheep by inoculation with vaccine lymph, are very different indeed from those of the genuine vaccine disease as exhibited on the cow or on man, or from those of inoculated sheep-pox in the sheep. There is generally some difficulty in getting vaccine lymph to take any effect on sheep at all, and it is found that in nearly two-thirds of the cases the inoculation requires to be repeated once,

[1] Art. "Small-pox" in System of Medicine, ed. by J. R. Reynolds, M.D., vol. i. p. 433.

[2] Simonds, Practical Treatise, &c. p. 155; also Report of Experiments made under direction of the Lords of the Council as to the Vaccination of Sheep, &c. by Mr. Marson and Prof. Simonds, (Parl. Paper, 1864), p. 5.

[3] Dictionnaire de Médecine Vétérinaire, art. "Clavelisation."

or oftener. "When effect is produced, the resulting affection," say Mr. Marson and Professor Simonds, "even when developed to its fullest extent, is very unlike the same disease in the human subject. In the sheep it is but seldom anything more than the production of a small papule, which occasionally results in the formation of a minute vesicle, or more commonly a pustule, which is sometimes, although very rarely, surrounded with a slight areola. Generally, however, neither vesication nor pustulation follows, but a small scab is produced, which soon falls from the site of the puncture, leaving no trace behind. The disease passes quickly and irregularly through its several stages, so as to have ended by the eighth or ninth day, or not unfrequently even before this time. Lymph is but rarely obtainable, and never but in the smallest quantity, and this on the fifth or sixth day succeeding the vaccination. The effects are only local, and the animal's health never impaired."[1] The entirely local nature of this affection is shown by the fact that sheep who have gone through it are, on the one hand, just as susceptible of the action of the vaccine virus on immediate repetition of the operation as if nothing had been done to them, and are, on the other hand, not in the least protected against sheep-pox. The description of the results of vaccination on sheep, which is given by other observers, agrees closely with that of Marson and Simonds, even of those observers who, like Sacco, thought that the sheep *was* constitutionally affected thereby, and was, in fact, really *vaccinated*. For Sacco speaks of the vesicles being "mostly resolved before coming to maturity; the cutis detaching itself in small scales from their surfaces, as from the pustules of ovine variola. It is very seldom that true vesicles are produced, which

[1] Report of Experiments, &c. p. 6.

are succeeded by scabs."[1] Still, by this affection, such as it was, Sacco hoped, and believed, and taught that sheep might be protected against sheep-pox. Unfortunately, this has turned out not to be the case. No fact is more conclusively established than the utter worthlessness of vaccination for saving sheep from sheep-pox.[2] The effects of vaccination in the sheep, such as they are, are entirely local, not in the least degree constitutional; and this result is calculated, I think, to throw further doubt on those experiments by which the converse—the production of constitutional vaccinia in the human subject by inoculation with the lymph of sheep-pox—has been supposed by some to be established.

22. **Variolation of Sheep.**—It may be added that attempts to inoculate sheep with human variola have equally failed. Mr. Marson tried this on a hundred sheep, six punctures being made on each sheep, but the results were essentially the same, both locally and constitutionally, as those obtained with vaccine lymph. Sheep in whom the variolous virus had produced a local effect were found still susceptible of the sheep-pox, and some of them being submitted to vaccination became

[1] Sacco, as quoted by Simonds, Pract. Treatise, &c. p. 142.

[2] Report of Experiments, &c.; also Simonds, Pract. Treatise, &c. chap. vi. Hurtrel d'Arboral, Huzard, and other French veterinarians, who have experimented on a large scale, bear unanimous testimony to the same effect. It is not a little surprising, therefore, to find M. de Paul, the Director of the Vaccinations of the Académie Imp. de Méd. at Paris, stating to the Academy that vaccination takes perfectly (*prend à merveille*) on sheep, and gives them complete protection against sheep-pox; that sheep-pox matter inoculated on cows produces perfect vaccine, &c. &c. (Bull. de l'Acad. tome xxix.) In a former note (note 2, p. 17) I referred to very positive statements made, and insisted on, by M. de Paul on very insufficient evidence, but the present statements are in the teeth of all evidence.

affected, in about the same proportion, and to the same extent, as others not inoculated.

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23. Analogous Pocks in other animals?—In the Camel?—Although various animals have at times been stated to be liable to eruptive fevers, which have been considered to have some analogy to human variola on the one hand, or to cow-pox on the other, we have no accounts respecting any of these which are not vague and wholly inconclusive. The most probable instance of any animal being subject to an affection like the cow-pox is the occurrence, it is said, among camels, in the province of Lus, in Beloochistan, of a disease which the natives call "Photoshootur," or the small-pox of camels. This disease is affirmed to be communicable to the camel-milkers, and to protect them from small-pox. No attempt is made by them to propagate it by inoculation.[1]

24. Vaccination, and Variolation, of other animals.—The insertion of vaccine lymph on dogs produces an effect much more resembling regular vaccine than the like experiment on sheep; but, according to Sacco, the course is shorter than in the human subject, and there is no areola. The lymph obtainable from the vesicles produced in the dog may, it is said, be continued from animal to animal, and even re-inoculated in the human subject with the result of reproducing genuine vaccination.[2] Jenner at first believed that dogs might be *constitutionally* affected by vaccinia, and thereby protected against that infectious disease the distemper; but

[1] Indian Journal of Medical Science, Oct. 1839.

[2] Baron's Life of Jenner, vol. i. p. 243; and Sacco, as quoted in Ring's Treatise, p. 941.

he apparently did not remain long in this belief, for, in his account of the dog distemper in 1809,[1] he makes no allusion whatever to the employment of vaccination. Inoculation of dogs with the matter of variola by MM. Reynal and Renault produced no result:[2] and I do not in the least know what value is to be attached to a statement that Viborg performed a successful inoculation of this kind.[3] The goat is said, on the authority of M. Valentin of Nancy,[4] of M. Husson, and more recently of MM. Mathieu and Auzias Turenne, to be susceptible of vaccination: and M. Chauveau and his colleagues produced on this animal in two experiments umbilicated vesicles, but of a very modified kind.[5] The accounts we have of inoculations performed with vaccine, or with variolous, lymph on various other kinds of animals, either record failure, or give results too vaguely and inconclusively to render a detail of them of any interest.

[1] Medico-Chirurgical Transactions, vol. i.

[2] Bulletin de l'Académie, tome xxix. p. 334.

[3] Baron's Life of Jenner, vol. i. p. 216.

[4] Ibid. p. 243.

[5] Vaccine et Variole: Rapport, &c. (*op. cit.*). [M. Chauveau and his colleagues speak of the goat as being an animal to which Jenner had communicated the vaccine, but this is a mistake.

CHAPTER IV.

Of the Relation of Cow-pox and Horse-Pox to Human Variola.

25. Jenner's views on this subject.—It was one of Jenner's fundamental doctrines, that the cow-pox and the horse-pox (or grease, as he at first regarded it) were products of the same virus as produced the small-pox in man. The disease in the horse was considered by him to be the parent disease: that in the cow and in man as derived diseases. The malignancy and peculiarly infectious character of human variola were not, in his view, any essential part of the effects producible by the variolous poison on the human constitution, but were properties at first accidentally superadded, and, when once acquired, capable of propagation. "May it not be reasonably conjectured that the source of the small-pox is morbid matter of a peculiar kind, generated by a disease in the horse, and that accidental circumstances may have again and again arisen, still working new changes upon it, until it has acquired the contagious and malignant form under which we now commonly see it making its devastations amongst us?"[1] If man would only go back to the horse or cow, and take his small-pox

[1] Inquiry into the Causes and Effects of the Variolæ Vaccinæ, p. 52.

direct from them, he might have it apart from these unessential malignant characters. And a person having, accidentally or designedly, contracted cow-pox, was held by Jenner to be safe from small-pox, not because he had gone through some peculiar disease which stood in mysterious antagonism to small-pox, but simply because he had actually gone through small-pox itself. So much of these speculations as ascribes the origin of human and vaccine variola to the horse has received less attention probably than it deserved, and has certainly had little acceptance : but the truth of the more essential part of the teaching—the common origin of the Variolæ Vaccinæ, Variolæ Equinæ, and Variolæ Humanæ, from one specific infection—has been established by conclusive experiments.

26. Inoculation of Cattle with Small-pox.—Jenner himself did not perform any inoculations of cattle with the lymph of human variola. But as early as 1801, Gassner, of Günsburg, by inoculating eleven cows with small-pox matter, produced on one of them vesicles from which he was able to inoculate four children : these children developed the ordinary phenomena of vaccination, and, with lymph from them, seventeen other children were similarly infected.[1] Thus, it happened that in the same year—the third after the promulgation of Jenner's discovery—Loy demonstrated the production of the vaccine disease in the cow by inoculation from Variolæ Equinæ (§ 14), and Gassner, by inoculation from human small-pox. But the production of vaccine in the cow by small-pox inoculation is a matter of very considerable difficulty : for one case in which the inoculation succeeds, it will fail in at least a dozen. And as Gassner's experiments, somehow or

[1] Henke's Zeitschrift Ergänzungs, heft xxx. p. 57.

other, were not very widely known, while other experiments made about the same time in England and elsewhere failed, Jenner's doctrine was far from being universally received. Beyond a mere general, though no doubt well-founded, statement made by Dr. M^c^Michael to the Royal College of Physicians, in 1828, that in Egypt it had been discovered by some medical men that fine active vaccine virus might be produced by inoculating the cow with small-pox from the human body, and that several children had been vaccinated with complete success with the lymph thus generated,[1] there is no account of any further experiments till 1830. In that year Dr. Sonderland of Barmen managed, he tells us, to infect cows with the contagion of variola, by enveloping them in blankets taken from the bed of a patient who had died of small-pox, and by hanging such blankets up around the head of the animal, so that it must breathe the effluvia arising from them. And the result was, that in a few days the cows manifested the symptoms of cow-pox, and lymph taken from them produced genuine vaccine vesicles in the human subject.[2] Some remarkable circumstances will presently be stated (§ 27), tending strongly to show that vaccinia may be produced in cows by the action of variolous effluvia. All the attempts, however, which were made to infect cows directly by repetition of Sonderland's experiments—as in England by Mr. Ceely,[3] in India by Mr. Macpherson and by Mr. Lamb,[4] and on the Continent at the Veterinary School at Alfort, at Berlin, Weimar, Bergen, Dresden,

[1] Report of the Vaccination Section of Prov. Med. and Surg. Assoc., 1839, p. 24.

[2] Hufeland's Journal, Jan. 1831.

[3] Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 380.

[4] Trans. Med. and Phys. Society of Calcutta, vol. vi. and vol. viii. Both also tried variolous *inoculation* on cows without success.

Kasan, Utrecht, and Stockholm—were unsuccessful: for although both at Utrecht and Stockholm a pustular or vesicular eruption manifested itself on those parts of the bodies of the animals experimented on which were in immediate contact with the infected coverings, this was evidently of a local non-specific character.[1]

But, in 1836, Dr. Thiele, of Kasan, after several fruitless attempts to infect the cow by inoculation of the variolous virus, at length succeeded in so doing, and in producing thereby the genuine vaccine disease; from this he raised a stock of lymph for human vaccinations, which, at the time his account was published, had gone through 75 transmissions, and been employed in the vaccination of more than 3,000 subjects, many of whom had had their security against small-pox tested by inoculation, and by the closest exposure to the infection of that disease. Dr. Thiele on various occasions afterwards succeeded in producing cow-pox in cows by variolous inoculation, and he attributes much of his later success, after so many early failures, to the precautions he takes in the selection of the animals, and in the mode of conducting the experiments. Cows should be selected from four to six years old, which have recently calved, and if possible which have white or fair teats; they should be kept at a uniform temperature (15° R.); the inoculation should be performed at the base of the udder, out of the way of licking, the udder being first shaven; and the variolous lymph should be in a clear limpid state.[2] Before Dr. Thiele's experiments

[1] Hering, Ueber Kuhpocken an Kühen, pp. 9–12. Hering *thinks* that Retzius, of Stockholm, told him that it had happened to Prof. Billing to produce regular vaccine by inoculating cows on the udders with variolous matter, and that a stock of lymph was thus obtained.

[2] Henke's Zeitschrift, 1839, heft 1.

were known in this country, Mr. Ceely of Aylesbury had succeeded (in February 1839) in inducing vaccine vesicles in two sturks by inoculation with variolous lymph, and in thus establishing lymph-stocks which passed at once into extensive use, so that, in a few months, more than 2,000 children had been vaccinated from them.[1] In many of these subjects the protective value of this variola-vaccine lymph was tested by variolous inoculation by Mr. Ceely himself at various periods after the vaccination; no constitutional affection was produced thereby in any case, and the local results resembled in every respect those recorded by Willan as having attended the test inoculations practised in the early days of vaccination.[2] In December 1840, Mr. Badcock, at that time residing at Brighton, without any previous knowledge of Mr. Ceely's experiments, succeeded in variolating a cow, and deriving therefrom a stock of genuine vaccine lymph;[3] and he has from 1840 to the present time, by inoculation of cows with the lymph of human variola, raised stocks of vaccine lymph for use on no fewer than thirty-seven separate occasions.[4] The lymph thus

[1] Trans. Prov. Med. and Surg. Assoc., vol. viii. pp. 379-402. The experiments were made on this occasion on three animals, and succeeded on two, but Ceely says he has many times failed to variolate the cow, at different seasons and under varying circumstances, by precisely or pretty nearly the same modes of operating as were successful in these instances. He gives most valuable hints to those disposed to repeat his experiments.

[2] Ibid. vol. x. p. 262, &c.

[3] A Detail of Experiments confirming the Power of Cow-pox, &c.

[4] It must be distinctly understood that every one of these thirty-seven successful experiments was the result of the direct inoculation of the animal with lymph taken from a human subject affected with variola; that no case is included in which lymph taken from a cow that had been variolated was used to inoculate other cows.

obtained by him is now largely employed; it has been supplied to many hundreds of practitioners, and very many thousands of children have been vaccinated with it. It is worthy of note, however, as illustrating the difficulty attendant on the production of vaccinia in the cow by variolous inoculation, that these thirty-seven successes represent but 7 per cent. of the experiments undertaken by Mr. Badcock: to obtain them, he had to perform between five and six hundred variolous inoculations. In 1852, Mr. Ceely's experiments were repeated in America by Dr. Adams of Waltham, and Dr. Putnam of Boston, who were able, it is said, in consequence to "furnish the city and neighbourhood (of Boston) with all the vaccine matter used there since that period."[1]

27. **Probable case of infection of Cattle by Variolous Effluvia.**—In 1840, Mr. Ceely met with a case of exceeding interest, in which there was good ground for believing that the vaccine disease was induced in cows by *variolous effluvia*. Eight milch cows and two sturks were turned to graze during the day-time in a meadow at Oakley, in the Vale of Aylesbury, in which the clothes and bedding of a person who had died of malignant variola had previously been exposed almost constantly night and day for a week, and in which they were still always exposed at night, and not always removed in the morning before the readmission of the animals. On one occasion, at least, the cows were observed in the midst of the bed-flock, licking it up.

But such transfer was also on one occasion made by Mr. Badcock, and a supply of vaccine lymph thus obtained.

[1] Boston (U. S.) *Daily Advertiser*, April 14, 1852, as quoted by Simon, Papers relating to the History and Practice of Vaccination, p. xiv.

Within twelve or fourteen days of their admission to the meadow, five of the milch cows and one sturk exhibited simultaneously, or almost simultaneously, well-marked cow-pox. It was most clearly ascertained that the animals, which were animals belonging to the place, and had not been brought in from elsewhere, were in good health at the time of their admission to the meadow, and that there was no vaccine disease at the time anywhere in the Vale. None of the milkers had any sores on their hands, *except what they subsequently got from these cows:* besides, one of the infected animals was a sturk. The simultaneousness of the attack in all the animals showed *a common cause:* and it is not in the least probable that this cause was a sudden epizöotic outbreak. For the disease, on the most minute and diligent inquiry, was not met with elsewhere: and when cow-pox occurs as an epizöotic, its characteristic is, not an appearance all at once in *many* animals *in the same dairy*, but an appearance of it at the same time, or about the same time, on *one or two* animals in *various different farms*. When on any farm several animals are attacked, this is found always to proceed from infection from the one or two primary cases; and Mr. Ceely states that, in the whole course of his experience, he never saw so many primary cases together in a dairy at one time, as on this occasion. Lastly, the period of attack—ten or twelve days from the first exposure—corresponds entirely with what might be anticipated if the common cause of the outbreak were variolous effluvia.[1]

28. Phenomena of successful Variolation of Cows.—The phenomena of successful variolation of the cow, as described by M. Thiele, consist first in the development of "tubercules" under the skin; these,

[1] Trans. Prov. Med. and Surg. Assoc., vol. x. pp. 211–225.

by the fifth day, resemble advancing vaccine vesicles; and from the seventh to the ninth day they have central depression and are found to contain limpid lymph. From the ninth to the eleventh day desiccation sets in, and a crust forms, which on falling leaves a smooth cicatrix. If from three to six punctures have been made, generally not more than one or two vesicles will be found resulting. Ceely states, with great care, the phenomena exhibited in his successful cases. In one of these, though seven punctures were made, and fourteen points, charged half their length with variolous lymph, were introduced, as well as two setons inserted which had been impregnated with small-pox virus, no phenomena indicative of taking were noticed till the tenth day, when some of the punctures were found hard and elevated, and one had assumed the form and appearance of the vaccine vesicle; it was nearly circular, had an elevated margin, and a small crust in the depressed centre. From this vesicle it was possible, by pains and care, scantily to charge thirty-eight points in the course of an hour, which points were afterwards used to inoculate children, and produced in them all the phenomena attending the use of primary cow-lymph. Two other of the punctures in this cow seemed to advance a little, but no lymph formed in them, and the vesicle above described was the single vesicle caused by variolation. In its progress and decline this vesicle followed exactly the course of the primary vaccine vesicle in the cow.[1]

In the other ultimately successful experiment, the first attempt to inoculate the cow, made in the same way, by seven punctures and two setons, failed; and, at the end of a fortnight, more small-pox virus, taken at the seventh and eighth days of the disease, was

1 Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 382, seq.

forced into eight punctures, "which were deluged with it, the punctures being afterwards irritated with points deeply charged with the same, which were suffered to remain in the punctures." By the fifth day there resulted from this last inoculation eight distinct papules, which by the day following had, each of them, all the appearance of the vaccine vesicle. From one of them clear lymph was obtained, with much difficulty, so as scantily to charge thirty-nine points. On the eighth, the ninth, and the tenth days, it was found that four only of the papules had become decided vesicles, and from one or other of these some more lymph was taken. The vesicles were at their fullest development on the tenth day, and the commencement of the decline on the eleventh was obvious; the crusts fell about the twenty-fourth day.[1] When the lymph generated by these experiments was employed on the human subject, it was found to produce exactly the same phenomena as are developed by primary cow-lymph;[2] and it is most important to note, for reasons that will immediately appear, that though on *some* of the subjects in whom this lymph was used, eruptions of roseola and lichen were seen, as is frequently the case when primary cow-lymph has been used, no eruption with the slightest approach to varioloid character was observed. It is further very material to note, that these experiments were made with every care to guard against any possible source of fallacy. The small-pox virus used was collected by Ceely himself: every point and tube used was perfectly new. The phenomena were watched by himself and others day by day; and in collecting the products of the inoculation, which was also done by

[1] Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 385.

[2] See description of the effects produced on the human subject by variola-vaccine lymph in chap. v. § 44.

himself in the presence of others, every precaution was employed so that no possible mistake could arise.[1]

29. Change which the variolous virus undergoes in passing through the Cow.—But though cow-pox in the cow and human variola have been thus clearly proved to arise from the same infection, this infection in passing through the cow undergoes such alteration as deprives it of all malignity and of all power of propagating itself among the human species by effluvia. The small-pox of man conveyed to the cow produces cow-pox; but the cow-pox thus induced, retransferred to man, is as incapable as the natural cow-pox itself of producing infectious small-pox. Many tens of thousands of persons in England have been vaccinated by various hands (see *ante*, § 26) with lymph thus generated—variola-vaccine lymph, as it is called. Mr. Badcock alone has performed upwards of 20,000 vaccinations with it. So that the properties of the lymph are established on a scale far too considerable for question.

30. Experiments of M. Chauveau, &c.—Probably the experiments of Thiele and Ceely have been known chiefly in France through the singularly inaccurate and imperfect account of them given in the classical work of Bousquet,[2] and probably also the confirmation

[1] Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 390. The reader must himself consult this admirable memoir fully to appreciate the care with which the whole investigation was conducted.

[2] The fourteen pages devoted by M. Bousquet to the subject of the renewal of vaccine "en inoculant la variole à la vache" (Nouveau Traité, pp. 437–451), besides many inaccuracies with regard to Thiele's and Ceely's experiments, contain a piece of intelligence which sounds strange and amusing to English ears. M. Bousquet says that, in England, when children were vaccinated with Ceely's variola-vaccine lymph, "les premiers n'ont eu qu'une éruption locale ; mais, en poursuivant les expériences, il s'en est trouvé qui ont eu une variole complète, tellement que l'autorité a fait

they have received from the repeated experiments of Mr. Badcock is there quite unknown; but certain it is that the variolous origin of cow-pox, which has been completely accepted in this country for the last quarter of a century and more, has remained in France one of the open questions. And now, some recent experiments which have been made at Lyons are said to have shown that it is a delusion to suppose that the inoculation of cows with variola has ever produced cow-pox, for in fact it produces in that animal real small-pox, and nothing else. This statement, however, is not quite new. Once before, at the Veterinary School at Berlin, inoculation of the cow with variolous lymph was performed, and "pustules," it is said, produced, which, when inoculated back on the human subject, were found to reproduce small-pox. No details were given, and the value of the experiment cannot, therefore, be determined.[1] A similar result is said to have been obtained at Boston (U. S.) in 1860.[2] But the more recent experiments leading to the same conclusion, which were performed by M. Chauveau of Lyons, with the assistance of MM. Viennois and Meynet, are stated in full detail in a most interesting memoir published by them on this subject;[3] and as these experiments satisfied a committee of the Académie des Sciences that a

défense de communiquer ce virus, et a puni une infraction de 300 fr. d'amende." Perhaps this extraordinary statement, for which it need scarcely be said there is not the slightest foundation, may have helped to mislead M. Chauveau and his colleagues. (Vide postea.)

[1] Verheyen, Mémoire sur la Vaccine primitive, in Mém. de l'Acad. Royale de Médecine de Belgique, tome i. But Verheyen gives the statement at second hand, and refers to Viborg, *Samml.* B. iii. S. 112.

[2] Boston *Med. and Surg. Journ.*, Feb. 23, 1860, as quoted in the "Year-Book of Medicine for 1860" (New. Syd. Soc.).

[3] Vaccine et Variole: Rapport par MM. Chauveau, Viennois, et Meynet, in Mémoires et Comptes Rendus de la Soc. des Sc. Méd. de Lyon, tome v.

distinct small-pox disease may be induced in the cow or horse by variolous inoculation, as cow-pox is induced in them by vaccine inoculation, the small-pox virus in its transit through these animals being incapable of conversion into vaccine, they demand our most attentive consideration. According to the statements of M. Chauveau and his colleagues, inoculation of cows or of horses with the lymph of human variola gives rise to no general symptoms of any kind, but is invariably followed by a local eruption of papules. These papules in the cow are described as being from two to four millimètres only in diameter, scarcely projecting above the surface, slightly conical, and with the puncture of inoculation visible at the centre; they are at their fullest development by the fifth day, and are quite gone by the twelfth, leaving an extremely small blackish crust or scale at the point of puncture: at no period of their course do they exhibit any tendency whatever to secretion. The authors state that the greater number of persons, competent to form a judgment, to whom these papules were shown, regarded them as the simple result of inflammatory action round an inoculated point, and as indicative of no specific infection: they themselves, however, consider them to be a true variolous eruption, which, it is admitted, is "si peu accusé dans un grand nombre de cas, qu'il faut une certaine habitude pour en constater la présence." There is, in fact, so little of definite character about this eruption, that though the authors can themselves detect it, they would find it difficult, they say, to point out to others the exact characters which should distinguish a successful inoculation from a failure. In the horse, papulation was found, in the three experimental inoculations that were made, to be much more evident than in the cow: the papules were conical, reddish, and tender; they ran

a course exactly like that of the papules in the cow, and disappeared ("sans qu'on ait constaté la moindre tendance à la sécrétion") by gradual absorption and desquamation of the epidermis over their surface. By removing a number of these papules from some cows, and scraping well their inner surface, or by removing the central scales from some of the papules of the horse and squeezing the little cavities then laid bare, excessively minute quantities of a serous liquid were got, which, when inoculated from cow to cow, or from horse to horse, or from horse to cow, produced much slighter local effects than the foregoing, so that (except in one case, which unfortunately could not be followed out) it was uncertain, even to the authors, whether the inoculation had taken or not, but which when inoculated on the human subject reproduced variola. With serosity taken from one of the cows and one of the horses, local vesicles, followed by general varioliform eruption, were in fact produced on three children, and from these children other variolous inoculations were performed.[1] These results are regarded by the experimenters as showing that the inoculation of variola on horses and cows produces a true variolous infection, and that the organism of these animals is therefore incapable of transforming variola into vaccine. But they do not appear to me to lead at all necessarily to the conclusions thus drawn. The local effects produced by these inoculations were not in any

[1] With regard to some of these cases, however, more particular information would have been very desirable as to the opportunities the children had of contracting variola by infection in the usual way. It is clear there was small-pox at Lyons at the time; and I think it not improbable that in some of the later inoculations, which were attended with dangerous symptoms, the subjects of inoculation might already have taken infection in the natural way. Refer to the concluding note of this chapter.

respect greater than those produced by Ceely in cases which he regarded as failures,[1] nor than in cases which the authors themselves at first put aside as failures, nor than the results which followed some variolous inoculations of horses (two) performed in 1863 by MM. Le Blanc and De Paul, which were regarded by them as unsuccessful.[2] And it is not in the least improbable that if Mr. Ceely, or MM. Le Blanc and De Paul, had, in the cases they describe, dealt with the tumid papules that arose as M. Chauveau and his colleagues did,[3] they might have got from them the same stuff they had put in, stuff which had undergone no sort of transformation whatever, but which had lain where it was put, as in a pouch, quite inert, giving rise only to local irritation without inducing any sort of general affection or disease. M. Chauveau and his colleagues are indeed fully aware that, unless they can prove that *a disease*, a constitutional affection, was imparted to the animals by variolous inoculation, their experiments will remain inconclusive; and they endeavour to show that horses and cows, that have undergone what they consider as successful variolous inoculation (and *all* their inoculations of these animals with the matter of natural human variola *were* successful),[4] became insusceptible of vaccination. But their

[1] Ceely, Trans. Prov. Med. and Surg. Assoc., vol. viii. pp. 385, 387.

[2] Bulletin de l'Acad., tome xxix. p. 370.

[3] No doubt, by removing the papules as they did, these experimenters may have missed a chance of a really successful inoculation. In Mr. Ceely's first successful experiment (*op. cit.* p. 382) the local phenomena on the fifth day were fully as much developed as any described in the Lyons memoir, by the ninth day he had begun to despair of the inoculation taking, and it was not till the tenth that a vaccine vesicle was developed. (See account in text, § 28.)

[4] Considering the difficulties always more or less attending the transplantation of the exanthematous diseases of one species of animal to animals of another species, the *uniform* success of these

experiments are far from establishing this: in ten cows and one horse which had had the so-called variolous eruption, vaccination took completely on one, imperfectly on three, and on the remainder failed. It is quite true that the same vaccine lymph with which these experiments were made, used on three animals on which no variolous lymph had been inserted, took effect in all, and that, generally, the vaccination of cows was found by the experimenters very surely to take effect; but it is a well-known fact that the degree to which cows are susceptible of the vaccine inoculation, independently of any variolous or other experiment having been tried upon them, is very various (see § 12, c), and the test would have to be applied to a much larger extent, and under other conditions,[1] than has yet been done, to justify such sweeping

attempts is very remarkable, and in itself suggestive of error. Of twelve cows and three horses, in which inoculation with variola was tried, there was *not one* failure; and although the results on five cows (they do not remember the number exactly, but are sure it was at least five) inoculated at an antecedent period had been regarded at the time as unsuccessful, this judgment was afterwards recalled by the experimenters, and ascribed to their not having then made out the real characters of the variolous eruption in the cow. So that the inoculation, according to this account, took effect on the whole twenty animals on which it was tried.

[1] Especially it would be desirable that the vaccination should in some cases be tried *some time after* the variolous inoculation, and not, as in all these cases, immediately after it. It has been said (I know not with what truth) that the vaccination of sheep, which only produces, as has been shown, a local affection, and no disease which stands in the place of sheep-pox, will yet for a few weeks render the animals insusceptible of sheep-pox. In reference to this, Dr. W. Budd observes:—"There is, indeed, evidence to render it probable that, for some weeks after vaccination, sheep are somewhat less prone to take *clavelée*—sheep-pox—in the natural way; but there is clearly nothing specific in the protecting influence. Louis has remarked that typhoid fever hardly ever occurs in persons who may at the time be the subject of any other morbid disturbance. The two facts are

conclusions. When M. Bouley inoculated a cow with variola with the same results as M. Chauveau obtained, and vaccinated it afterwards, he produced regular cow-pox: and Ceely informs me that in his variolous experiments on cattle he constantly produced the phenomena described by M. Chauveau, and found subsequent vaccination of these animals, in the great majority of cases, successful. Lastly, the experimenters of Lyons, who do not appear to have seen Ceely's original memoir,[1] do not in the least dispute his account of the results he met with: only, what he mistook for cow-pox vesicles on the cow was the variolous eruption: and what he produced on

probably of the same order." I do not myself, however, lay much stress on this. I simply think that a great deal too much is made of half a dozen cows not taking cow-pox when inoculated with it, and I confess I have not much doubt that, if the vaccination were repeated on those animals, it would be found to take effect on some of them—unless, indeed, they were animals which had already had cow-pox naturally or otherwise. Four attempts to produce the variolous eruption on animals of the ox and horse tribe, which had previously had cow-pox or horse-pox, are said to have failed, but the account is very unsatisfactory. It is quite clear that some local effect was produced, and it is with reference to these experiments on cows that M. Chauveau and his colleagues make the observation, cited before in the text, that they find it difficult to point out to others the difference between failure and success.

[1] They state that they have not seen "the plates," and the memoir has not been published in English apart from them; they are also to be found in the only complete foreign translation with which I am acquainted, viz. that of Dr. Heim, of Ludwigsburg, though, it must be confessed, sadly spoilt in the colouring they underwent in Germany. There may, however, be some complete translation of the memoir with which I am not acquainted. A sight of the plates would apparently be of little consequence to the Lyonnese experimenters, because, if these should show any vaccine vesicle as the result of the variolous inoculation, it would only, they say, prove that the draughtsman did not know what he was about! It would at all events have shown them that their own local results on cattle were quite well known in this country twenty-five years before.

children with lymph taken from these vesicles—the effects he describes with such singular care and minuteness—were not, as he imagined, cow-pox at all, but simply inoculated small-pox! The hundreds of practitioners who in England have for nearly thirty years been using Ceely's or Badcock's lymph, must learn with extreme surprise that all this time they have not been vaccinating, as they supposed, but actually unconsciously variolating, their patients!—that they have in fact been making their patients so many foci of variolous infection![1] It seems difficult to treat as serious this hypothetical suggestion of M. Chauveau.

31. Cattle not shown to be subject to any other variolous affection than Cow-pox. — It has been advanced by some distinguished writers—the late Dr. Baron, the friend and biographer of Jenner, held strongly this opinion—that cattle are subject to an epidemic small-pox of their own; probably, they thought, a malignant variety of the disease known to us as cow-pox, but differing from the cow-pox as we see it, just as in the human subject a severe case of natural small-pox might differ from an inoculated case of the same disease. But the facts that have been advanced appear insufficient to sustain this opinion. Great stress has been laid by those who have held it on the resemblance which, in many of its features, the "cattle plague" of last century bore to human small-pox, a resemblance which had struck various distinguished observers of that period, and from which the authors

[1] "La variolation médiate" (by which is meant the inoculation of human subjects with variolous virus that has passed through the cow, but the statement particularly includes Thiele's and Ceely's results) "comme l'inoculation variolique directe, créerait, si elle se généralisait, un foyer permanent d'infection, qui couvrirait presque toute la surface du globe." (Vaccine et Variole, &c. *op. cit.*)

to whom I refer were led to consider that pestilence as nothing else than bovine variola.[1] The same opinion, it will be remembered, obtained considerable acceptance for a time respecting the cattle plague which recently made such severe havoc among the herds of Great Britain. But I believe I am right in stating it to be now universally accepted that both these plagues—the one of last century and the one with which we have been lately visited—are one and the same disease, that which has been long known abroad as Rinderpest or Steppe-murrain : a disease which, in its course and symptoms, has no doubt points of analogy with small-pox, but which stands in no causal relation to it. Each has its own distinct infection.[2]

In support of this opinion, reference has also been made to a disease said to affect cattle in India, to which the natives give the same name which they apply to small-pox in human-kind, calling it Bussunt, Mhata, or Gotee.[3] To this similarity of name no importance whatever is to be attached, for the term, so far as it is applied to cattle, is not limited to one disease in particular, but includes a number of diseases, some

1 Dr. Baron even regarded the cow-pox discovered by Jenner in the Gloucestershire dairies as the remains of the violent epizöotics of cattle plague which invaded England during last century. (Report of Vaccination Section of Prov. Med. and Surg. Assoc., 1839, p. 12.) Cheshire was, of all the counties of England, the one that *suffered most from cattle plague* during last century ; but we have Dr. Percival's authority that *the cow-pox was unknown there*, and yet it is not less a dairy county than Gloucestershire, and the office of milking is performed also by men and maid-servants indiscriminately. (Letter from Dr. Percival to Dr. Jenner, Baron's Life of Jenner, vol. i. p. 158.)

2 See Third Report of the Commissioners appointed to inquire into the Origin, Nature, &c. of the Cattle Plague.

3 Rep. of Vaccination Section, &c. (*op. cit.*), p. 17.

of which, so far from being analogous to small-pox, are not attended with any sort of eruption.[1] Nor are those forms of Gotee which *are* attended with eruption regarded by the natives as in any degree infectious to mankind; no fear of contracting sores from handling affected animals being entertained by them. From some kind of Gotee, cow-pox is said to have been propagated to the human subject, in 1832, by Mr. Macpherson, who was then the superintendent of vaccination at Moorshedabad.[2] The disease which at that time prevailed among the cattle in that district appears, by his description of it, to have been very like rinderpest, the analogy to small-pox consisting in its being attended with what were called pustules all over the body, terminating in ulceration. All the cattle in the neighbourhood became affected, "and amongst others" (I now quote Mr. Macpherson's words) "two belonging to one of my own vaccinators. I had them covered with blankets, leaving merely the udder and teats exposed to the air; on the seventh day two small pustules made their appearance on the teats of one, which dried up on the tenth, and the crusts were removed on the twelfth day." From these crusts eleven native children were inoculated; one of them successfully, a vesicle appearing on the fifth day which continued to increase till the ninth day, when it had all the characters of true vaccine: the child suffered much from fever for four days. Two children were vaccinated from this vesicle with complete success, the symptomatic fever being very severe; from these two children, five others were successfully vaccinated, and the stock of vaccine thus established was after-

[1] Duncan Stewart's Report on Small-pox in Calcutta (1844), pp. 84, 85.

[2] Trans. Med. and Phys. Society of Calcutta, vol. vi.

wards regularly continued. Some of the children vaccinated with this lymph were tested by variolous inoculation and by exposure to variolous infection, and found to be secure. From these facts it is not to be doubted that a case of cow-pox in the cow had been met with; but what is to be doubted is that the Gotee—the malignant disease above referred to—was the source of this infection. The description of the state of the animal from which the lymph was taken (which I have fully quoted) is, it will be remarked, exceedingly meagre; there is not any account whatever of the general symptoms it exhibited,[1] and the eruption, so far from being like that said to be prevalent, viz. one of pustules all over the body terminating in ulceration, was of a couple of pustules (vesicles) only, having exactly the character of an ordinary case of casual small-pox. Other occurrences of equal, and in some respects of more remarkable, interest took place the year following (in 1833), in another part of India, at Silhat in Assam.[2] A disease then prevailing there among cattle, which the natives called Gotee, and which, like the disease at Moorshedabad, was attended with eruption, Mr. Furnell, a surgeon, made an unsuccessful inoculation with some dry scabs taken from the body of one of the animals, and, being obliged then to leave for a short time, requested another surgeon, Mr. Brown, to continue the experiments. Mr. Brown's inoculations of

[1] All I think must participate in the "frequent regret" expressed by Dr. Duncan Stewart, in whose official report these cases will be found, that "information was not given more fully regarding the appearances of the disease in the cows from which he took the crusts, one of which succeeded." (Stewart, *op. cit.* p. 146.)

[2] Trans. Med. and Phys. Soc. of Calcutta, vol. vii. p. 453 (Mr. Furnell's account); and vol. viii. Appendix, p. 97, seq. (Mr. Brown's account).

four children from similar scabs were all successful. No account is given of the symptoms which the animals said to have Gotee manifested, nor of the state of the particular cow from which the scabs were taken, except that it was lean and ill-conditioned, and studded with scabs over the back and abdomen; whence it is evident that, in this case, the animal had a generalized eruption of some kind or other. The four children inoculated from the scabs had genuine vaccine vesicles, with the increased constitutional disturbance usual when primary cow-lymph is used, and for several weeks the lymph was continued with the production, as was believed, of only the ordinary effects of vaccine, although afterwards there was ground for suspecting that, on some of the children vaccinated during this period, an eruption of some kind (which from subsequent events we need have no hesitation in calling modified small-pox) had manifested itself after the day on which the children had been inspected. At length, however—at the end of about two months from the introduction of this lymph—the vaccinations, as they were believed to have been, of a particular day resulted in unquestionable small-pox. Now as it is quite out of the question that cow-pox on the human subject should have been transformed into small-pox, only one of two explanations of these occurrences is possible: either the disease conveyed from the animal to the children was, from the first, small-pox; or some of the native children who had been the subjects of the vaccinations of Mr. Brown and the native assistants, during the two months that elapsed before these occurrences took place, had before the day of their vaccination been exposed to variolous infection, and contracted variola; and from one of these cases variola had been propagated. It is quite certain that the native child from whom the

inoculations were performed which resulted in undoubted variola had had an eruption, for it was sent for as soon as alarm was taken, and there were found "a few scabs, about twenty, on his entire body." There can be, I think, little hesitation as to which of these explanations should be accepted.[1] I have not been able to find any particulars of another case referred to by Dr. Baron as having given rise to similar circumstances in the practice of Mr. Wood, at Gowalpara. For the last thirty years we have had no further accounts of Gotee in India, in connexion with small-pox. But it would be very interesting that further inquiries should be made in that country, not only in reference to this point, but for the detection (and no doubt it will be discovered, if carefully looked for) of cow-pox in the form in which it is known in Europe and in America, wherever it is met with as a natural disease.

[1] In trying new lymphs it is very essential to be on one's guard against the fallacies that may arise if the subjects on whom they are tried have been exposed, or are liable to exposure, to small-pox infection. When, in 1799, Woodville found the natural cow-pox in a London dairy and commenced vaccinating with it at the Small-pox and Inoculation Hospital, he was astonished to find three-fifths of his patients have eruptions not to be distinguished from variola; and for some time he held that the vaccine disease was an eruptive disease, like inoculated small-pox, and, like it, infectious. Jenner at once pointed out that a fallacy existed—that the effects observed were not the effects of "uncontaminated" cow-pox, and that variola itself must, in some way or other, have crept into the constitution. When the same lymph was sent to Berkeley (where there was at the time no small-pox), or when it was used by Woodville himself in his large private practice, no eruptions followed. Woodville afterwards was quite satisfied of, and admitted, his error.

CHAPTER V.

Of Vaccinia, or Cow-pox, in the Human Subject.

32. Cow-pox in the Human subject.—Cow-pox can only be communicated to the human subject by inoculation of the specific virus of the disease : it is not communicable by effluvia. The inoculation may be made directly from the cow or horse, but is much more surely and conveniently made in the way discovered by Jenner, viz. from a human being who is at the time the subject of the infection. The phenomena to which cow-pox inoculation gives rise in those to whom the infection is communicated for the first time, differ, generally, considerably from those exhibited by persons who have already passed through the disease. It will be necessary, therefore, in description, to treat separately of the course of primary and of secondary vaccination.

(A) COURSE OF COW-POX IN PERSONS NOT PREVIOUSLY INFECTED BY IT.

33. Phenomena and course of Vaccination.—As there are certain points of difference between the phenomena which ensue when the lymph used for

vaccinating is taken from human subjects, and when it is taken direct from the cow, and as vaccination from the human subject is the plan universally, or all but universally, adopted, I shall describe first the course of vaccination thus performed, and then notice such differences as are observed when lymph from the cow is employed.

34. Usual course.—When vaccine lymph taken on the point of a lancet is inserted by puncture on the arm of an infant who has not before been vaccinated, no particular local effect is noticeable for the first two days; but, if the vaccination be about to succeed, by the end of the second, or by the third day, a slight papular elevation is perceptible; and this, by the fifth or sixth day, has become a distinct vesicle, of a bluish-white colour, with a raised edge, and a peculiar central cup-like depression. This vesicle, the structure of which, like that of the cow-pox vesicle in the cow (§ 6), is cellular, gradually enlarges, and by the eighth day (the day week from the insertion of the lymph) has attained its highest perfection. It is then plump, round, and more decidedly pearl-coloured; it is distended with clear lymph; the elevation of its margin and the depression of its centre are more marked. At this date, or sometimes a few hours earlier, a ring of inflammation, termed the areola, begins to form about its base, and the vesicle and areola together continue for the next two days to spread. The areola is circular, and, when fully developed, has a diameter of from one to two inches; it is often attended with considerable hardness and swelling of the subjacent connective tissue. The establishment of the areola demands always the attention of the practitioner and student, as the anatomical evidence that the cow-pox has produced its specific effect on the constitution. Other proofs of the constitutional influence of the vaccination

are at this period of its course generally afforded in the child's restlessness and heat of skin, with (frequently) derangement of the stomach and bowels, and with (sometimes) swelling of the axillary glands. But these general symptoms, though seldom altogether absent, are often exceedingly slight; and their absence (provided always that the proper areola is formed) constitutes no reason for doubting the protective influence of the vaccination. After the tenth day the areola begins to fade, the vesicle begins to dry in the centre, the lymph remaining in it becomes opaque and concretes, and, by the fourteenth or fifteenth day, a hard brown scab is formed. The scab gradually contracts, dries, and blackens, and, from the twentieth to the twenty-fifth day, falls off, leaving a cicatrix which is commonly permanent, and which in character is circular, somewhat depressed, foveated or indented with minute pits, and sometimes radiated. A well-foveated cicatrix is, next to having watched the vaccination through its course, the best test we have of the security of the system against small-pox. On comparing the course of cow-pox as it manifests itself in the human subject with its course in the cow, we find that the phenomena are essentially alike, but that there exist, at the same time, certain points of difference. In the human subject the vesicles are fresher, juicier, and more convex; their appearance is more exactly simultaneous; they have more uniformly, and more essentially, the central depression; and the areola is much broader and much more marked.

When the mode of inserting or applying the lymph has not been by single puncture, nor by such abrasion of the skin as would raise a single vesicle, but by two, three, or more punctures close set together, or by scarifications or abrasions over some extent of surface, in a manner that

will hereafter be described (§ 50, c, 3), so that two, three, or more vesicles are developed in close proximity, these usually coalesce, and a vesicle results, the compound character of which is very obvious; or there may be a crop of coalescent vesicles, each having its distinct head with characteristic depression. These compound vesicles and crops are round, oval, or of irregular outline, according to the manner in which they have been induced, and the shape of the resulting cicatrices varies accordingly.

The clear, smooth, supple, delicate skin of the infant is peculiarly adapted for manifesting in perfection the local characters of the vaccine disease. In elder children, and much more in adults, though the phenomena of primary vaccination are essentially the same as in the infant, the vesicle is often wanting in that plumpness, sharp definition of edge, and beautiful lustre, which the experienced vaccinator delights to see.

35. Constitutional symptoms; vaccine roseola, vaccine lichen, &c.—In some infants constitutional symptoms are noticed before the formation of the areola—never, however, amounting to more than a little feverishness and fretfulness, most observed in the evening and remitting in the morning, about the sixth or seventh day;[1] but in elder children, and still more in adults, who are the subjects of primary vaccination, these early symptoms are usually more marked. The amount of the constitutional affection which, two or three days later, attends the development of the areola (see pre-

[1] From notes with which Mr. Squire, of Orchard Street, has favoured me, of a few observations made by him on the temperature, as indicated by the thermometer, of children at different stages of vaccination, it appears probable that a rise will generally be found existing by the sixth day, or even perhaps a day earlier. Mr. Squire is, I believe, continuing these interesting observations.

vious section), varies in different subjects with the texture and vascularity of the parts, with the extent of local inflammation, and with the temperament and age of the individual; infants suffer usually less than elder children, and these less than adults. But, even with the most perfect areola, the general symptoms are often very trifling. In adolescents and adults the course of primary cow-pox is apt to be somewhat more retarded than in infants, the areola is frequently much more diffuse, and there is much oftener swelling of the axillary glands. In young children of full habit, especially in hot weather, about the ninth or tenth day, when the areola is at its height, an eruption of roseola will occasionally take place, especially on the extremities; sometimes the eruption takes a papular form, constituting what is termed vaccine lichen; sometimes it is vesicular. In the latter case, however, the vesicles have no resemblance to the cow-pox vesicles, but are more like those of chicken-pox; that disease, in fact, occurring in the course of a vaccination, might easily, without due care and inquiry, be mistaken for the vesicular eruption which occasionally attends the course of regular vaccine. But the occurrence of *any* of these forms of eruption during vaccination is the exception and not the rule: when they do occur, their duration is, for the most part, very transitory, usually not extending beyond a week, and very seldom indeed lasting beyond the falling of the scab. Their appearance is almost limited to the period of childhood: they are very rarely seen on adolescents or adults.

36. **Abnormal course.**—But vaccinia in the human subject does not invariably follow the course above described. Its progress may be, (*a*) retarded, (*b*) accelerated, or (*c*) altogether irregular and spurious.

(a) **Retarded Cow-pox.**—The most simple and

frequently seen form of retardation is a mere delay of a day or two in the course of the vesicle; by the eighth day this has not more size and development than ordinarily it has on the sixth, and the areola does not form till the tenth day, or even later. This amount of retardation is held by many experienced vaccinators to be more frequently met with in cold weather, especially during the prevalence of a dry easterly wind, in persons who are much exposed to the air. Sometimes a longer delay occurs; at the end of a week from the vaccination, when the child is brought for inspection, there is so little evidence of result, that it is a question whether the vaccination has not altogether failed; some fresh lymph is inserted on other spots, and as the vesicles of the new vaccination rise, those of the first vaccination are seen also to develop themselves, the two vaccinations running their course at the same time. Bousquet refers to a case (not in his own practice) in which this sort of revival of a dormant vaccination was said to have been brought about at the end of three weeks.[1] But without any recourse to a second vaccination, it will sometimes be found that vesicles will rise some days, or a week, or more, after the usual period, and when success had ceased to be looked for. A tardy development of the vesicle occurs much more frequently when the vaccination has been done with dry lymph than when it has been performed direct from the arm. In many of these cases, indeed, the vaccine process can scarcely properly be said to have been retarded; the lymph, no doubt, at the time that it was deposited on the cutis, was in a dry or undissolved state, and it simply waited solution to be taken up by the system. A mere retardation of cow-pox in a healthy individual does not in the least impair its pro-

[1] Nouveau Traité de la Vaccine, p. 176.

tective value, provided only the phenomena be regular in their character.

Effects of incubation of Measles, Scarlatina, &c. on course of Cow-pox.—Certain temporary conditions of the system may operate to retard cow-pox. If vaccination has been successfully performed during the incubation of measles, but the vesicles have not reached their mature or areolar stage by the time that disease manifests itself, it will very frequently, if not usually, be found that they will not go through that stage until such time as the measles have subsided. In such cases the areola may not be formed till a fortnight or more after vaccination, or it may not be formed at all. The same has been observed with regard to scarlatina and chicken-pox, and the early or febrile stage of hooping-cough.[1] Jenner gives a very interesting account of two sisters in whom scarlatina manifested itself on the eighth day from vaccination. In one, the vaccine vesicle remained at its maturity, but "there was a total suspension of areola till the scarlatina had retired from the constitution;" as soon as this occurred, the areola advanced in the usual way. In the sister, the symptoms indicative of scarlatina came on severely for about twelve hours; then a rash showed itself faintly upon the face and part of the neck, but in two or three hours suddenly disappeared, and the patient was free from every complaint; it was *then* observed that the vesicle had the usual areola, and this continued till the fourth day, when it subsided, and scarlatina again appeared, and went through its course with the common symptoms.[2] It is not always,

[1] See interesting cases in point by Aikin, London Med. Gazette, vol. xiii. p. 752, seq.; also Addington's eleventh and twelfth cases, as cited by Ring, Treatise on Cow-pox, p. 524.

[2] A Continuation of Facts and Observations, &c.

however, that scarlatina, or measles, or chicken-pox acts thus on the course of cow-pox, or cow-pox on them; vaccination has been repeatedly seen running its course along with them and uninfluenced by them.[1] The course of cow-pox when accompanied by any of the specific febrile eruptive diseases should be watched most carefully throughout, and no warrant of protection against small-pox given unless a regular areola has been developed.

Effects of incubation of Small-pox.—When vaccination has been performed on any one who is incubating small-pox, if the incubation of that disease be so far advanced that the small-pox manifests itself within two or three days of the vaccination, no vaccine vesicles will rise, but small-pox only will be developed.[2] But if the incubation has been less advanced, and the cow-pox has taken local effect before the small-pox symptoms set in, the further progress of the vaccination may, or may not, be retarded. Very frequently the two diseases will be seen going on together, so distinct, the one from the other, that lymph from the cow-pox vesicles will certainly produce cow-pox and cow-pox only, and lymph from the small-pox vesicles will produce small-pox and small-pox only.[3] If, however, the cow-pox

[1] Jenner (Further Observations, &c. p. 137) gives a case of this kind. Various instances will be found recorded in Ring (*op. cit.*). He also relates several cases of *small-pox* and measles, running their course together, uninfluenced the one by the other; and one case in which small-pox, measles, and hooping-cough co-existed. (See particularly on this subject, Marson's Paper on the Co-existence of the Eruptive Fevers, Med.-Chir. Trans., vol. xxx.)

[2] Under these circumstances *variolous* vesicles will often be met with *on the vaccinated spots.* (See cases in point, Ring's Treatise, &c. pp. 483 and 525. Also Willan on Vaccine Inoculation, p. 8, note.)

[3] So distinct are they, that the variolous pustule may be developed within the margin of the vaccine vesicle, and matter

vesicles had not *reached the stage of areola before* the small-pox set in, no influence will be produced on the course of the small-pox; if, on the other hand, the areola be fully formed round the cow-pox vesicles *before* the small-pox symptoms appear, the vaccination will, according to its date, either arrest the small-pox at its premonitory stage, or alter and modify the course of the eruption. This is a distinction of great practical importance, to which I shall further advert hereafter (§ 50, a, p. 103). In consequence of the frequent delay of parents to have their children vaccinated until epidemics of small-pox break out, it is no uncommon thing to see variola and vaccinia concurrent.

(b) **Accelerated Cow-pox.**—A hastened course of the cow-pox vesicle is to be regarded with much more suspicion, in reference to its effect on the protection of the individual, than a retarded course, for spurious vaccination is generally accelerated. There may be, however, *simple* acceleration—a course some twelve or twenty-four hours in advance of the usual course; the vesicle on the eighth day being in the state in which it is usually seen on the ninth, the areola nevertheless being regular, and the crust being subsequently duly formed. In such case the protective value of the vaccination is not impaired.

(c) **Spurious Cow-pox.**—Vaccination sometimes runs an entirely irregular course. The varieties of irregularity are considerable. In the form most frequently seen, the course resembles very closely that of a re-vaccination (§ 47): the vesicle begins with itching and irritation; it is acuminated or conoidal, instead of

taken from it produce small-pox, while fluid taken from the opposite edge of the vesicle communicates cow-pox. (See Willan on Vaccine Inoculation, p. 6, note.)

being flat and with central depression, and it contains straw-coloured or opaque fluid, instead of clear lymph: it has an early and irregular areola, which is at its height by the fifth or sixth day, and when seen on the day-week is far on the decline; there is then a small scab on the surface which usually drops off by the tenth day. The local effect in some cases is much less than this, and on the day-week there is nothing to be seen but a very thin scab or scale just about to detach itself, and which at the lightest touch falls off. In other cases, the vesicles, when seen on the eighth day, are found to have burst, and present an irregular pustuloid or scabby appearance, or are so many open sores. It would be difficult, and is quite unnecessary, to give a minute verbal description of each form of irregularity that may be observed; the real important practical point being, that a vaccination presenting any deviation from the perfect character of the vesicle, and the regular development of the areola, is not to be relied on as protective against small-pox.

Causes of spurious Cow-pox.—A spurious and irregular course of the vaccine vesicle is sometimes seen to occur where no cause can be assigned for it, as in a child apparently perfectly healthy, and when the vaccination has been done by a careful and experienced hand, with lymph which in other children has produced only its normal effects. Occasionally the best vaccinator may find that on a particular day some of his cases, done probably from different sources, present more or less of deviation from the normal results—whence it has been assumed, for want of other explanation, that there may be an occult and indefinable influence of season or weather. But these are the exceptions—the rare exceptions; and far, far more commonly, spurious vaccination may be traced

directly to one of two causes—either to the use of lymph which was not well chosen by the vaccinator or which has been spoilt in the storage or keeping, or to something amiss in the state of the child vaccinated. The former of these causes is illustrated by the occurrence of various forms of irregularity in several children, vaccinated all from one and the same source; the latter in children vaccinated from unexceptionable sources, but in whom the presence, at the time of vaccination, of one or other of those affections which, like herpes, intertrigo, &c. frequently interfere materially with the regular progress of the vaccine vesicle, had been overlooked or disregarded.[1] The

1 My experience supplies me with numerous instances of either kind. Some two or three years ago I saw nine children who had been vaccinated the day-week previous, in each of whom the vaccination was running an irregular course. I found on inquiry that they had all been done from one source, and *that* a source which, from the description given of it, ought not to have been employed —a case in which the lymph was thin and serous, running down the arm in profusion when the vesicles were opened. On a subsequent occasion I saw, in a large town in the south of England, spurious results in every one of several children vaccinated the day-week previous, it was believed all from one child; and one of these irregular cases was being used for the vaccination (?) of some more children. The other kind of error is of more frequent occurrence; and seldom many weeks pass but that I see some irregular case or another, and am able, by looking behind the ears of the child, or in the folds of its neck, &c. to point out to the vaccinator the cause of the irregularity. "If we see the vaccine pustule," says Jenner, "straying a few days after the insertion of the vaccine fluid, we must not be content with a superficial examination of the skin of our patient, but we shall find it necessary to make a more minute inquiry. For after a general examination without detecting conspicuous herpetic blotches, we shall find perhaps that the child has an herpetic eyelid, a speck behind the ears, or an excoriation in other parts oozes out this fluid, which produces impediment. I find that in many instances an abraded cuticle, not larger than the surface of a split pea, is as capable as a blotch of fifty times the extent, of producing

best proof how much irregular and abnormal results of vaccination are dependent on the want of care and skill of vaccinators, is the frequency with which they are seen in the hands of some vaccinators, and their great comparative rarity in the hands of others.

37. Effects of mechanical interference.—Mechanical irritation of the vesicles of cow-pox, friction of the clothes, scratching with the nails, &c. may cause the vesicles to be prematurely ruptured, and may otherwise materially affect the course of the disease; they should always therefore carefully be guarded against. These occurrences are more frequently met with in children who are past babyhood when they are vaccinated, than in young infants. But it is not at all an unfrequent thing to find a spoilt and broken appearance of the vesicles on the eighth day ascribed to rubbing, when in fact it is really a form of spurious vaccination resulting from one or other of the causes stated in the preceding paragraph.[1]

this effect." (Letter to Dr. Labatt, Jan. 6, 1821, in Dub. Quar. Journal of Med. Sc., vol. xxvii. p. 471.)

[1] It is an interesting subject of inquiry how far a vaccination, the vesicles of which have been early broken, or are otherwise spoilt or spurious, affects, or may affect, the constitution as regards its liability to small-pox. In some cases of this kind, vaccination duly performed soon afterwards goes through its regular course as if nothing had been done before; and in such cases we can have no doubt that the effect of the first vaccination had been *nil*. But oftentimes, after spurious results, a repetition of the vaccination will only produce an irregular and incomplete effect. Yet we have abundant evidence that persons whose vaccination has been disturbed or imperfect are liable, if they do not take care to get revaccinated, to contract small-pox and to have it badly. Ceely mentions having met at different times with several cases in which vaccination took imperfectly, and in which subsequent vaccination three or four months after took (not perfectly, but) less imperfectly. But one of these cases failing to appear, for revaccination, as

38. Degeneration of the vaccine vesicle; Erysipelas, &c.—In a small proportion of cases vaccination, especially if it has taken effect in a hastened or spurious form, will in its course manifest inflammatory symptoms of considerable activity, and very sore arms will result; the vesicle degenerating into a purulent ulcer, or sometimes into a sloughing sore, leaving a cicatrix which has none of the characteristic pittings, but is simply a puckering, or a flat, smooth, shining scar. In a still smaller proportion of cases true erysipelas may occur. These events, it need scarcely be said, deprive the cow-pox of its specific protective power. Small-pox, and of a very severe kind, is frequently met with in persons having the sort of cicatrix just described. Lymph taken from re-vaccination cases, or from spurious primary cases, or the lymph of normal primary cases, if taken at too late a period of the vesicle, or if kept so as to have become partially decomposed, may give rise to these consequences; but at other times they are met with where no possible fault can be found with the lymph, other children vaccinated with the same lymph going through their vaccination in a perfectly normal way. The cause must then be looked for either in the constitution and habit of body of the child vaccinated, or (so far as erysipelas is concerned) in the "constitution of the air," to use Sydenham's convenient form of expression. Accordingly, cases of erysipelas following vaccination, when they do occur, are not unfrequently met with two or three together in one locality, and at times when

desired, sustained about ten years afterwards a severe attack of small-pox. (See an interesting note at p. 411 of his Memoir, *op. cit.*) Practically, revaccination should always be carefully performed, whenever there has been any irregularity, whether from mechanical disturbance or otherwise, in the character of the first vaccination.

erysipelas is noticed as attending wounds from other surgical operations.

39. Effects of climate on the course of vaccination.—In climates like our own, or in colder countries, the utmost effect of season, of hotter or of colder weather, is but to accelerate or to retard (and that only exceptionally, and seldom beyond a few hours) the course of vaccination ; but the heat and moisture which at certain seasons of the year prevail within the tropics, and in places with tropical climates, interfere considerably, according to the best authorities, with the regular progress of the vaccine disease. In the north-west provinces of India, and to a less degree in Bengal, it has been observed that, after the hot season has set in, vaccination is less successful; that in Calcutta, for instance, it is only among the European and better-off classes, who can afford to look after their children, and protect them properly from the heat, that vaccination can at this season be prudently performed.[1] But the rainy season is even more inimical to successful vaccination in Bengal. At that period of the year, "in some, if not all, the districts of Lower Bengal, the simple puncture for the insertion of vaccine virus frequently produces violent inflammation, which either degenerates into foul sloughing sores, or the same degeneration succeeds to the maturation of the vesicle. In both cases vaccination must necessarily be suspended for a time."[2] The Bengal Sanitary Commissioners have recently also stated that the cool season of the year is that in which alone vaccination can usually be practised with success in the plains of India, though in the more temperate

[1] See Report of the Small-pox Commissioners appointed by the (Indian) Government in 1850, pp. 50, 51.

[2] Ibid. p. 51.

climate of the hills it can be carried on almost throughout the year.[1] In most parts of the Bombay Presidency, and in Sind, as would appear from the annual official reports, vaccination is carried out at all seasons of the year. None, or scarcely any, of the surgeons officially employed in the performance and direction of vaccination in that Presidency, find it necessary *to omit* vaccinating on account either of the hot or the rainy season. But some of them state that at these periods of the year difficulty is experienced *in keeping lymph*, so that they are obliged to be then especially careful to maintain a series of cases from arm to arm; and some also note that the operations are attended with a minor degree of success, and with occasional deterioration of the vaccine vesicle.[2] It would appear, on the whole, that in the cooler parts of India vaccination may be performed at any period of the year, but that in the hotter parts the best months for vaccinating are from October till March. The experience of Dr. John Davy, in Ceylon and in the West Indies, induced him to consider the cool season, the winter months, as the best for vaccinating within the tropics.

40. **Supernumerary vesicles.**—A very interesting, but quite exceptional, phenomenon in the course of vaccination is the development of vaccine vesicles on parts of the body where no vaccine lymph had been inserted; these are termed "supernumerary vesicles." They are sometimes only two or three in number, at other times eight, ten, twenty, or more, in various situations over the body and limbs. *Accidental* supernumerary vesicles—the result of a chance puncture with a

[1] First Annual Report, p. 60.

[2] Reports (presented annually) on Vaccination, throughout the Bombay Presidency and Sind.

lancet charged with vaccine lymph, or of an accidental application of lymph to an abraded surface—are by no means rare; but the phenomenon to which I refer is the development of vesicles where, it is believed, none of these accidental occurrences can have taken place—vesicles which are really *eruptive*, and which nevertheless, as proved by the effect of vaccinating from them, are of genuine vaccine character. The cases on record seem to establish that real *eruptive* supernumerary vesicles *may* occur in the course of an ordinary vaccination; but so rare at all events is their occurrence, that Bousquet, in his long career, has only seen two or three instances of them (which, he says, at the time satisfied his mind, but concerning which on subsequent reflection he has been led to entertain doubts); and Marson's vast experience, which amounts to about 60,000 vaccinations, does not, he informs me, enable him to say more than that he has seen cases of additional vesicles which *he thinks* were eruptive.[1] In all cases of "supernumerary vesicles," we are not justified in regarding these as an *eruption of vaccine* until we have satisfied ourselves, first,

1 Like many practitioners, I have seen cases of supernumerary vesicles, but never of any which I could regard as eruptive. M. de Paul stated in a discussion at the Acad. Imp. de Méd., that he had seen five cases of eruptive vesicles, but gave no particulars of them. (Bull. de l'Acad. tome xxix. p. 203.) In the Annual Reports of the vaccinations in France for twenty-four years (1841–64) I find but eight cases of supernumerary vesicles reported by the different vaccinators, and in four of these the accounts render it probable that the supernumerary vesicles were accidental. Three of the remaining four cases stand entirely on the accuracy and habits of observation of the individual reporters, and it can scarcely be said of all of them that the accounts are quite conclusive. But in one case (in 1841) the whole circumstances, the existence of the supernumerary vesicles and the results of the vaccinations performed from them, were watched by members of the Vaccine Commission of the Académie.

that the vesicles are of real vaccine character, and not an ordinary vesicular eruption attendant on cow-pox—this may be *inferred* from their appearance, but *proved* by inoculating the fluid from them; secondly, that the vesicles, if genuine, are not after all accidental, the result of an unintentional inoculation of lymph by the vaccinator, by the child, or by its nurse—for, as Ceely justly remarks, "It is rare, indeed, for them to be found on spots to which lymph might not have been directly applied," and if the lymph be good and active, it is not indispensable that the skin should have been visibly abraded;[1] and, thirdly (and this applies particularly to those cases in which the supernumerary vesicles are many in number, and have somewhat of the character of a general eruption), that we have not mistaken for vaccine vesicles an eruption of modified variola accompanying vaccinia, such as happens in a person vaccinated during the incubation of small-pox—the variolous eruption under such circumstances being often very sparse, and the vaccine vesicles and small-pox vesicles more or less

[1] "Use active liquid lymph in great abundance to every puncture, made so as to draw blood rather freely; wipe the lancet over the puncture, leaving it covered all around with lymph; take care, by attention to position, &c. that the blood shall dry over and around the wound, and thus cover the lymph. It will often happen, in young and favourable skins, that one or two supernumerary vesicles will appear at a greater or less distance from the punctures, which, in time, nearly or completely coalesce. Sometimes they will appear even two or three inches distant from the puncture, when the blood, mixed with lymph, has trickled down and dried there." (Ceely in Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 326, note.) In one case a vesicle, produced in this way at a distance of *four inches* from the inoculated vesicles, attained on the twelfth day the size of a small horse-bean, and having no *firm* connexion with the skin at its centre, like the casual vesicle on the cow, it acuminated on the eleventh day, as perfectly as on that animal. (Ibid. p. 400, note.)

resembling one another. Each of these kinds of mistake has been made, and the second kind, viz. that of mistaking accidental for eruptive supernumerary vesicles, very often made.

41. Re-insertion of Vaccine Lymph within five days of a successful insertion; Bryce's test.—If, at any period not later than the fifth day from the successful insertion of vaccine lymph into the arm of a child, a fresh insertion of lymph be made, this second vaccination will take effect as certainly as if no previous vaccination had been done; but the vesicles arising, while corresponding in *size* to the date of their origin, will overtake in their *course* the vesicles first made, will arrive at maturity and will fade at the same time with them. Thus, if a child be vaccinated with effect on a certain day, and some good active vaccine lymph be inserted, say, on the fourth or fifth day afterwards, the vesicles of this second insertion will by the tenth day of the original vaccination not usually be larger than ordinary vesicles of the sixth or fifth day, but they will have an areola as advanced as the areola round the vesicles of the first insertion, and the incrustation and further progress of the two inoculations will go on simultaneously. Had the second insertion been made a day or two earlier, as by the second or third day of the vaccination, the vesicles developed by it would have got larger by the time the first insertion was at its maturity than in the case just cited; but, just as in it, whatever was the day of maturity of the first insertion would be the day of maturity of the second. That this result, however, may follow a second insertion of lymph, such insertion must be always made within five days, *i.e.* within five times twenty-four hours, from the primary insertion. If it be delayed beyond this, it will

fail; there will either be no result or a mere hard papule. No doubt there are apparent exceptions to this rule, and cases are now and then met with where lymph takes effect though not inserted until the sixth or seventh day of a vaccination; but these, it will be found, are not real exceptions, they are simply cases in which the course of the vaccination has been *retarded*, the areola, instead of appearing on the eighth day of the first insertion, not coming on till the ninth or tenth.

Its history.—The very first account, indeed, we have of any experimental re-insertion of lymph during the early stages of a vaccination, was in a retarded case. It was in a vaccination performed, in 1799, by Jenner's friend and correspondent, Henry Hicks. In two cases of vaccination in which the arms on the sixth day appeared to be not much more forward than they generally are on the third or fourth, and the appearances were somewhat irregular, he two days afterwards inserted some fresh lymph. "The second inoculation seemed to make immense strides to overtake the first, and, what is wonderful, the first pustules began to change their character and to put on the true vaccine character."[1] Jenner afterwards (in 1801) made an experimental inoculation of this kind on a child with lymph taken from the vesicle which was developing itself on the child's own arm.[2] But it was Mr. Bryce of Edinburgh—one of the early and one of the best writers on vaccination[3]—who first instituted any number of these experiments, or who suggested any practical application of the discovery. Starting with the belief that there might be a *perfect local* development of the phe-

[1] Baron's Life of Jenner, vol. i. p. 331.

[2] Ibid. vol. i. p. 450.

[3] Practical Observations on the Inoculation of Cow-pox, Edinb. 1802; and 2d edition, 1809.

nomena of vaccination without such affection of the *system* as would impart security against small-pox, he thought that, by inserting lymph always on the fourth or fifth day of a vaccination, the existence or absence of this constitutional affection might effectually be tested. He argued, that unless the system were pre-occupied by the vaccine influence, any inoculation of vaccine lymph would of course produce effects which would go through *the ordinary periods of action*, and that an *acceleration* or *cutting short* of these periods was to be taken as evidence of the constitutional affection of the vaccine. Hence the practice has become generally known as "Bryce's test." He recommended that it should be systematically employed. The reasoning is ingenious, and the phenomena are interesting, but the necessity of the practice has never been generally admitted, and the practice itself is now wholly disused. Jenner recommended it to the uninitiated, but, as he justly observed, the course of the vaccination will be sufficient to enable the experienced to determine.

Its analogy with some of the phenomena of natural Cow-pox.—The analogy presented by the phenomena resulting from Bryce's test, to some of the appearances met with in the course of natural cow-pox in the cow, in which vesicles are seen at the same time in various stages of progress, but all terminating together (§ 5), can scarcely have escaped the reader's notice. Various apparent anomalies in the course of the disease in the cow become thus readily explicable. "No sooner is lymph produced in the cow," says Ceely, "than by pressure in the recumbent posture, self-vaccination may occur; but a more frequent and more efficient cause are the reiterated manipulations of the milkers. These men, night and morning, in the per-

formance of another task, unconsciously but most effectually perform on an extensive scale a very important process—a series of *re-vaccinations* both from the infecting and infected animals.[1]

42. Vaccination with primary Cow Lymph.—When, instead of vaccination being performed, as it usually is, with lymph that has been long humanized, some lymph is employed which is derived directly or very recently, say within three or four removes, from the natural or casual disease in the cow, there is often considerable difficulty in getting it to take effect. While lymph transferred from one human being to another will, if used under proper conditions, infect with almost unerring certainty, cow-lymph will fail to infect in a great number of instances. Ceely found that more than half his attempts to vaccinate with primary cow-lymph, taken from vesicles at a proper stage and possessing all the characteristics of perfection, resulted in entire failure, the same individuals being successfully vaccinated immediately afterwards with the current humanized vaccine lymph. Of the cases in which the cow-lymph did not fail, it produced, in some, only spurious results; in others, a still smaller number, it succeeded perfectly; but, in nearly all the successful cases, the number of vesicles seldom equalled one-half of the number of punctures. Similar phenomena of entire failure, imperfect vaccination, or complete vaccination, with all attendant circumstances, resulted from the use of lymph from perfect casual vesicles on the hands of milkers; and the same was the case with *the early removes* of primary cow-lymph until it became humanized.

Local phenomena and general symptoms.—In all cases, whether successful or not, the insertion of primary cow-

[1] Trans. Prov. Med. and Surg. Assoc., vol. viii. p. 325.

lymph induces a remarkable and unusual redness at the point of puncture, a vivid blush, which gradually declines on the third or fourth day, and when the vaccination fails soon entirely disappears, but when it is successful becomes more and more concentrated, and at length blends with the red elevation of the vaccine pimple. But between the decline of the blush and the commencement of papulation there is often an interval, and papulation is sometimes postponed till the sixth, seventh, eighth, or even tenth day, giving rise to corresponding irregularity in the period of full development of the vesicle, so that the areola is frequently not complete till from the eleventh to the fourteenth, or even the sixteenth day. At this period, especially in children, small supernumerary vesicles in miniature often appear within its limits; sometimes they are seen also on the shoulder, still more rarely on the face and body. The papular and vesicular eruptions which occasionally attend ordinary vaccination at this stage of its course (§ 35) are more frequently seen when primary cow-lymph is used.[1] The areola, when at its height, is more indurated than is observed in vaccination with ordinary humanized lymph, and its colour declines and revives, continuing to exhibit a brick-red or purplish hue

[1] Steinbrenner noticed the more frequent occurrence of the papulo-vesicular eruptions attendant on vaccinia, when this has been produced by primary cow-lymph and its early removes, than when old lymph is used. In seven out of twenty children vaccinated with lymph at the first, third, or twelfth removes from the cow, there was a secondary papulo-vesicular eruption from the twelfth to the sixteenth day; but of thirty-nine children vaccinated with the Passy lymph, then three or four years old, or with lymph of the original stock, forty years old or more, only one had a papular eruption. (Traité sur la Vaccine, p. 552.) But this does not pertain to all stocks of lymph. Jenner does not appear to have found these secondary eruptions more frequent in his earlier than in his subsequent vaccinations.

while the hardness remains. The vesicles themselves in most instances are not more developed than those produced by ordinary lymph. Desiccation is generally prolonged, being often for some days limited to the centre. When the vesicle is neither ruptured, nor spontaneously bursts, the crust is often retained to the fourth or fifth week, bringing away with it a circle of the corium, often the whole depth of it, and some of the subjacent connective tissue. A deep foveated red cicatrix is left, or there is a yellow foul excavation which ultimately furnishes the pink, shining, puckered aspect of a small-pox scar. Often, however, the vesicles burst or get broken at the time of the height, or about the decline, of the areola; and when this occurs in strumous or irritable subjects, secondary inflammation may be set up, with sloughing, abscesses in the cellular membrane and axillary glands, and proportionate constitutional irritation—mischief which, however, generally soon subsides.

Progress of humanization of lymph.—Transmission of the lymph from subjects directly infected from the cow, through two, three, or more children successively, diminishes the severity of the local symptoms; and the vesicles then acquire increased size and beauty. In succeeding removes, varieties of appearance will, as in ordinary vaccinations, depend much on variety of subjects, vaccination with the same lymph producing in some finer, in others smaller vesicles, the latter being often accompanied with more intensity of constitutional symptoms than the former.

Varieties in amount of constitutional disturbance.—As regards, indeed, the general or constitutional disturbance of subjects vaccinated by primary cow-lymph, or its early removes, the greatest variety exists; roseola or lichen, with vomiting, diarrhœa, delirium, &c. arising in some

subjects, while in others mere acceleration of pulse is observed, without complaint; a single vesicle in some being attended with earlier, more severe, and longer protracted symptoms than four or six will produce in others. "Although," says Ceely, whose description of the effects of primary cow-lymph I have closely followed, "the greater part of my experiments with primary lymph and its early removes have exhibited the above as its qualities and accidents, I think it not improbable that primary lymph may vary in these respects, and be modified by season and other circumstances, both individual and local."[1] Of the truth of this observation I apprehend there can be no doubt. The primary lymph, discovered at Passy, in 1836, which was the subject of M. Bousquet's experiments, appears to have developed generally phenomena closely corresponding to Ceely's description, as (1) the reddish blush immediately succeeding the operation, and passing gradually into papule; (2) the size, long duration, and hardness of the areola; (3) the prolongation of the stage of desiccation; and (4) the long retention of the crust.[2] The lymph-stock which Mr. Estlin set on foot from the cow, in 1836, developed for some time, during its early transmissions, very active local and constitutional phenomena; much care was required in its use, deep ulceration and glandular abscesses otherwise sometimes resulting. But, in the accounts we have of many other stocks, we are far from finding that the same activity of symptoms has always been manifested, or that specialties have continued through so many removes. The primary lymph of some stocks, indeed, has been found to produce results differ-

[1] See Ceely's admirable and oft-quoted Memoir, Trans. Prov. Med. and Surg. Assoc., vol. viii. pp. 342-352.

[2] Nouveau Traité, &c. p. 403, seq.

ing in no respect from those of an ordinary vaccination. More generally, there has been some retardation of progress, and some manifestation of unusual local or constitutional activity, at all events for a transmission or two ; the phenomena, after two or three removes, being the same as those observed where humanized lymph has been employed.[1] The difficulty in getting the lymph to take until it has become humanized is always experienced.

43. Symptoms, &c. of the casual Cow-pox of Milkers.—In milkers who contract cow-pox casually the severity of the local and general symptoms is often much greater than in subjects in whom vaccination with primary cow-lymph has been designedly performed. This is due (1) to the constant movement to which the vesicles, from their position on the hands, &c. are generally subject, and (2) to their frequent rupture, with consequent reiterated applications of lymph. Hence there are not unfrequently deep sloughing of the skin and connective tissue, and ulcerations slow to heal. Ceely has met with instances in which, probably either from an insufficient application of lymph, or a local or constitutional indisposition to receive the disease in the usual way, the vesicles on milkers have been imperfectly developed, with little or no obvious constitutional disturbance, exhibiting a marked contrast to the local or general effects on other individuals affected at the same time from the same source : and some such cases he has seen suffer afterwards from unquestionable though mild small-pox. It is not only, therefore, where milkers have mistaken spurious for real cow-pox, that they are liable to be deceived as to their protection against small-pox. They

[1] See Hering, Ueber Kuhpocken an Kühen ; Rapport sur les Vaccin. pratiquées en France pendant 1841 ; and Sixth Report of Medical Officer of the Privy Council, p. 10.

may continue subject to that disease, according to Ceely's observations, after infection from cows affected with real cow-pox, if their infection has been "at a late period of the disease with *deteriorated* and purulent virus, or even with *perfect* lymph of which they had not at the time been sufficiently susceptible."[1] The casual cow-pox in man and its early removes are of course liable to be attended occasionally with the same papular and vesicular eruptions as have been described as occurring sometimes in the course of vaccination with primary cow-lymph (§ 42).

44. Vaccination with Variola-vaccine Lymph.—It is impossible to read Ceely's careful and most interesting account[2] of the phenomena exhibited by human subjects vaccinated by him with the lymph generated by the variolation of the cow, without recognising that we are reading over again the whole story of the inoculation of the human subject with *primary* cow-lymph. In the children and others inoculated with the variola-vaccine lymph, either direct or in its earliest removes, there was the same difficulty in making the vaccination take, the same occasional occurrence of imperfect results, the same retardation in successful cases of the papular and subsequent stages, and the same activity of local symptoms as are noticed when primary cow-lymph is used. The *small* supernumerary vesicles round the vaccinated spots, within the sphere of the areola, were also noticed in particular cases: and in four cases a supernumerary vesicle or two was developed elsewhere. The constitutional symptoms were well marked and in some cases severe, but pertained only to the secondary or developed state of the disease, and were scarcely noticeable until the vesicles had attained the stage of

[1] Ceely, *op. cit.* p. 336. [2] *Op. cit.* pp. 402–420.

areola,—just as with primary cow-lymph, the vesicles improved in appearance by passing through two or three subjects, and attained then, and retained, a state of great beauty and perfection. Roseola, strophulus, and lichen were seen in some of the subjects: the papules in a few instances became vesicular. In one infant, six months old, vaccinated at the sixth remove, an eruption of strophulus became vesiculated at its summit to an extraordinary degree, disappearing and reappearing for three weeks: in another infant, aged fifteen months, six days after vaccination at the sixth remove, an eruption of vesicular varicella (which disease was prevailing in the village at the time) appeared, and retarded the progress of the vaccination for a couple of days. But *no eruption with the slightest approach to varioloid was seen:* and the only other sort of eruption noticed than those above stated was, in a few instances, "a vesicular eruption of a pemphigoid character, either in large bullæ or closely resembling lenticular varicellæ."[1] And, just as when primary cow-lymph is used, the attendant vaccine eruptions, when they did occur, were limited almost exclusively to young children.

45. Vaccination with secondary, or inoculated Cow-lymph: Animal vaccination.—When primary cow-lymph is first passed by inoculation through a succession of animals and *then* transplanted to the

[1] This eruption is strictly one of the attendant vaccinal eruptions. It may be seen on the cow, and often on young dogs, during the progress of vaccination. In young children it may subside in a few days or may continue for some weeks. Ceely (Trans. Prov. Med. and Surg. Assoc., vol. x. p. 231) narrates a case in a child, eight months old, vaccinated with lymph eighty removes from the cow, in which it appeared and lasted five or six weeks; and Mr. Farish, of Cambridge, also narrates a considerably protracted case. See Willan on Vaccine Inoculation, Appendix, p. 41.

human subject, the effects it produces depend partly on the properties of the parent stock, and partly on the number of artificial transmissions it has undergone. Lymph of a very active kind, which had been obtained from the natural disease in a cow at Beaugency, in 1866, and which, after being passed through three animals, was used for vaccinating children at the Académie de Médecine at Paris, (in the performance of what has been termed "Animal Vaccination,") still manifested the active and virulent symptoms which attend, as we have seen, the use of *some stocks* of primary cow-lymph. The vesicles it produced on children were even said to be nearly double the size of those resulting from the first removes of the Passy lymph, and the inflammatory effects to be so exceedingly severe that M. Bousquet, on seeing the cases, judiciously recommended one of the members of the Académie, who was about to take some of this lymph for use in his own practice, to wait till it had undergone further transmissions.[1] But with further transits through animals these peculiar effects appear to have subsided : and when lymph of this stock, continued through animals and taken from an animal later in the series, was sent to Brussels and there employed, its effects resembled more those of an ordinary vaccination. Tried side by side, by a Commission of the Belgian Académie, with some Jennerian lymph which they had in use, the only difference noted was that the vesicles it produced were a little bigger (*un peu plus larges*) :[2] but,

[1] Gazette Médicale, 1866, p. 319.

[2] Bulletin de l'Académie, tome xxxii. According to M. de Paul, not only the vesicles produced by *this* lymph, but also the vesicles produced by retro-vaccine lymph which had undergone a number of transits through animals (p. 17, note 2), when compared at the Académie with the vesicles produced by the humanized lymph there in use, were found to be very much finer and larger. But if so, the

like Ceely's and some other primary lymphs, it was found to improve by a few transits through the human subject. When some of it thus humanized, and some of it continued through animals, were used in the vaccination of the same subjects, the vesicles of the humanized lymph were manifestly the finer and better developed. The course of vaccination of the human subject with inoculated cow-lymph (animal vaccination) is frequently retarded. Vaccination thus performed is much less successful than vaccination with humanized lymph.[1]

stock of the Académie must have differed in its effects from the Jennerian stock in use in Brussels. In these comparisons everything, in fact, depends on the stocks with which the comparison is instituted—whether they have or have not lost any of their essential properties (see Chap. X., On the Alleged Degeneration of Lymph, which should be read along with this Section). Let it be well understood, however, that I am far from thinking the *size* of the vesicle an *essential* quality: any one has only to look at Jenner's plates to see that it is nothing of the sort. It is the character and course that must be looked to; and a vesicle is not to be condemned on account of its size, unless it is also puny and inactive.

[1] Well aware of the difficulties frequently attending the transplantation to the human subject of primary cow-lymph, or of retro-vaccine lymph, I saw, certainly with surprise, the statement of M. de Paul and others that the inoculated cow-lymph (animal vaccination) was *more successful* in the performance of human vaccinations than humanized lymph from arm to arm: and this surprise was greatly increased on examination of the facts on which the statement was based, viz. the results of the animal vaccinations of M. Husson and at the Académie. A good vaccinator, it may be premised, vaccinating from arm to arm with humanized lymph, does not fail to infect above once in 150 operations (see § 69). Now from the largest series of observations which we have of animal vaccinations, that of M. Husson, it appears that of 4,163 vaccinations of children (I exclude, of course, all cases of re-vaccination) he was successful in 2,614, or 62·79 per cent., was unsuccessful in 949 or 22·80 per cent., 600 of the cases not having been inspected. But this result, confessedly unsatisfactory, is considered to be in some measure explained by M. Husson having been obliged (from the limited

46. Vaccination with Retro-vaccine Lymph.—When active lymph, such as passes from arm to arm with the greatest facility, is passed through the cow (§ 12, c) and at once vaccinated back, it yet *retains* so much of its humanization that it is not apt to fail like primary cow-lymph, but will be found also to have *lost* so much of its humanization that on its return to the human subject it takes effect less kindly: papulation is usually retarded, and though the vaccination may attain maturity at the ordinary average period the completion of the maturation is often postponed. The

number of animals at his command) to perform many of the operations with lymph taken from the animal after the sixth day of the vaccine infection, and when it had become comparatively inert. The vaccinations at the Académie were 681, but by eliminating 275 of these cases, or 40 per cent. of the whole, as being cases in which it is said the vaccination had either also been done with late lymph, or with lymph from heifers who were in ill-health (*génisses malades*), [it is not explained why in this large proportion of cases the vaccination had been done in this objectionable way, or from these objectionable sources,] it was found that, out of the remaining 406 cases, the operation had been successful on 278, or upwards of 68 per cent., and unsuccessful on five only, or 1.2 per cent. But, as in no fewer than 123 cases, or 30 per cent., the result was not ascertained, the utter worthlessness of these observations to determine the real effects of a new mode of proceeding is obvious. If any satisfactory conclusions at all are to be come to, it can only be done by taking two or three hundred cases, and following them completely out: it is very singular that this course, so properly recommended by M. Guérin, should not have been pursued. Of 988 animal vaccinations, performed on babies at La Pitié by M. Empis, the results were observed in all but fifty-eight cases, and they gave 558 successes to 372 failures. The vaccinations watched by the Commission in Brussels appear to have been made with great care and with unusual success, but they were far too few in number for safe conclusions. But, even in them, in the first series of twenty-four (inspected) cases, there were but 104 vesicles for 144 insertions—a number far short of that obtainable with good humanized lymph.

vesicles are often smaller and the disease not really so well developed as by the stock from which the lymph was derived. Two, three, four, or several removes are necessary to give it the same activity as it had before it was transferred.

(B) COURSE OF COW-POX IN PERSONS WHO HAVE ALREADY BEEN INFECTED BY IT.

47. Phenomena and course of Re-vaccination. —In the majority of persons the regular phenomena of vaccination, such as have been above described, can only be produced once in the lifetime; any subsequent introduction of vaccine lymph either failing to produce any local effect whatever, or (much more commonly) producing a modified effect, resembling one of the forms of spurious vaccination. The absence of effect is relatively most common in the child, the spurious effect most common in the adolescent and adult. This spurious effect consists either in a papule, or (more often) in an acuminated vesicle, with a hard and irregular areola. The symptoms begin early, reach their height by the fifth or sixth day, and then decline. The scab, small and imperfect, forms generally on the eighth day, and soon falls. There is usually much itching, and often considerable constitutional irritation. Severe constitutional symptoms are, out of all proportion, more frequent in re-vaccination than in primary vaccination; and in very exceptional cases the vaccine lymph may act as an animal poison, giving rise to phlegmonous erysipelas; some still rarer cases have occurred of pyæmia, terminating fatally. In a certain proportion of cases, the results of re-vaccination are the same as those of primary vaccination, the vesicle in shape and character being in no

degree distinguishable; in such cases the areola is sometimes small and transitory, and the scab on falling leaves a small and poor cicatrix; at other times the areola is perfect, and a good cicatrix is left. Normal vesicles resulting from re-vaccination are much more frequent in adults than in children, but I have seen them on the arms of children a few years old, who had excellent marks of their first vaccination.

(C) TREATMENT OF VACCINATION.

48. Treatment of Vaccination.—The ordinary symptoms of cow-pox seldom call for any treatment, general or local. If the child be feverish, a little castor oil, or magnesia, or powder of jalap, or of calomel and jalap, may be given with advantage: if the arm be more than usually inflamed, a dressing of tepid water with oil silk, or tepid lead-lotion, may be employed. A simple cooling treatment is enough to meet any cases of vaccine lichen or roseola. If the vesicles should degenerate or ulcerate, the sores may be dressed with oxide of zinc ointment, and the general health may require to be looked to. If erythema or erysipelas should occur, the treatment would be the same as that of erythema or erysipelas arising from any other cause.

CHAPTER VI.

Of Vaccinating.

49. Origin of the term Vaccination.—The terms "Vaccination" and "to Vaccinate," to signify the inoculation of the cow-pox, were first introduced by Dunning;[1] and their convenience was at once recognised. They are the terms now exclusively employed for the purpose in medical writings, in the conversation of the educated, and among the common people also in the greater part of England; but there are still parts of the kingdom in which the lower orders seem never to have heard of vaccination, though they are quite familiar with the process of being "cut for the cow-pock."

50. Things to be attended to in Vaccinating.—In conducting Vaccination special attention must be given (*a*) to the state of the person to be vaccinated, (*b*) to the selection of the lymph to be used in the Vaccination, and (*c*) to the thorough insertion of the lymph.[2]

a. State of the individual to be vaccinated: (1) Health. Except for pressing reasons persons should only be vaccinated when they are in good health. By this is not meant that they need always be robust at the time of vaccination, but simply that they should be fre-

[1] Baron's Life of Jenner, vol. ii. p. 336.

[2] In reference to the matters treated in this Section, see "Instructions to Vaccinators," in Appendix II.

from any acute disease, or from any chronic disease which is known to interfere with the regular course of the vaccine vesicle. There are many diseases which do not interfere at all with the course of vaccination. Cline's famous first vaccination was in a lad who had disease of the hip-joint: it is well known that scrofula and syphilis do not prevent the system receiving the vaccine influence in the normal way: and one would never hesitate to vaccinate a child, whose general condition was fair, merely because it was going through the chronic stage of hooping-cough. The diseases which most decidedly contra-indicate vaccination are (besides acute febrile diseases) diarrhœa and cutaneous diseases, especially cutaneous diseases of the vesicular type, as herpes, eczema, and intertrigo. Jenner throughout his writings insists strongly, and with frequent iteration, on the extent to which herpes may interfere with the regular course of the vaccine vesicle;[1] and that very simple disease, intertrigo, so often modifies, or even completely spoils, the course of vaccination, that it is a precaution which should never be neglected by a vaccinator, to look well whether there be any chafing behind the ears, in the folds of the neck, or in the groins, before he proceeds to vaccinate a child (§ 36, c, p. 77). But other cutaneous diseases, of the non-vesicular kind, such as strophulus and lichen, have been observed to interfere with the full and correct reception of the vaccine influence, and Jenner's own rule "to sweep away *all* eruptions from the skin previous to inserting the vaccine lymph" should

[1] The same diseases were found to interfere with the regular progress of *variolous* inoculation. "The most ample testimonies," says Jenner, "lie before me that the herpetic and some other irritative eruptions are capable of rendering *variolous* inoculation imperfect, as well as the vaccine." (See his tract on the Varieties and Modifications of the Vaccine Pustule.)

never, under ordinary circumstances, be departed from.[1] It is nothing to the point that children suffering from these and other forms of eruption have been frequently vaccinated with perfect success and the utmost regularity of vesicle. Undoubtedly this is so:[2] but frequently also it is *not* the case, and the careful and conscientious vaccinator looks always to the making his success as certain as possible, and scrupulously avoids anything of a haphazard kind. In laying down these rules, however, so positively, as to the health of a person in whom vaccination is to be performed, it is always assumed that the patient is not in any immediate risk of small-pox; for, when this is the case, it would be foolish in the extreme to hesitate or to wait. However much, under other circumstances, we should have preferred that the patient should be in a better state of health, nothing but the actual presence of acute febrile disease of a serious character would then be a sufficient contra-indication.

(2) **Age.** Health permitting, vaccination should always be performed in very early infancy. Young children, unvaccinated, are the chief sufferers from small-pox. About one-fourth of all the mortality which arises from that fatal disease in England takes place in children under the age of one year. (See Appendix I., B.) In Scotland, where, until the passing of the recent excellent Vaccination Act, infantile vaccination was much more neglected than in England, the proportion even amounted to thirty per cent.; and of the deaths under one year, nearly one-fourth were under the age of three months.

1 On the Influence of Artificial Eruptions in certain Diseases. 4to. Lond. 1822.

2 As Willan justly observes, "The effect of cutaneous eruptions on the vaccine vesicle is frequent, not universal." (On Vaccine Inoculation, p. 40, note.)

(See Appendix I., C.) The great risk of delay is therefore obvious. This risk is by far the greatest in large towns, because from them small-pox is seldom absent at any time, and never absent for any long period together. Plump and healthy children living in such towns should be vaccinated when a month or six weeks old;[1] in more delicate children the vaccination might be postponed till they are two or three months old, but all whose health does not offer some positive contra-indication should be vaccinated by the age of three months. This early period of life is also particularly suitable for vaccination, as being usually free from the disturbing influence of teething: it is therefore on every account to be preferred. Circumstances connected with lymph-supply render a longer delay unavoidable in many instances in small towns and rural districts; and, when small-pox is not present in the localities, such delay, if not too long continued, is not of material moment. But even children living in such districts should always be vaccinated within a few months, six or seven at the utmost, from birth.

(3) **Circumstances which call for the immediate performance of Vaccination.**—While the periods above stated should not, except for special reasons in individual cases, be exceeded, it may often be prudent, and even indispensable, to perform vaccination at a much earlier age. The danger of delay is always of course in direct relation to the exposure, or liability to

[1] My opportunities of watching vaccination at this age have been considerable, and enable me strongly to recommend it, *when the children are well and plump.* They take as surely, have vesicles quite as fine, and go through the disease as regularly, as do children vaccinated some weeks older. The early, and all subsequent, Instructions of the National Vaccine Establishment recommend six weeks as the best age, except when children are delicate, or suffering from disease.

exposure, to the infection of small-pox: and when this disease is prevailing in a locality, every parent who has an unvaccinated child, however young, should be anxious and watchful until he has secured its protection. When small-pox is in the family or house, no age must be considered too early for vaccination: repeatedly, under such circumstances, have infants been vaccinated immediately after birth, and saved thereby from the disease; repeatedly, for want of the like precaution, have their lives been sacrificed. Vaccination at this early age is certainly as safe, and appears to be also generally as successful, as in older infants.[1]

No question in medical practice may be regarded as more completely settled than the course which a practitioner should take when there are persons of any age whatever, unvaccinated or not otherwise protected against small-pox, in a house or family in which that disease breaks out. At once, and without any delay, the vaccination of all such persons should be performed: the loss of a day may be the sacrifice of a life. It does not follow that because a person has been exposed to the infection of small-pox that he has therefore received the infection, and the vaccination may be in time to prevent the disease altogether: but supposing that before the vaccination is performed the variolous infection has actually been taken up by the system (of which, of course, during the stage of incubation we can know nothing), unless that infection have so far got the start that the

[1] See "Rapport de l'Acad. Imp. de Méd. sur les Vaccinations," &c. 1860, where a large number of facts are brought together, from maternities and the practice of large vaccinators, illustrative of this point. It is only, however, where there is immediate exposure to small-pox infection that vaccination within the first few days from birth is necessary, or is at all likely, I apprehend, to be practised.

small-pox symptoms appear before the vaccination reaches the stage of developed areola, the vaccine process will still either prevent or modify the small-pox eruption; if, on the other hand, the variola manifest itself before the vaccination has reached its protective stage, its stage of areola, the vaccination, though it will have done no good, will most certainly have done no harm—the small-pox will simply go on as though it had never been performed. Now, whether the vaccination shall reach the stage of areola or not before the small-pox appears, depends entirely on the length of time which had elapsed between the reception by the system of the variolous poison and the performance of the vaccination. As the incubative period of small-pox is twelve days, while the time requisite to bring vaccination to the stage of areola is only nine days, vaccination performed any time within the first three days will reach areola soon enough to produce its protective power; after this, whatever the local success of the vaccination, no constitutional protection will be imparted.[1]

If there were only any means of ascertaining whether a person exposed to small-pox infection had actually received it, and if so at what moment this had taken place, we should know exactly whether it were worth while to vaccinate or not: but as no such means exist, the

[1] "Suppose an unvaccinated person to inhale the germ of variola on a Monday; if he be vaccinated as late as the following Wednesday, the vaccination will be in time to prevent small-pox being developed; if it be put off until Thursday, the small-pox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use, it will not have had time to reach the stage of areola, the index of safety, before the illness of small-pox begins: this we have seen over and over again, and know it to be the exact state of the question." (Marson, art. "Small-pox" in System of Medicine, *op. cit.*, vol. i. p. 477.)

obvious rule of practice is to assume that the poison has *not* been inhaled, or has only recently been inhaled, and to give our patient the chance. But no prudent practitioner, vaccinating under these circumstances, will commit himself as to the protective value of his vaccination until he sees the areola completely formed.

For want of knowledge or of consideration of these simple facts, practitioners have repeatedly compromised their credit, many lives have been lost that should have been saved, and erroneous entries are daily made in our death-registers. Seeing perfect vaccine vesicles on the eighth day, the practitioner who was not aware of the necessity of *waiting for areola* has promised safety, and been cruelly disappointed: his credit and the credit of vaccination have equally suffered. The occurrence of three or four cases together of unmodified, and perhaps fatal, small-pox in persons having well-formed and complete vaccine vesicles on their arms, has at times led the practitioner, not to the true explanation, viz. that his vaccination in these cases had been too late, but to the notion that vaccination was always useless when small-pox was incubating, and even to the absurd and totally unfounded supposition that it might increase the danger: so he has shut up his vaccine lancet, and children have been allowed to perish from non-performance of vaccination, whose deaths were clearly chargeable to his error.[1] Our death-registers contain innumerable entries of deaths from "small-pox after vaccination," which were simply cases of

[1] "Pascal a dit qu'on ne fait jamais mieux le mal que quand on le fait en sûreté de conscience. Telle était la position de ces médecins qui refusaient la vaccine à ceux qui la demandaient, de peur d'attirer sur eux la maladie régnante." (Rapport de l'Acad. Roy. de Méd. sur les Vacc. &c. 1846, p. 16.)

death from small-pox in children in whom vaccination was performed during the incubation of small-pox: and heaps of published and other records are quite unusable for any statistical purposes, because cases of this kind are not distinguished from the cases in which small-pox really did occur in persons who had properly received the constitutional infection of vaccination.[1]

The practice, which I have known at times adopted, of vaccinating a person *after* symptoms of small-pox have actually manifested themselves, is utterly absurd: so far as the patient is concerned, the effect, of course, is *nil;* but on account of the discredit it tends to bring upon vaccination with the public, it is a practice which should be strongly discountenanced.

b. Selection of the Lymph to be used in Vaccinating.—This is a matter of the utmost consequence. The lymph must be taken only from perfectly healthy subjects, and from thoroughly characteristic vesicles. No second-rate vesicles should ever be used to take lymph from. Babies are in general much better lymph-givers than elder children or adults. Children of dark complexion, not too florid, with a thick, smooth, clear skin, are those which yield the finest and most effective lymph. Prime lymph is always perfectly limpid, and has besides (and no less essentially) a certain degree of *viscidity*. A

[1] In cases of small-pox in persons on whom vaccination has only a short time before been performed, the most scrupulous attention should be given to *dates*, whether in recording cases for one's own information, or in certifying deaths. The *date* of the successful vaccination, and the *date* of the first or premonitory symptoms of the small-pox, should always be carefully noted. Might I venture to urge also on my professional brethren a more careful use of the word "vaccinated" in death-certificates? I have known deaths from small-pox *medically certified* as "vaccinated," when it was admitted on inquiry that vaccination had only been attempted, and had been without result.

thin serous lymph is always to be avoided (see note, p. 77). With regard to the period of the vesicle's course at which the lymph should be taken from it, this *may* be done, and with perfect propriety, as soon as ever the vesicle will yield any; such lymph, though it can only be got in small quantity, is very effective. Usually, however, lymph is not taken, nor for the purposes of good vaccination is there any necessity whatever that it should be taken, until the vesicle is fully formed, which, in regular cases, is the day-week from the vaccination. The vesicle then yields lymph of the best quality, and in sufficient abundance. It must be taken, however, according to Jenner's "golden rule," before the appearance of the areola, or at all events within a very few hours of its commencement. No greater mistake can be made than that of taking it later, and when the areola is fully complete. The protest which Jenner felt it necessary to make against this practice in the earlier days of vaccination has been repeated by every vaccinator of authority since his time. No doubt, the lymph flows more freely at this late period, and may be got in greater abundance, and no doubt also (as is alleged by those who defend this practice) such lymph very often takes; but, in the first place, it does not take *with anything like the same certainty* as earlier and more active lymph, and, in the second place, it is more apt to be followed by erysipelatous and spurious results. I repeat, that judicious *choice* of lymph—the taking it only from suitable subjects, from the primest vesicles, at the proper time—is a cardinal point in good vaccination. And I will venture to say that just in proportion as the rules here laid down—rules sanctioned by all the best authorities—are adhered to, so will success be attained, and irregularities in the course of the vaccinations performed be avoided.

c. Performance of the Vaccination: (1) Collection of the Lymph.—A child and a vesicle fit for the purpose having been selected, the vaccinator, in order to collect the lymph, proceeds to open the vesicle by a number of minute punctures, which must be made on its surface, and not round the base. The object of many punctures is to open the various cells of the vesicle in which the lymph is contained, and the reason for making these on the surface and not round the base is to obtain the lymph free from any admixture of blood. If by accident any blood be drawn, this must be allowed to coagulate and then be carefully removed before taking the lymph; for it is a rule, never to be deviated from, that the vaccination must be with vaccine lymph, *and with lymph only*. When the cells of the vesicle are freely opened, the lymph soon exudes and lies on the surface; and thus lying, it may be taken on the point of a lancet, or in any other way that is desired, for use. On no account must there be any pressure or squeezing of the vesicle with the lancet, or otherwise, to make the lymph exude; and when lymph ceases to stand spontaneously on the surface of a vesicle, that vesicle must be considered no longer useable for lymph-supply. Very generally, however, when the lymph which has first exuded has been taken, and the surface of the vesicle left apparently dry, if the operator wait a minute or two he will find there has been a fresh exudation of good useable lymph; and when he does not find, he may often induce this in a way quite unobjectionable by wiping very gently the surface of the vesicle with a soft wet linen cloth, thereby removing or dissolving the inspissated lymph which clogs the punctures. Vesicles of perfect character, and of the same size and appearance, differ very much in their yield of lymph; ordinarily, from a vesicle of such size as is produced by a single

deep puncture, enough lymph may be got for the direct vaccination of from four to six children, or for charging (*i.e.* for well charging, dipping once and again) six to eight ivory points. Some vesicles yield much more, but the caution already given against a thin, serous, too-readily flowing lymph, must be borne well in mind. When vesicles are compound, their yield of lymph is of course proportionally increased.

(2) **Considerations respecting Vaccinating from the Arm, or with stored Lymph.**—Lymph should in every instance (where practicable) be inserted direct from arm to arm. Vaccination with preserved and conveyed lymph—whatever the mode of preservation and conveyance—is in the long run far less successful than direct vaccination, and should only be adopted in case of necessity. But a caution, which experience has shown me to be much called for, must be interposed. The superior relative advantages of arm-to-arm vaccination are so generally appreciated by vaccinators, that practitioners whose vaccinations are few, and whose opportunities of lymph-selection are therefore limited, are often induced to take lymph from second-rate vesicles, rather than lose the opportunity of vaccinating direct from an arm. This, which I know to be the source of much current inferior vaccination, is a course which should not be adopted. It is better to employ preserved lymph of first-rate quality (and no lymph which is not first-rate ought ever to be preserved), with of course such extra care in the insertion of it as the use of stored lymph always requires, than for the sake of a direct vaccination to take lymph from an inferior vesicle. Best of all is it, unless circumstances forbid, to put off the vaccination till there is an opportunity of doing it direct from the arm, from a thoroughly satisfactory vesicle.

(3) **Various methods of inserting Lymph.**—Various methods may be employed for inserting lymph, the essential part of all of them being either to introduce the lymph into the substance of the cutis, or to bring it well in contact with its absorbing surface. (*a*) One of the most familiar methods is that of puncture. When it is intended to operate in this way, the arm of the child to be vaccinated should be grasped by the left hand of the vaccinator, so as to put the skin on the stretch, and a very sharp, perfectly clean lancet, well charged with the lymph selected, should be introduced by valvular puncture from above downwards, so that the lymph may gravitate into the wound. The lancet should not be held level with the skin, but at an angle of 45°, or thereabouts, and made to *enter the cutis.* If the lymph be thus well put in, it is retained by the valvular character of the puncture and the elasticity of the skin; and any fear that the bleeding which ensues will cause the vaccination to fail is quite chimerical.[1] Superficial puncture, on the other hand, unless the lancet be thrust far under the cuticle so as to bring the lymph into contact with a considerable extent of absorbing surface, will oftener fail, or will result in much smaller vesicles. In vaccinating by puncture *not less than* five should be made, and they should be at a distance of half an inch from each other. Five or more punctures at this distance from each other can very well be made in one arm if the vaccinator prefer to vaccinate

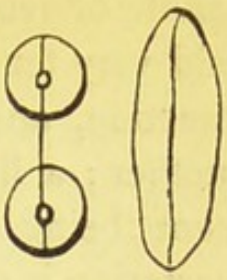
[1] Amongst high authorities, Gregory and Marson both insist strongly on the advantages of making the punctures sufficiently *deep;* and Bousquet ridicules the notion of the blood that flows washing the lymph away, if this have only been put in properly in the way recommended in the text, and remarks also on the finer vesicles which ensue from a deep, than from a superficial, puncture. (Rapport de l'Acad. Imp. for 1850.) My own experience, as the text shows, entirely coincides with that of these vaccinators.

on one arm only, or three or four may be made on *each* arm.[1] Six or seven vesicles, such as ordinarily result from puncture, are not at all too many for complete protection, and are just as well borne by infants as one or two would be. In the manipulations by which vaccination is effected by puncture, it is a very good plan to make each puncture a double one, thus //. A finer and larger, often oval, compound vesicle is thereby raised. For vaccination by puncture no instrument is needed but a common lancet, very sharp: most of the special instruments which have been devised for the purpose are not nearly so good; none certainly has any advantage over it, and it is therefore not necessary to enter into any description of them. (*b*) A modification of the plan of vaccinating by puncture is that of multiple superficial puncture, or tattooing; a number of minute superficial punctures being made over one spot with the point of the lancet, thus  and the lymph then spread over with the flat part of the lancet. The number of spots over which this tattooing should take place will depend, of course, on the extent of

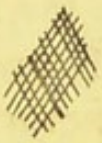
1 It is not a little surprising to those who are familiar with the practice of the National Vaccine Establishment, and of other first-class vaccinating-stations in England, where hundreds of thousands of children have been vaccinated in this way without the least danger having been incurred, or with the practice of various continental kingdoms, to hear this number of punctures excepted to as if it imported some "danger" to a child. More than one practitioner has told me he would not mind trying two punctures, but he should be quite afraid to make three! Heim recommends six punctures, three on each arm; Marson always makes six; Bousquet six, even on children a day old; and in the vaccinations to which reference was made in the former note, as performed in France shortly after birth, the usual course of operating appears to have been by six punctures. Steinbrenner makes ten punctures, five on each arm. I am informed that it is usual in Prussia to make sixteen punctures.

surface operated on at each spot. Tattooing over such a surface as is above depicted should be repeated on as many spots as one would operate on by the method of puncture above described,—that is, on at least five spots, and preferably on six or seven. But if the tattooing at each spot be done over a larger surface, as some practitioners prefer, raising compound vesicles of larger extent, or sometimes crops of vesicles, at each spot, the operation need of course be done over fewer spots; thus, a tattooing such as this  over two spots on each arm, or three spots on one arm, would be sufficient. (*c*) Another modification of puncture, common in some of the northern districts of England, is that of first spreading the lymph on the arm of the child to be vaccinated, and then ripping up the cuticle with the point of the lancet (which for this purpose should not be too sharp) over a surface equal to a sixpenny piece or more, with, frequently, a second plastering of lymph afterwards: crops of vesicles, close set together and nearly always confluent, are thus raised, often from a dozen to twenty on one base, each vesicle having its distinct depressed head, but prevented of course by the pressure of surrounding vesicles from developing itself in the way separate vesicles do. Two such crops, which may be made either one on each arm, or both on one arm, may be regarded as sufficient for full protection. (*d*) Many practitioners prefer vaccinating by scarification, to the plan of vaccinating by puncture. Scratches, single or double, like  these, each about half an inch or more long, but at distances which should be from half to three-quarters of an inch apart from each other on the arm, are made with the point of a lancet, or with a thick

needle, and the lymph is then rubbed on.[1] In the course of each scratch two or three separate vesicles will arise, or more frequently one oblong compound vesicle will be produced. Two scratches of this kind should be made on each arm, or four on one arm. (*e*) An excellent modification of scarification, very generally adopted, consists in abrading the cuticle by a number of fine parallel scratches, thus: or by further cross-scratch, thus: Abrasion should only be carried so far as to make it certain, by the appearance of blood oozing, that the cutis is reached; it is better, therefore, not to use for this purpose too sharp a lancet: the oozing that occurs, or the bleeding if it should amount to that, is then rapidly wiped away with the finger, and the lymph is plastered on. Just as in tattooing, it depends on the extent of surface abraded on each spot, how many abrasions it is desirable to make. When the abrasion is made over such surface as this five or six should be employed; but when, as is the custom of many practitioners, the abrasion is made over a considerably larger surface, as above depicted, two on each arm, or three on one arm, about three-quarters of an inch or an inch from each other, will be sufficient. Although for the performance of vaccination by scarification no instrument can be better than a common lancet, many practitioners prefer a very good little instrument invented by Dr. G. Weir,—a sort













[1] In Denmark an instrument (invented by Professor Dryer, of Copenhagen), which in appearance resembles the iron pen with two legs and screw for regulating their distance commonly contained in

of rake, consisting of four needle-points inserted in a handle of ivory. (See preceding page.) The skin being held very tense, this rake is drawn tightly across in one direction, and then, if the operator pleases, crossed in another; a little spatula at the other end of the instrument being employed for collecting the lymph and plastering it on the abraded surface.

For the performance of the nice and delicate operation of vaccination, the most scrupulous care should be taken to keep the instruments employed clean and in good order. Lancets that are used for any other purpose should never be employed for vaccinating; and vaccinating lancets should not only be cleaned before being put away, but when several children are to be vaccinated at a sitting, a cup of water and a napkin should always be on the table, and the lancet dipped and wiped after each operation.

(4) **Particular steps necessary when the Lymph used is dry-stored.**—In the above descriptions it has been assumed that the vaccinator was operating immediately from child to child; and the same directions are sufficient when he uses lymph that has been conveyed or preserved (Chap. VIII.) in the liquid form, as in the vaccine bottle, in capillary tubes, or in any other way. But when he has to use lymph that has been preserved by drying, as on points or glasses, it will be necessary this should be revived, or brought back to the liquid state, in order that it may be taken up by the system. This may be done by the use of a very minute quantity of *cold* water:

cases of philosophical instruments, but which has the extremities of the legs broad and sharp instead of being pointed, is extensively employed for this form of longitudinal scarification. It answers its purpose very well, but no better than a common lancet properly employed.

if the lymph to be revived has been preserved on glasses, a very small drop of water should be taken on the point of the lancet and well rubbed in with it, and the lymph left for some minutes to soften; if it has been kept on points, these should be very lightly and for a moment dipped in the water, the superfluous water shaken off, and the moistened point left for a few minutes on the edge of a book for the lymph to soften. Then, if the vaccination is to be done by puncture, the revived lymph should be taken on the lancet-point and inserted as in a vaccination direct from arm to arm; or, better still, supposing the lymph has been preserved on points, punctures may be made with a clean uncharged lancet, and the ivory points themselves then inserted into these punctures and kept in position by the thumb for a short time—care being taken to press the thumb well down as the points are being withdrawn, so that the lymph may be thoroughly wiped off them and left in the wound. If the vaccination is to be done by scarification or abrasion, the revived lymph may either be taken on the lancet, and applied as in an ordinary wet-lymph vaccination, or the flat of the glass or the flat of the point may be itself rubbed over the scarified or abraded surface. When the lymph on the point or glass has not, by keeping or otherwise, become very dry, the oozing of the abraded surface will generally afford all the moisture that is needed for its revival. When the scab is employed for vaccinating it must be well moistened and worked up with a little cold water on a slab, or the back of a plate, by means of a clean knife, and abundance of the ropy solution inserted.

(5) **Is any one mode of insertion better than another?**—An important question arises, whether any one of the different modes of inserting lymph above

described, or of numerous modifications of them that are met with in practice, can be more relied on than another for producing success. The only difference that I am aware of, to a careful man who thoroughly understands his work, is this—that he will succeed best in the way to which he is most accustomed. So much depends on habit, and, if I may so say, on trick of hand, that a practitioner who has learnt properly how to vaccinate, say by ordinary puncture, and can rely on securing thus the results he aims at, is more likely to be disappointed than gratified by attempting to change his plan for any other, and *vice versâ*. There is not, in fact, one of these plans by which I have not seen the best results of vaccination produced with singular uniformity and constancy by various practitioners, and if a score of the best vaccinators in England were picked out there can be no doubt that each form of working which I have described would have its representative. Nothing certainly can be finer, or more completely models of what vaccination should be, than such results as Marson and some other vaccinators produce by the process I first described,—that of simple puncture. Still, whether it be that this plan has been often imperfectly taught (for few teach it and practise it as Marson teaches and practises it), or whether it be in itself more difficult than the other ways described, large opportunities of observing the general practice of vaccination throughout England have left no doubt on my mind that in most hands it has been much less successful than the others. This is especially the case when, as in country practice, conveyed lymph or dry lymph has frequently to be employed. I have, in fact, found comparatively few persons making dry lymph take well by simple puncture ; and for vaccinations under these circumstances, at all events, some of the forms of abrasion

or scarification are in most hands by far the most successful.[1] Looking broadly at the results I have met with in the practice of large numbers of vaccinators, and with no personal prejudice in its favour (for it is not the mode in which I have ever myself been in the habit of vaccinating), it appears to me that no method is more highly to be recommended than that of parallel scratches, crossed or not crossed, be had to the  or to the size, the resulting  and this whether regard infrequency of failure, depth, and foveation of cicatrices. And this conclusion in favour of abrasion or scarification has, I believe, pressed itself on the minds of all those who have taken part with me in the inspection of public vaccination in England.

51. Watching the course of Vaccination. Inspection of results.—When the performance of vaccination is completed, a particular charge should be given to the parent to keep the arms from rubbing or other mechanical irritation, and means should be taken for seeing the child again on the same day of the following week, that the success of the operation may be ascertained. Such inspection is important to the practitioner, in order that, in suitable cases, he may be able to obtain lymph from the vesicles that have been produced, whether for immediate use or for storage. It is indispensable to the parent, who, without it, can never be sure that the object of vaccination is gained, that the child is really protected against small-pox. This is not a point which an uninitiated person can determine for himself;

[1] Ceely is of the same opinion. "With dry lymph on points," says he, "there is no mode equal to that for certainty, and I have tried many." (See Appendix to Badcock's Detail of Experiments, &c. p. 7.)

he can only know that *an* effect has been produced, not whether *the specific* effect which alone makes the child safe has followed. On various occasions I have known parents in perfect good faith, and without the slightest intention of deceiving, affirm that a vaccination has taken beautifully, when inspection has shown that the results were spurious. The law, therefore, requires that children should not only be vaccinated, but that the vaccination should always be duly inspected; nor without actual inspection can a medical practitioner properly give a certificate of successful vaccination. When, on this eighth-day inspection, vesicles of a perfectly characteristic kind are found to have risen, it is not very likely that anything in the subsequent course of the vaccination will interfere with its protective value, and the practitioner will seldom find that he has made a mistake, who (besides giving the parent the certificate of success to which he is then legally entitled) should venture also to pronounce the child safe; at the same time this assurance might be given with more absolute certainty were the case seen *through the stage of areola*, and I cannot but think it is to be regretted that the old custom of inspecting the vaccination on the eleventh or twelfth day, as well as on the eighth, should have fallen into disuse. Without, however, insisting on a second inspection in a perfectly regular case, my experience compels me to urge strongly the necessity of such further inspection in all cases where the appearances on the day-week are retarded, or in any degree dubious. Many times have I known assurance given that the case was "all right," when, from retardation, the vesicles were so little advanced in their course that it was impossible for the practitioner then properly to determine it; and I have also, in non-retarded but dubious cases, seen results on the day-week so far resembling the

normal effects of vaccination that to an inexperienced person they might readily have seemed such, and that an experienced person, if compelled then to decide, would have been inclined to pronounce them regular, and which yet, on further watching, turned out irregular and spurious. The only safe rule, therefore, with regard to doubtful or retarded cases, is to inspect them again. Whenever a case, whether on the day-week or on subsequent inspection, is found to be spurious, the parents should be most carefully warned not to rely on that vaccination as protective against small-pox, but to have the operation repeated either at once, if it be quite certain that the cause of irregularity is not in the child's own health or condition, or else after an interval of a few weeks or months.

52. Performance of Vaccination from the natural or casual disease in the Cow.—Opportunities of seeing the natural disease in the cow are not common, but for the sake of those to whom they may chance to occur, and who may conceive that some advantage may attend the raising a fresh stock of lymph from such cases, it is desirable to offer a few hints, taken chiefly from Ceely's admirable and oft-quoted memoir, both as to the collection of the lymph, and as to the insertion of it. A practitioner in search of such lymph will often have to take a great deal of trouble and be doomed to much disappointment. He will frequently find himself deceived by false reports, and, when he arrives, see some spurious disease instead of the genuine cow-pock. Even if the pock be genuine, the period for taking lymph will most probably have gone by, and it is, in fact, only when a number of animals are affected in succession in a dairy that there is much chance of finding any vesicles fit to yield lymph. Careful search,

especially on the lower and naked parts of the udder and the adjoining bases of the teats, should, however, be made, with the view of finding, if possible, some entire unacuminated vesicles, or vesicles with central crusts. The former, if found, should be punctured with a sharp lancet *as near* the centre of the vesicle as possible, and the epidermis gently raised to a moderate extent round the discoloured or most depressed part. The greatest delicacy in manipulation throughout the examination and subsequent puncture is necessary, for the quantity of lymph is exceedingly small, and exudation of blood will obscure it, or sensitiveness of the animal under a rough manipulation prevent the operation altogether. With due care, slight gentle pressure either with the blade of the instrument, or between the thumb and finger, will enable the operator to charge a few points. "Patience and a treble charging of the points are always," says Ceely, "to be recommended." Puncture at the elevated and indurated margin of the vesicle will be useless, only yielding blood. Vesicles with central crusts will be found perhaps more convenient than the entire unacuminated vesicles, and will yield nearly as much lymph, if the crust be small and the margin of the vesicle tender, hot, and tumid. The crust may be removed or pressed on one side, the epidermis then carefully raised, and a limpid fluid in small quantities thus obtained.[1] Small

[1] In like way, when we desire to vaccinate from the casual vesicle of a milker, and the case, as may often be, has not come under our observation till the vesicle is well advanced, the areola perhaps declining, as at the tenth day, effective lymph may still be got from *the centre* of the vesicle. Displace the fragment of concrete lymph which occupies this centre : wipe away with repeated dossils of lint the turbid serous fluid which issues. The lancet will then be able to take up, though probably not without some intermixture with the turbid opaque fluid, a tenacious limpid lymph from the deep

superficial vesicles will often yield more lymph than contiguous larger vesicles more deeply seated.

When we are deprived of opportunities of getting lymph in either of these ways, we may often succeed by reviving (1) amorphous masses of concrete lymph which have exuded from broken vesicles; (2) the central rough and irregular crusts, the more transparent and nearer a dark brown the better; (3) desiccated vesicles, or formed crusts, if of primary formation, the secondary and tertiary crusts being of scarcely any value.

It is *before* acumination that we must always look for lymph from the cow: after acumination, lymph is comparatively of little value. The vesicle immediately before acumination will yield it in as active a state as earlier; while at an earlier period, as from the fifth to the ninth day, it is scarcely possible to obtain it in any quantity. In the early stages of some vesicles, especially those which are superficial or have been irritated, lymph may be turbid or even bloody without impairment of its efficacy. Even turbid lymph from an unacuminated vesicle will answer when limpid lymph from an acuminated one will fail. Lymph will generally be found more abundant on the cow than on the heifer, more abundant and less viscid on the teats than on the udder.

To establish and maintain a stock of lymph from the cow, we must be careful to have at hand a sufficient number of subjects to receive it, whether direct or through its earliest removes. Young infants with a thick, smooth, clear skin and a dark complexion, but not too florid, are the best. Strumous, thin-skinned children should be avoided. And this selection must be adhered to with great care until (which, however, is generally the case in

centre of the vesicle. (Trans. Prov. Med. and Surg. Assoc., vol. x. p. 245.)

a very few removes) the local intensity of the symptoms is materially diminished. With this very active lymph, three or four punctures will generally be amply sufficient, and unless we are sure of our subjects it will be safer to use a less number: in all cases it is a matter of the greatest moment to avoid rupture and disturbance of the vesicle. If we desire for any reason to vaccinate with this acrid lymph any subjects whom we deem unfavourable, we should prepare them beforehand, as the old inoculators did the subjects of variolous inoculation.[1]

[1] Trans. Prov. Med. and Surg. Assoc., vol. viii. pp. 338-342, and 349.

CHAPTER VII.

Of Arrangements for the Performance of Vaccination and the Maintenance of Lymph-supply.

53. Great relative Advantages of Arm-to-arm Vaccination. — Vaccination performed direct from child to child with well-selected lymph, in skilled hands, very rarely fails. This is much more than can be said of any other mode of proceeding. Lymph conveyed liquid from patient to patient, however promptly, does not infect with nearly the same certainty as the lymph transferred immediately from arm to arm; and stored or preserved lymph, whatever the mode of storage or preservation, is greatly more unsuccessful. And if this be the case with the best operators, the difference in less practised hands is still more remarkable. "De quelque manière qu'on s'y prenne," says Bousquet, "jamais le vaccin conservé ne vaut le vaccin de bras à bras."[1] The superiority, indeed, of arm-to-arm vaccination is not a point which admits of dispute, and, by every practitioner who duly reflects on the importance of making vaccination thoroughly successful, the performance of it in this way is regarded as a matter of the utmost consequence.

54. Method and suitable Arrangements are

[1] Rapport de l'Académie sur les Vaccinations pratiquées en France pendant l'Année 1844.

requisite for thus performing Vaccination.—But for vaccinating from arm to arm, and especially for carrying on a series of such vaccinations, method and suitable arrangements are indispensable. "Our arrangements," says Jenner, writing to a gentleman whose children he had undertaken to vaccinate, "must be carefully made, as the children must be met here by proper subjects for transferring the lymph; for on the accuracy of this part of the process much depends." But how can we make sure of having proper subjects for supplying lymph for a day's vaccinations, unless we have several children under vaccination at the same time? Every experienced vaccinator knows that a child who has been successfully vaccinated so as to be well protected against small-pox, may yet not be a good, and often will not be an eligible, child for transmitting lymph. Let half a dozen successful cases of vaccination present themselves for inspection on the same day, and you may not have more than two or three, if so many, really choice arms from which to carry on the day's vaccinations; and a vaccinator who is dependent on only one two, or three vaccinations of the previous week is liable to be stopped in his proceedings, not merely by the case or cases having failed, but by the vesicles being such as experience dictates he had better not employ for continuing his lymph. If, rather than be stopped, he succumbs to the temptation of vaccinating from such cases, more especially if (as such a vaccinator is sure to do) he succumbs again and again, he will soon find his stock of lymph deteriorate.

55. Selection of Lymph is necessary to prevent its degenerating.—Whatever opinion may be entertained as to lymph losing any of its original power,

necessarily and inevitably, by the mere fact of its transmission through a succession of human subjects (a matter which will be discussed hereafter), no one can doubt that such loss of activity may take place unless due care be taken in the selection of the subjects through which the lymph is continued : and the best vaccinators, whether at home or abroad, lay great stress on this point. Bousquet strongly insists upon it : "S'il y a un moyen d'empêcher ou du moins de ralentir la dégénérescence du vaccin, c'est de le prendre toujours sur les plus beaux enfants, et dans les plus belles pustules."[1] Steinbrenner severely condemns the habit of taking lymph almost indiscriminately from any vesicles which are not abnormal, instead of choosing only the most perfect and the most characteristic—unlike the wiser husbandman, who, he says, picks out the finest grain for his seed-corn.[2] The case is admirably stated, and the views of our own highest authorities in practical vaccination are embodied, in the following extract from Simon's preface to the "Papers relating to the History and Practice of Vaccination :" "Whether slow progressive degeneration of the vaccine contagion in its successive human transmissions be or be not proved, whether its renewal at stated intervals from the cow be or be not an unconditional necessity, the practical conclusion evidently is, that its operation must in every case be intelligently watched ; that no line of transmission is to be continued through a subject in whom imperfect infection is produced ; that at any such point the vaccinator must stop ; and that from all such points, as they are arrived at, re-application must be made to the parent stock—not necessarily at its source, but at least at some stage of descent in which its infective

[1] Nouveau Traité de la Vaccine, p. 228.

[2] Traité sur la Vaccine, p. 570.

powers are unimpaired. Upon each individual vaccinator must rest the responsibility of providing in his own practice against those obvious chances of deterioration of supply. It becomes difficult or impossible to fulfil this obligation, except when the vaccinator carries on simultaneously a certain number of vaccinations; so that he may be able at any time to choose between several arms as sources for continuing his contagion, and may never be tempted to take lymph otherwise than from the typical Jennerian vesicle of a thoroughly healthy subject. It is on these grounds that persons who have given most attention to the scientific culture of vaccination (foremost among whom I am permitted to name Mr. Ceely and Mr. Marson) look with some alarm on our present minute subdivision of the duty of public vaccination, as tending to reduce many public vaccinators to an objectionable alternative; either that they must have frequent recourse to extrinsic assistance, or must incur the chance of the contagion degenerating by its transmission through unselected subjects."[1]

56. Continuous supplies of fresh Lymph depend on the arrangements for Public Vaccination in large towns.—Although a full consideration of the arrangements for public vaccination in England involves details which must be reserved for a subsequent chapter, it is impossible to treat properly of arm-to-arm vaccination, and of lymph-supply, without an examination of the principles on which a public system of vaccination should be based. For, firstly, under the distribution of vaccination which now exists, a very large majority—probably at the least two-thirds[2]—of the children born are vaccinated by the

[1] Preface to Papers relating, &c. p. xxxvii, note.

[2] More probably even three-fourths. It is impossible to state

public vaccinators, and it depends therefore *directly* on the public arrangements how far this large majority shall have the advantages of well-performed arm-to-arm vaccination; and, secondly, inasmuch as circumstances render it impossible for any but the public vaccinators of large towns to maintain *continuously* stocks of *fresh* lymph, and as there is a constant demand for such lymph for the use of other practitioners not so fortunately placed, the public arrangements adopted in these towns must, obviously, *indirectly* influence, more or less, the whole vaccination of the kingdom.

A very little consideration of the subject is sufficient to show that the conditions already stated—viz. that for every arm-to-arm vaccination there should be a *choice* of children for transferring the lymph, and that properly to carry on a series of arm-to-arm vaccinations there must

exactly what proportion of each year's births are vaccinated by the public vaccinators in the kingdom, because, in the annual returns of the public vaccinations performed, cases of re-vaccination are included without being distinguished from primary cases. The returns, however, give separately the vaccinations performed *under one year of age*, which of course are all primary: and these alone have since 1854 averaged annually more than half the registered births. Now, as in the remaining, or minor half, are included (1) all that very large number of children who, remaining unvaccinated till they are more than a year old, are *then* vaccinated by the public vaccinators, and constitute the bulk of the cases annually returned as publicly vaccinated over one year of age, (2) all children who die before vaccination has been done, and (3) all living whose vaccination remains unperformed, the remnant vaccinated by private practitioners, cannot, I think, exceed, and can scarcely amount to, one-fourth of the children born. It must further be borne in mind that this small proportion of cases is distributed amongst several times as many operators as are employed in vaccinating the other and larger portion, to understand the difficulties of private practitioners with regard to maintaining their lymph-supply. The distribution of vaccinations into private and public varies considerably, it need scarcely be said, in different places and districts.

be several cases assembled on each vaccinating day—are conditions which only *some* out of the many thousand medical practitioners who practise vaccination in England can *continuously* fulfil. For it has been found by experience that an average of ten vaccinations at a time is as little as can be relied on for the purpose; and to supply this number of subjects continuously once a week, a vaccinator would need to have more than five hundred cases a year.[1] Now such an amount of cases as this is not attainable in any rural district, nor even if the amount were attainable would considerations of distance admit of the children in such districts being all brought together to one place. It is not attainable in small towns, nor in any town where the births are less than seven or eight hundred a year, and frequently is not attainable even where the births exceed this number, on account of the vaccination of these children being distributed among various practitioners. It is an amount which, even in our largest towns, no private practitioner, or scarcely any private practitioner, can command.[2] *Constant* supplies of

[1] Of course with an *average* attendance of ten children a week, there are many weeks when fifteen or twenty are brought, and others when only four or five attend. In summer the attendance is always better than in winter, and particular causes, as bad weather, &c. often interfere with the stational attendance on particular days. But, the law requiring vaccination to be performed within a fixed period from birth, it is found practically that there is so far steadiness of attendance, that, with the average stated, some children are always brought, and that with a very little management a vaccinator may make sure of having on any day at least three or four. But an average of ten is quite the minimum that should be allowed, and a larger average gives greater facilities of working, and greater opportunities of choice. This subject is further considered in § 57.

[2] In 1865 there were no fewer than 14,185, and in 1866 no fewer than 13,718 separate applications for lymph made to the Central Office of the National Vaccine Establishment alone by private practitioners practising in England and Wales; and this by no

fresh lymph can only, I repeat, be kept up by the public vaccinators of large towns; nor can they be maintained even by them, unless (1) the authorities have taken care to supply the respective vaccinators with the requisite number of cases, and (2) the local arrangements have provided for these cases being assembled in regular weekly succession. (See Mem. on Subdiv. of Vacc. as affecting Supply of Lymph in Appendix II., B.)[1]

Lymph-supply, then, is a matter primarily of public, and only secondarily of individual professional, arrangement. And it is on the authorities charged with the administration of the national system of public vaccination that it depends (1) to maintain continuously and in abundance, wherever this can be done, constant supplies

means represents all the assistance afforded by the Establishment to this portion of the medical profession, numerous applications being made and satisfied on the spot at its various metropolitan and extra-metropolitan stations. And, in each of these years, about 1,500 applications were made to the establishment from public vaccinators. Besides this, a demand for lymph, the extent of which there are no means of estimating, is constantly being made throughout the kingdom to district vaccinators unconnected with the Establishment.

[1] Conditions which require attention to the following general rules, which have for some time past been recommended to local authorities for their guidance in this matter:—

(1) That, except at times when there is immediate danger of small-pox, vaccination be not appointed to be performed at any station oftener than once a week;

(2) That, except at times when there is immediate danger of small-pox, or for special reason in individual cases, vaccination in town districts (unless it be of private patients) be performed only at the public station;

(3) That, as opportunity offers, especially in urban unions and parishes, all unnecessary subdivision of public vaccination among many districts or stations be discontinued; and that in populous towns, unless under special circumstances, subdivision be not made beyond the point where each vaccinating station will have annually at least 500 applicants for vaccination.

of *fresh* lymph, and (2) to make the superfluous lymph of the public vaccinations of large towns available for public use in other places, and for private professional use throughout the kingdom.

57. **Arrangements in large Towns.**—Wherever large numbers of children can be brought together in regular succession, stocks of fresh active lymph can be maintained with the greatest ease, and the abundance of supply is proportionate of course to the number of children. Hence, while an average of ten cases on a vaccinating day has been stated to be the minimum below which no station ought to be expected to maintain a constant fresh supply, it is of great consequence that, wherever practicable, a larger attendance of cases should be obtained. If the unfortunate, and in its results mischievous, system of subdivision which has heretofore existed in the arrangements for public vaccination in the towns of England (see Chap. XV.) were abolished, it would be found that in the denser parts of the metropolis, and of such towns as Liverpool, Manchester, Birmingham, Leeds, Sheffield, Bristol, &c. stations, at each of which the annual vaccinations should range from 1,000 to 1,500, could readily be maintained without any disregard of the public convenience as to distance. London alone would supply a large number of such stations within a quarter of a mile of nearly every house, and within a third of a mile of every house.[1] Many stations

[1] That is, in its central and most thickly-peopled parts: this was ascertained by Dr. Buchanan and myself in the inquiry we made into the public vaccination of London, by direction of the Privy Council, in 1863. In parts in which population was less dense, including the populous suburbs, stations at the same distance apart would still have from 500 to 1,000 cases a year. It was only in the outskirts that the stations would have smaller attendances, or need to be placed further asunder. (See Sixth Rep. Med. Off. of Privy Council, p. 118.)

much more frequented than this existed before the introduction of "Public Vaccination,"[1] but there are not now more than three or four in the kingdom at which the average annual vaccinations amount to a thousand. In the official visits which, in the course of the last seven years I have repeatedly made to the principal vaccinating stations in England, I have had ample opportunities of noticing the very great advantages these few larger stations had over those at which the above-stated minimum number of 500 annual cases was merely attained, or only a little exceeded,—whether in regard to their opportunities of selection, their assurance of a fair attendance of subjects in unfavourable weather, or their much larger means of supplying lymph for the use of others. Wherever they exist, the local population is greatly the gainer by them. And their national importance cannot be overrated. It is on them exclusively, if a proper number of them were provided, that reliance should be placed for obtaining that large fund of fresh-stored lymph which needs to be constantly kept on hand by the National Vaccine Establishment for the use of practitioners, public or private, in the small towns and rural districts of the kingdom, as well as for other public or professional needs. The stations at which the annual vaccinations fall on an average below a thousand, and especially those at which they nearly fall down to the prescribed minimum—the stations, in fact, under a proper system, of the less dense parts of towns of the first magnitude and the stations of moderate-sized towns—would not then be needed, or would only exceptionally be needed, to contribute to the national stores, and might

[1] At the Small-pox Hospital the annual vaccinations were above 3,000; so also at Surrey Chapel; at the Birmingham Dispensary there were between 2,000 and 3,000, &c. &c.

be reserved for the supply of local professional wants. It is only in the very largest towns that these first-class stations (such I call those the vaccinations at which amount to a thousand a year) could be obtained: but every town in the kingdom of 40,000 inhabitants, and many towns of smaller population than this, yield annually a sufficient number of subjects for public vaccination to maintain a station at which the performance of arm-to-arm vaccination with selected lymph might be placed weekly within the reach of the inhabitants, and at which a continuous stock of lymph fresh from the arm might be kept up. If at present, in such towns, a large amount of the vaccination, and even of the public vaccination, is done, as we know it is, with stored and conveyed lymph, to the great detriment of the public, it is because the advantages which number and aggregation of population give have not been duly considered—have in fact been thrown away; and the public cases, instead of being kept together, have been so dispersed in various ways, that the maintenance of a local fresh-lymph supply became impossible. (See *postea*, § 61.)

I venture, then, to think that, if the authorities will do away with the present superfluous appointments, and the excessive subdivision in towns, and so divide or distribute the public performance of vaccination in England that the public stations, in the denser parts of towns of great magnitude, shall be supplied with an average of at least twenty cases on each vaccinating day—and in the less dense parts of such towns, and in towns which, though smaller, can yet furnish cases enough properly to maintain continuous arm-to-arm vaccination, with an average approaching that number as far as population and other local circumstances admit—the following advantages would be derived: (1) the necessity of

any use whatever of preserved or conveyed lymph in the public vaccination of the town (with rare exceptions for special reasons in some individual cases) would be obviated altogether—and in effect (inasmuch as public vaccination is a public right, open to all) no necessity would exist in the town for the use of such lymph at all, except in so far as parents preferred not to avail themselves of the public station; (2) in the cases in which parents desired to have the vaccination performed by their own medical attendants, there would be furnished on the spot to the private practitioners of the town (who, however methodical in the arrangement of their own cases, must still from limited numbers be more or less frequently obliged, unless they had recourse to long-stored lymph, to seek assistance from without) the aid they require, and in the most effective manner, viz. with lymph perfectly fresh;[1] and (3) the lymph, which

[1] What an absurdity, what a gross absurdity it is, that in such towns as (say) Hull, or Bradford, or Nottingham, or York (and I might name, indeed, nearly all the large towns in the kingdom), a practitioner, instead of having in his own town a station at which on the appointed week-day he might always be supplied with lymph straight from the arm, should either be obliged to send about, first to one place or neighbour, and then to another, to beg some lymph —which often cannot be got, and often if it be got is of some length of storage—or be obliged to send up to London to the National Vaccine Establishment, whence the lymph sent out to him must at the earliest be a day or two old, and frequently necessarily older. From the towns I have named, and others as large or larger, applications to the National Vaccine Establishment are of weekly occurrence. Contrast with these places a few others where proper arrangements exist, and where a local practitioner is not only sure of obtaining fresh from the arm the lymph he wants, but where the public vaccinator (as I have myself repeatedly seen) not unfrequently looks out for him a suitable child, the parents of whom are willing for a small *douceur* to accompany him to his patients' residences, so that the operations may be done direct from arm to arm. I would take this opportunity of calling the attention of my profes

must necessarily be kept always in store (*but which should always be as fresh as possible*) for the wants of small towns and of rural districts, as well as for the use of the Army and Navy, the colonies, and abroad, would be supplied of the choicest kind, and in quantity practically unlimited. Under such arrangements as have been here described, any dearth of lymph, of the best and freshest kind, must, I conceive (and I write with some practical knowledge of the subject), be at any time utterly impossible.

58. **Arrangements in smaller urban populations.**—In urban populations in which the cases for public vaccination fall short, but do not very largely fall short, of the number assigned as the minimum for properly carrying on continuous arm-to-arm vaccination, in which (say) there is but an average of seven or eight cases a week instead of an average of ten, weekly public vaccination may still with pains be maintained, without the necessity for recourse to preserved lymph (except only occasionally), and with very fair opportunities of selection. A good deal of contrivance, however, has often to be resorted to for the purpose, the difficulties increasing as the number of cases diminishes, but in a much greater ratio. Public vaccinators, under such circumstances, require to be watchful that their lymph does not deteriorate, and, though they may frequently be able to assist their brethren in private practice, they are not to be counted on for being able to do so at any and all times, as in larger towns. What is the lowest annual

sional brethren to the great mutual advantages I have always found attending a good understanding between the public vaccinator and the private practitioners of a town, the latter sending to the public station such of their patients as pay them no fee for vaccination, or doing what they can to induce them to go there, and the former in return being ready, and justly considering that under the circumstances there is a claim on him, to give the assistance above stated.

number of cases with which a practitioner may advantageously attempt to carry on continuous weekly vaccination, depends greatly on the pains he takes in methodical arrangement, and on his judgment in his individual selections. Hence, sometimes, vaccinators with limited numbers are found maintaining better stations than others who have larger opportunities. But, as a rule, my experience would lead me to think it of disadvantage, if attempt were made to carry on a public station weekly throughout the year where the annual number of cases fell at all, or at all events if it fell much, below 300.

59. Arrangements in still smaller towns, and in rural districts.—Wherever the number and distribution of cases for public vaccination is such, as it must be in all small towns and rural districts, that a continuous weekly succession of applicants in sufficient number at a station cannot be maintained, the best mode of providing good arm-to-arm vaccination for the public consists in the adoption of some form of periodical vaccination. Thus, public vaccination might be carried on during the summer months only, and suspended during the winter months. In a town which will give (say) its 200 cases a year to a public vaccinator—a number quite insufficient to keep a station always going—vaccinations may very well be kept up weekly throughout the summer. Where population is smaller or more scattered, the vaccination should be carried on for a few successive weeks at two or three periods in the year. The best provision for rural districts, including the small towns of such districts, consists in the systematic sweeping of the district (if I may be allowed the expression) every spring and autumn. In laying out arrangements for periodical vaccination in districts of this kind, with a view to the performance of the vaccination, as far as possible, from

arm to arm, local authorities should (1) appoint as few stations as is consistent with due regard to the convenience of the population as to distance, (2) consider in reference to each station what is the number of cases to be annually provided for thereat, and (3) so fix the attendances of the vaccinator that, as a rule, there shall be several children assembled for each attendance. In periodical vaccinations, the vaccinator has only to provide himself *from without* with lymph for the commencement of the periodical proceedings. He gets lymph for the vaccination, say, of three well-chosen children; from them, or from one or other of them, he is able to vaccinate his first group, who yield him lymph, not only wherewith to continue his arm-to-arm work, but for use *fresh-stored*, in those cases in which the use of preserved lymph may be indispensable. No arrangements that can be devised for rural, or for any little populated districts, will obviate altogether the necessity for the occasional use of lymph stored or conveyed: but what may, and should be, done, is to reduce this necessity to a minimum. And we know from experience that in rural districts, by steady adhesion of the vaccinator to periodical stational arrangements, the inhabitants may enjoy, with few exceptions, the advantages of well-performed arm-to-arm vaccination. Under the Vaccination Laws recently in force, the establishment of a good periodical system of public vaccination in districts which required it was not practicable. It would have been clearly inconsistent with a law which enacted, under penalty, that *all* children (health permitting) should be vaccinated within three months of birth, that public vaccination should in *any* district be suspended for three, four, or six months together. But by the "Vaccination Act, 1867," it is expressly provided, that, in those districts in

which the paucity or diffusion of population renders it expedient that public vaccination should only be carried on at intervals exceeding three months, parents shall be exempt from any penalty for neglect arising during an interval, on condition that the vaccination be performed during the next periodical attendance of the public vaccinator.

60. Arrangements for Private Vaccination.—I have but few hints to offer with regard to the conduct of private vaccination, but some probably may be acceptable. The principles on which private vaccination should be carried on are of course essentially the same as those recommended for public vaccination. There are scarcely any private practitioners whose cases are numerous enough to enable them to maintain stocks of lymph of their own for any long time together, and most private vaccination has to be done periodically, or in batches. Extraneous assistance must be given for the commencement of each batch, but the practitioner, having received this assistance to start with, should endeavour so to arrange his cases as to keep up his own supply until the batch requiring vaccination is exhausted. I find many practitioners, in their desire to maintain a stock of their own as long as possible, reducing their weekly vaccinations to an inconveniently low number—taking care, in fact, *not* to vaccinate above a case or two a week. I venture to suggest that this is an undesirable arrangement, and one that often defeats its own object. If a practitioner has twenty cases on his list to vaccinate, he will do them more easily, and more satisfactorily, if he vaccinate them all in two or three successive weeks, than if he try to eke out his vaccination for five, or six, or seven weeks, or more. In the upper and upper-middle classes of society it is usual to perform the vacci-

nation at the patients' dwellings: but, where this has to be done, it is always desirable that a child fit for transferring the lymph should be taken to the house. Practitioners have not, generally, much trouble in getting most of their lower-middle class patients to attend at their surgery. Parents are generally very ready to do this when they know that it is for an object beneficial to the child: and the surgery-attendances of course should be regulated in weekly succession. In all large towns where continuous weekly public vaccination can be maintained (§ 57), fresh lymph should be procurable by the private practitioners at the station of the town, to enable them to commence their proceedings when several cases have accumulated for vaccination. Practitioners in other places could always obtain it for the same purpose, as at present, from the National Establishment.

61. Results of disregard of the foregoing considerations.—I have felt the more anxious to make clearly understood the sort of arrangements upon which reliance may be placed for securing good lymph-supply, and, as far as possible, the performance of arm-to-arm vaccination, because, in the discharge of my official duties, I witness daily the unfortunate results which have ensued from the adoption of quite other arrangements for the performance of public vaccination—arrangements in which these, the matters of first consequence, have been overlooked or disregarded. It seems scarcely credible, but it is nevertheless true, that in this densely-peopled metropolis, where, if anywhere, there should be every facility for affording to children invariably the benefit of the best arm-to-arm vaccination, a large proportion even of the public vaccination should be done with stored lymph, or done from the arm under conditions that admit of no proper selection of lymph being

made ;[1] that in some districts of London more than half the public vaccination, and in others even a much larger proportion, should be so done ; that in most of the large towns of England the same evils should be found extensively to exist ; and that, in many of them, not only is public vaccination with stored lymph the rule, instead of being (what in such places it should be) the very rare exception, but the performance of public vaccination at all is, in some of the districts into which the towns have been divided, at times suspended for months together.[2] The Poor-Law Board will henceforth be able to put an end to that multiplication of districts, and multiplication of appointments, which have been the main causes of these results. And the provisions which have been introduced for that purpose into the New Vaccination Act —provisions which give to the central authorities regulative and controlling powers which they have not heretofore had—will, there can be no doubt, soon lead to the substitution of arrangements more advantageous to the public.

[1] It was only the other day that a public vaccinator of one of the most densely-peopled parishes of London told me that, from his small number of cases, he must sometimes vaccinate from second-rate arms, or he could not do it from the arm at all : the public vaccinators of this parish were five-fold as many as there should have been to keep up proper supplies.

[2] See fuller illustrations in the concluding section of Chapter XV. ; also, the successive Annual Reports of the Medical Officer of the Privy Council (Appendices containing Results of Local Inquiries as to Vaccination), iii.—vii. inclusive, and particularly the Sixth Report, in which is included the results of an inquiry, made by Dr. Buchanan and myself, into public vaccination in the metropolis.

CHAPTER VIII.

Of the Conveyance and Storage of Lymph.

62. Conveyance and Storage of Lymph.—After all has been done that can possibly be done for giving the population the benefits of arm-to-arm vaccination, there will still be frequent occasions on which recourse must be had to conveyed or stored lymph. Everywhere individual cases will be met with in which it may be required; and it must be kept ready on a large scale to meet the wants of those who are unable to maintain their own supplies—*e.g.* for starting periodical public vaccinations, for starting series of private vaccinations, for the use of the public services in the army, navy, &c. and for transmission to the colonies, and to other foreign places, where, from paucity of subjects, and climatic or other causes, stocks of lymph cannot be maintained, or require at times to be renewed. The best modes of conveying and storing lymph demand, then, our most attentive consideration.

63. Modes of Conveyance for immediate Use.—For mere conveyance of lymph from one house to another some practitioners use their ordinary vaccinating lancets, charging the points of them well, and keeping the blades from contact with the handles by a strip of paper folded as a shield round the base; or they use lancets specially constructed so as not to admit of the blade coming into contact

with the handles. For immediate, or for very prompt use, this will do very well, but the lymph on the lancet-points soon concretes, and the drier it is allowed to get the greater are the chances of failure; besides which, any attempt to keep lymph on lancets beyond a day or two, is at the risk of its spoiling and decomposing. When lancets are employed for conveying lymph, the utmost care is requisite to prevent them from getting rusty, and usually lancets so employed do not remain long fit for use. The state of rust in which I have repeatedly seen lancets sent by practitioners to vaccinating stations to be charged, assures me that a caution in this respect is much needed, and no doubt to this carelessness are traceable not a few sore arms. To make sure of success in using charged lancets, the practitioner should allow for each insertion he makes the charge collected on one lancet. And if he is not able to perform his vaccination on the day on which the lymph is taken, he should not use the lancets at all, but wash off the lymph and clean the instruments well.

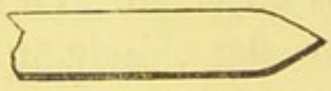
A better way of conveying lymph in a fluid state for prompt use, is the *vaccine bottle*—a small square bottle with a well-ground glass stopper, so shaped that its inner surface projects into the bottle in the form of an oblong blade of glass, on which the lymph is collected. Or the lymph may be carried between two flat closely-fitting bits of glass, each about three-quarters of an inch square—one of which bits may, if the practitioner chooses, be furnished with a cup-like depression at its centre. In either case, the lymph must be used within twenty-four hours, or, if the weather be cold and the bottle or glasses have been kept in a cool place, within thirty-six, or at the utmost forty-eight, hours



of being taken. Lymph, like other moist animal matter that has access to air, soon undergoes changes which render it unfit for use, and the prudent practitioner will never attempt to keep it in a liquid state longer than the time above specified, except in hermetically sealed tubes. I think it scarcely necessary to advert, except for the sake of deprecating it, to the proposal which has been made of keeping lymph liquid for a longer time by mixing it with glycerine. What effect, if any, glycerine might have in retarding the decomposition of lymph, I have not thought it worth while to inquire : because it is with *lymph*, *pure lymph*, as pure, as concentrated, and as pungent as can be, that we should vaccinate, not with mixtures and compounds. But I happen to be acquainted with some results of using the mixture, and they exhibited, as might be expected, a large relative amount of failure.

64. **Various modes of Storage.**—Lymph that is to be kept beyond the times above stated before being used should be dried and kept in a dry state on points or on glasses, or should be preserved liquid in capillary tubes hermetically sealed.

(a) **Points.**—The points used for preserving lymph are made of ivory. Old ivory should be used, as being less absorbent. They are generally cut of this size and shape,



or scarcely so big, but much larger points would be far preferable, and best of all are such points as Ceely, Marson, and others have had made for their own use, which have the size and shape of the ordinary lancet—are in fact ivory lancets. This size, no doubt, would be inconvenient for transmitting lymph, but I know no reason why much larger points than the present should not be used. For charging the points, the vesicles are opened according to the directions given

when lymph is to be taken from the arm for a direct vaccination (§ 50, c, 1), and the points well dipped in the exuded lymph till a good drop stands on each of them; they should then be laid on some flat raised surface, as the edge of a book (but so that their wet ends do not touch it), to dry; and if, when they have undergone some drying, any should appear insufficiently coated, these should be re-dipped. Under any circumstances, indeed, *a second coating is most desirable:* and a third coating will make them take all the more surely. It is not only the ends of the points, but some considerable part of their flat surface, which should be coated. Under the disadvantages in which a practitioner is placed who has to use preserved lymph on points, care should be taken to give him as abundant a supply of it on each point as possible. When the points have dried they should be wrapped up in oil silk, which must be tightly closed with gum; they should then be put away in a dry place, in a well-corked bottle full of cotton-wool, or else they should be sent off to their destination, if they are to be sent away. Points charged from the arms of different children should not be mixed together, and on each set of points should be noted the source (the particular child) from which the lymph was taken.

(b) **Glasses.**—The glasses which are used for storing lymph are the same square closely-fitting bits of glass already described as sometimes used for conveying moist lymph. When the lymph, however, is to be dry-stored, both of the plates must be flat and free from cup-like depression. First one square, and then another, is dipped and re-dipped in the lymph which stands on the surface of an opened vesicle till they are found to be well coated; the lymph must then be allowed to concrete, and the coated

surfaces of the squares pressed very close together. Successive pairs of glasses may be treated, of course, in the same way : each pair should be wrapped up in oil silk or tinfoil, and put by for use ; the source of the lymph, as in the case of points, being always noted upon it. Glasses should be so coated that when they are held to the light the inspissated lymph should be very visible.

(c) **Tubes.**—Capillary tubes, or tubes that were called capillary, were of very early employment for collecting and preserving lymph ; but, probably from the nicety that attaches to the use of them and the difficulty often experienced in filling them if the bore be not really capillary, another form of tube, tapering in shape and bulbed at the extremity, came into use, and almost, if not quite, superseded them for a time. The bulb was warmed in the hand, in the mouth, or by a flame, so as to rarefy the air within the tube, the open extremity of which was then plunged into the lymph as it stood on the surface of a vesicle previously opened ; when the lymph had risen in the tube as far as it would rise, the open end was hermetically sealed. This kind of tube was objectionable on account of the amount of air which always remained in the bulb, and it is now no longer employed. The only tubes now in use are the plain straight tubes of capillary bore. The profession is much indebted to Dr. Husband of Edinburgh, for the pains he has taken to perfect this mode of collecting and preserving lymph, and I cannot do better than give an account of it in his own words :—

"The tube employed is simple, straight, cylindrical, open at both ends, and of such dimensions as to fulfil the following conditions, upon which it will be found that its peculiar value, as a means for preserving lymph for future every-day use, essentially depends. It must be,—

"1. In the first place, of such tenuity that it can be sealed instantaneously at the flame of a candle.

"2. In the second place, large enough to contain as much lymph as is sufficient for one vaccination.

"3. In the third place, long enough to admit of both ends being sealed hermetically without subjecting the charge to the heat of the flame.

"4. And, in the fourth place, of such strength as not to break easily in the mere handling.

"There need be no difficulty in procuring tubes which perfectly answer this description, only they must be made according to a certain standard, which obviously, from the very nature of the case, is not an arbitrary one, admitting of being altered to suit the notions of different individuals, but one concerning which, within certain limits, there can be no dispute nor difference of opinion.[1]

"The following is the mean of several measurements which I have made of tubes, differing somewhat in size, but all of them capable of containing a sufficient charge of lymph, and of being sealed instantaneously, at the flame of a candle, without subjecting the contained charge to the heat, and also strong enough to bear all necessary manipulations without breaking :—

Average length, $2\frac{3}{4}$ to 3 inches.

Diameter, $\frac{1}{28}$th of an inch.

Thickness of wall, $\frac{1}{190}$th of an inch.

"If any one be disposed to find fault with these measurements, and to prefer tubes differently proportioned, I have no objection, provided he keep in view the necessity of fulfilling the required conditions. The tubes need not

[1] This standard is not always adhered to as it ought to be, by the instrument-makers, partly owing to the conflicting orders given them by different persons, and hence large quantities of tubes are at this moment in circulation, which, being much too large to be manageable, give a very erroneous idea of the method.

strictly and rigidly conform to the standard laid down, but they must not vary from it except within certain limits, otherwise they become unfit for their purpose.

"Although their normal shape is cylindrical (fig. 1, C, Y)

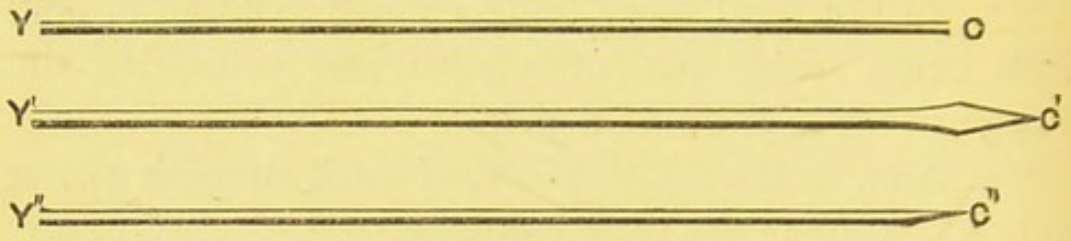


FIG. 1.

some of them are more or less fusiform towards one extremity, and terminate there in a fine point (fig. 1, C′, Y′), or one of the extremities may taper to a point without becoming fusiform (fig. 1, C″, Y″). In either case this departure from the regular form is accidental, and, as will appear presently, is no disadvantage, but rather the contrary.

"Having thus described the instrument itself, I come now to the mode of using it.

"The vesicles having been opened with a lancet in the usual way, the tube, held in a position more or less inclined to the horizontal, is charged by applying one end of it (the straight end, if they be not both straight) to the exuding lymph, which enters immediately by the force of capillary attraction. Allow as much to enter as will occupy from about one-seventh to one-half the length of the tube, according as its capacity is greater or less. As a general rule, each tube should not be charged with more than will suffice for one vaccination.

"It is now to be sealed in one or other of the following ways :—

"Either, 1st, make the lymph gravitate towards the middle by holding the tube vertically and giving it a few slight shocks by striking the wrist on the arm or table ;

then seal the end by which the lymph entered by applying it to the surface of the flame of a candle, or any similar flame. It melts over and is sealed immediately.

"Proceed with the other end in the same way, but first plunge it suddenly, say half an inch into the flame, and as quickly withdraw it till it touches the surface, and hold it there till it too melts over. It is necessary to plunge it first into the flame, for this reason, that if it be once applied to the external surface of the flame it melts over, no doubt, and is sealed; but before you have time to complete the process, and while the glass is still soft, the contained air expands with the heat, and forms a minute bulb, which either gives way on the instant, rendering it necessary for you to break off the end and commence anew, or, what is still worse, remains entire for the time, only to break afterwards, in consequence of its extreme tenuity of wall, by the lightest touch. Mr. Ceely has suggested that while this precaution is necessary for the reason stated, it serves also to expel a portion of air, and so leaves less air to be sealed up along with the fluid lymph.

"Or else, 2ndly, the charge having entered, hold the tube with the finger and thumb, covering the inner extremity (L) of the column of lymph (L, Y, fig. 2), and protecting it from the heat, and draw nearly the whole of the empty portion (C, L) through the flame so as to rarefy the con-

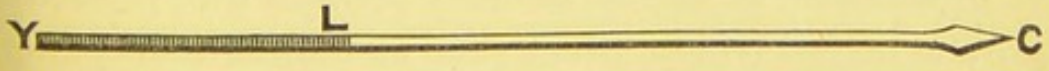


FIG. 2.

tained air, and in withdrawing it seal the further extremity (C). The column now passes quickly along towards the middle of the tube as the contained air cools, and you complete the process by sealing lastly the orifice (Y) by which it entered.

"This latter method answers especially well when the tube is below the average size, or has the form (C, Y), in which the opening at (C) is so minute that it seals over in the merest fraction of a second.

"It should be observed, that in no case is a tube to be laid down until the lymph has been made to pass towards the middle of it, for the fluid concretes quickly about the orifice, and you cannot afterwards detach it without difficulty: but if it be at once made to pass away from the orifice by holding the tube vertically, you may lay the charge down and take half a dozen or more in the same way before sealing them; only if you delay the sealing process too long, more than five or ten minutes perhaps (a delay which need never happen), the lymph within the tube is apt, from evaporation, to become adherent, especially if it be more than ordinarily viscid, and it cannot afterwards be blown out when you come to use it.

"If the lymph do not exude freely, the tube may require to be drawn several times more or less obliquely across the surface of the vesicle, or cluster of vesicles, until a sufficient charge has entered; but generally if the exudation be copious, and a drop of some size has formed before you begin to take your supply, the orifice of the tube need not, indeed ought not to, touch the surface, but is merely to be dipped into the clear fluid; and one may commonly in this manner from one infant's arm charge five or six tubes in almost as many seconds with perfectly pure and limpid lymph, which shall contain neither epithelial scales nor pus globules nor blood-discs, and therefore be, so far, in the best possible condition for preservation.

"In order to obtain the lymph from a tube for the purpose of vaccinating, the sealed ends are broken off, and the contents blown out gently on the point of the lancet."[1]

[1] Second Ann. Rep. of Medical Officer of Privy Council, p. 20.

The source whence the lymph is taken may be conveniently indicated by attaching a piece of thin writing-paper, as represented in fig. 3.

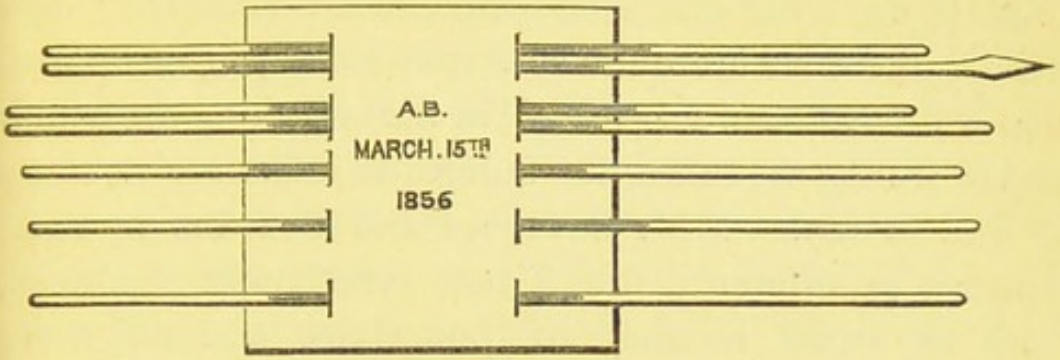


FIG. 3.

65. Is any one mode of Storage preferable to another?—The question whether any one of these modes of preserving lymph has a decided superiority over the others, is difficult to determine. Probably, under different circumstances and in different hands, each has its advantages. At first sight it might appear that the lymph in capillary tubes, existing apparently in exactly the same condition as at the moment it was taken from the vesicle, should not differ materially in its efficacy from lymph transferred direct from arm to arm; but this is far indeed from being the case. Whether it be that the heat employed in the process of sealing produces some action upon the lymph, or whether by keeping in the liquid state it is liable to undergo molecular changes,[1]

[1] Whatever the changes may be that lymph undergoes by storage in capillary tubes, they must take place either in the act of storage or very soon after, for it seems quite established (table, p. 153) that lymph stored in tubes is not affected by length of keeping. Of the cases in that table, 70 were vaccinated with lymph that had been stored less than a week, with as much relative failure as where the lymph was kept three months. I cannot but strongly suspect that the heat necessary for hermetically sealing *does* exercise an injurious influence, even if Dr. Husband's caution to fill the tube only from one-seventh to one-half of its length be observed, and *à fortiori* if, as is sometimes the case, the tube be nearly filled.

quite certain it is that tube-vaccination does not even approach the success of vaccination from arm to arm : the latter, properly performed, will not fail above once in 150 times (§ 69) ; but with tube-lymph, in Dr. Husband's own hands, where we are quite sure that every proper precaution will have been taken both in the collecting the lymph and in sealing the tubes, the failures to infect are as many as one in ten. MM. Bousquet and Bourdin, in comparative experiments, found that tube-lymph produced, from an equal number of punctures, scarcely more than half the number of vesicles resulting from lymph taken direct from the arm.[1] Dr. Pearse has been kind enough to furnish me with the comparative results of 696 vaccinations performed from arm to arm in the year 1865, at the Westminster station of the National Vaccine Establishment, and 55 vaccinations with lymph kept, but not long kept, in tubes. The vaccination was performed by himself in every case, and by six punctures : the results, reduced to percentage for the sake of comparison, are as follow :—

Kind of Vaccination.	Results per 100 Cases.						
	Failure.	One ves.	Two ves.	Three ves.	Four ves.	Five ves.	Six ves.
Arm to arm	0.72	0.43	1.05	1.87	3.3	5.0	87.6
Tubes . .	5.45	12.78	9.1	7.25	14.5	14.5	36.3

[1] Bousquet, Nouveau Traité de la Vaccine, p. 240. It is true that the tubes employed by MM. Bousquet and Bourdin so far differed from Dr. Husband's that they were slightly bulged at the centre, but I cannot regard this difference as material, and the results these observers obtained closely correspond with those of Dr. Pearse, who used Husband's tubes.

These results represent not unfavourably, so far as my own observations and inquiries (and they have been very considerable) have extended, the results of tube-vaccination: as regards the proportion of total failures, they are fewer than Dr. Husband's own: as regards the number of vesicles raised, they correspond very closely with the results met with by MM. Bousquet and Bourdin. In the hands of many good vaccinators, tubes have certainly given a larger amount of failure than they present: but even these results show the vast difference between the two modes of proceeding.

It is not, however, with arm-to-arm vaccination, but with other modes of preserving lymph, that the comparison ought to be made. And if, in making this, I were to take into account only what really skilful vaccinators can do, I should have little hesitation in saying that vaccination with lymph that has been preserved by drying, *if only it be used within a few days or a week or two of taking, and be carefully put on by abrasion*, is more successful than lymph in tubes. From an account supplied by the late Mr. Vincent of Oxford, an able and painstaking vaccinator, it appears that with lymph kept dry, but used within periods rarely exceeding three weeks from the time of taking it, and inserted by abrasion, he had only three per cent. of failures, and in 80 per cent. of his cases produced vesicles corresponding to the number of insertions; that for 340 insertions made in 100 cases, he produced altogether 311 vesicles, or upwards of 90 per cent., of insertional success —no single case having less than two vesicles.[1] These results no doubt are indicative of great care both in the storage of the lymph and in its use, but I have met with few really skilled vaccinators whose failures with well-coated

[1] Fifth Annual Report of Medical Officer of the Privy Council, p. 103.

points used within the periods stated by Mr. Vincent, amounted to more than five per cent., or half the proportion allowed by Dr. Husband for failure with tubes, or who did not get a much larger proportion of vesicles than shown in the tube-returns of Bousquet and Dr. Pearse.[1] On the other hand, practitioners who are not expert in the use of dry lymph fail with it so frequently that tubes have been to them a very welcome substitute. The difficulties attaching to tube-lymph attach exclusively to the collecting and storing, not to the use of it: the difficulties attaching to dry lymph attach chiefly to the using it. But if vaccinators were all properly instructed, I believe the greatest amount of success with stored lymph would be found to attend those modes of storage where no heat was employed, *provided the points or glasses were well charged and the lymph inserted by abrasion within a week or two of its being taken.*

But for long storage—for preserving lymph that must be kept for some time before it can be used, as, for example, for lymph which has to be sent abroad—the balance of advantages seems to me altogether in favour of tubes. It is quite true that lymph dried on points or glasses has been used with the most complete success after keeping three, four, six, nine months or more, and that it is seldom requisite, even with lymph sent abroad, to keep it so long before it can be employed. But great uncertainty attaches to the use of long-kept dry lymph, and frequent disappointment attends it, while to the length of time lymph may be kept in tubes there seems

[1] Marson's experience, he tells me, is very decidedly in favour of points, *well-charged* (and he is not likely to use any other), even though they should have been kept much longer than the times mentioned above, as compared with tubes. Especially, the latter disappoint him with regard to the number of resulting vesicles.

practically no limit. Mr. Vincent found that, in eleven operations with dry lymph kept from eight to fifteen weeks, two failed and thirty-four insertions produced but twenty-three vesicles; that, in nine operations with dry lymph kept from fifteen to twenty weeks, three failed and twenty-five insertions produced fifteen vesicles. Three operations, with lymph kept eleven months, succeeded in raising a single vesicle in one case only; and one vaccination, with lymph kept eighteen months, failed. So that non-success was much in proportion to the length of storage. On the other hand, it appears to me well made out that length of keeping does not in the least damage lymph stored in tubes. Some years ago the late Professor Alison, of Edinburgh, was so kind as to furnish me with the following results, obtained from Dr. Husband, of comparative experiments made, in 341 cases, with lymph kept for different periods, varying from a day to two and a half years; the greater part of the lymph having also, for experiment's sake, been exposed for several hours daily to a temperature of from 80° to 90° Fahr.

Length of time the Lymph was kept.	No. of cases experimented on.	Number of these cases that were successful.	Number of these cases that failed.
Under I month . . .	126	107	19
From I—VI months .	122	107	15
From VI—XXX months[1]	93	86	7
Total	341	300	41

[1] Dr. Husband states that particular circumstances, not necessary to enter into, would explain satisfactorily why in these experiments the older lymph was apparently *more* active than the more recent.

Mr. Ceely, who was requested by the Medical Department of the Privy Council to make inquiry at Edinburgh in 1859 as to the results of this mode of preserving lymph, states that he witnessed the successful results of vaccinations from tubes that had been kept $5\frac{1}{4}$, $6\frac{1}{2}$, $7\frac{1}{4}$ years.[1] And lymph which has been kept in this way for longer than the longest of these periods has been used with perfect success.

When the transmission of lymph abroad is to tropical climates, there is another point to be taken into consideration in balancing the advantages of dry-lymph and tube-lymph. The two conditions which most interfere with the successful preservation of lymph in hot climates are heat and moisture. When lymph sent out on points to tropical countries by the National Vaccine Establishment travelled in the ordinary mail-bags, which were deposited in the hot and unventilated holds of the ships, the result was, as Mr. Tomkins, the experienced inspector of the Establishment, informs me, that it very frequently spoilt. It is now the custom that the points should be carried in the writing-desk of some officer of the ship, and they thus arrive in a state fit for use. Tube-lymph has nothing to fear at all events from moisture; by heat, tropical heat, it may be affected, and Mr. Tomkins tells me it certainly is. He says also (and any statement of his on this point is worthy of the utmost attention) that the experience of the Establishment is still in favour of *well-charged* points, as the best mode of sending lymph abroad, to whatever climate. It is certain, however, that lymph sent in tubes to practitioners in various tropical countries—the East and West Indies, China, and the interior of Africa—has succeeded where former transmissions on points or glasses had, possibly from the circumstances pointed out by Mr. Tomkins, failed.

[1] Second Ann. Rep. Medical Officer of Privy Council, p. 24.

66. Use of the Vaccine Crusts.—A mode of storing lymph, of which I have not hitherto spoken, consists in preserving the crusts or scabs, which detach themselves from genuine vaccine vesicles at the termination of the vaccine affection. The *perfect* scab—the mahogany-coloured semi-transparent scab of a vesicle which has not been damaged, either for taking lymph or in any other way—should alone be employed. It is used by moistening it with water on the back of a plate, and then working it up with a little water by means of a clean knife, so as to get a ropy solution, abundance of which should be inserted (p. 115). It seems at first sight strange that this mode should succeed, when we know that the lymph taken at a late period from a vesicle is of very little value. Jenner illustrates and explains the difference thus: "Several punctures were made in the arms of a healthy child with vaccine matter taken from the edges of a vesicle when three-quarters of the centre were incrusted. Not one of them took effect. Some weeks afterwards, with a solution of the same scab, I vaccinated effectually. This, I think, may be accounted for—the scab is made up of the *early* as well as the late-formed matter."[1] Still, vaccination from the scab is a very uncertain mode of proceeding, and no one would think of employing it now in this country, where so much better means are at hand. The scab has at times, however, been found very useful as a means of transmitting lymph to hot climates, crusts so sent having on various occasions succeeded where points and glasses had failed; in parts of India this mode of storage and transmission would appear to be still employed to a considerable extent, and, in some places, by preference. From the Hill Station established by Dr. Pearson

[1] Baron's Life of Jenner, vol. ii. p. 401.

in Gurwhal, 7,794 crusts were distributed in one year —the charges sent out on points and glasses being only 1,759. But one chief reason of this is apparently to guard against the frauds of the natives, who are necessarily much employed for the verification of the results of the vaccinations performed and for the collection of lymph, and who, while they might deceive in any other way, cannot manufacture vaccine crusts.[1]

67. Early attempts to convey Vaccination abroad.—Some of the early attempts to convey vaccination to tropical and distant countries are full of interest. After various endeavours, successively made, to send lymph dry to India had failed, Jenner urged that more effectual means should be taken, and engaged that, if twenty recruits who had not had small-pox were selected, and he were allowed to appoint a surgeon to attend them, the disease should be conveyed in the most perfect state to any of our settlements. The proposition was too startling to the official mind of that day for it to be accepted, and the honour of establishing vaccination in India was reserved for foreigners. It was the indefatigable Dr. De Carro, of Vienna, who succeeded, and in this way. Taking a pair of glasses, such as have been described (§ 63), one of which had a concavity on its surface, he carefully filled the cavity with charpie *saturated* with lymph; a drop of oil was then put on the internal surface of the glasses, and the flat glass was made to slide upon the charpie so as to exclude the air as much as possible; the two bits were then tied together and the edges sealed. In order still more surely to exclude the air, Dr. De Carro then took the glasses to a wax-chandler's, and there dipped them again and again till a solid ball of wax was formed round them, and this he inclosed in a box filled

[1] Special Report of Bengal Sanitary Commission, 1864.

with shreds of paper. In this state the packet was safely conveyed across European and Asiatic Turkey, and over the whole line of deserts, to Bagdad. When it arrived there, it was opened; its contents were *still liquid*, and succeeded on the first trial. A vaccinated child was then sent down to Bussorah, and from its arm various vaccinations were there successfully performed. The lymph thus raised was continued in weekly succession, and, towards the end of May 1802, a few weeks after the stock had first arrived at Bagdad, some of it was sent on by the "Recovery" to Bombay.[1] The voyage to Bombay lasted three weeks. With the lymph thus conveyed, from twenty to thirty subjects were vaccinated, *but only one of them successfully*. The anxiety with which the progress of this case was watched may be easily imagined. On the eighth day five children were vaccinated from it, all successfully, and hence commenced the diffusion of vaccination over India. The lymph thus sent was not from Jenner's stock, but was Milanese lymph, with which De Carro had been furnished by Sacco. And it was lymph, not of *vaccine*, but of *equine* origin, which, according to De Carro, had never passed through the cow.[2]

The year before (in 1801), Jenner had succeeded in getting lymph out to Barbadoes through the kind offices of a gentleman who vaccinated several sailors succes-

[1] The lymph being probably transferred from subject to subject on the voyage, but this I cannot quite ascertain. Baron's account (Life of Jenner, vol. i. p. 420, seq.), in many respects very imperfect, is silent about this: and I have not been able to refer to Dr. Keir's "Account of the Introduction of Cow-pox in India," a book which, De Carro says, is little known, but contains an exact statement of the circumstances.

[2] See De Carro's Letter to Dr. Monro, London Med. Gaz. vol. xxix. p. 385.

sively on the voyage.[1] And the year after (in 1803), the Spanish Government sent an expedition from Corunna for the purpose of conveying vaccination to all the Spanish colonies, and to the foreign possessions of several other nations, with twenty-two children on board, selected for the preservation of the vaccine fluid by transmitting it from one to the other during the voyage. The Canary Islands and the American possessions were first visited; and the disease having been established in America, was conveyed on to the possessions in Asia, twenty-six more children being taken on board at Acapulco in New Spain. This expedition was the means of conveying cow-pox to some of the Portuguese settlements in the East, and to the great empire of China; and, on the way home, Dr. Balmis, who in the execution of his mission had circumnavigated the globe, touched at St. Helena, and (in 1806), "strange to say, was the first to induce the English inhabitants of that settlement to adopt the antidote."[2] The Brazilian Government, in like manner, secured its introduction (in 1803 or 1804), by sending a number of boys over to Lisbon, who were vaccinated in succession on the home voyage.[3]

[1] Baron's Life of Jenner, vol. i. p. 533.
[2] Ibid. vol. i. p. 606, and vol. ii. p. 78.
[3] Ibid. vol. ii. p. 10.

CHAPTER IX.

Of Skill and Success in Vaccinating, and of Insusceptibility to Vaccination.

68. What is successful Vaccination? Necessity for a Standard of Comparison.—Before a student of vaccination can know whether he ought to consider himself a successful vaccinator or not, he must have before him a standard of comparison. We meet daily with practitioners who call themselves 'successful' vaccinators, but who evidently in thus speaking mean very different things; for while one would think it anything but successful vaccination to fail once in every hundred operations, another will interpret this term to admit of two or three per cent. of failures, another of five per cent., another even of ten per cent. A failure, indeed, of one case only out of ten is very commonly spoken of as being good vaccination; and there are not a few practitioners who think they do well if they succeed in four cases out of five.[1] There are, besides, *degrees* of success in vaccinating. If scarification or puncture be made on half a dozen separate spots, and a vesicle arise on one spot only—a single but genuine vaccine vesicle—this is

[1] To an active and long-established vaccinator in London, who did his vaccinations chiefly by carrying glasses always about in his pockets, I said, "Do you find that children take that way as well as if you got them together, and did them from the arm?" "I'll engage to make them take quite as well as you will from the arm." "But how many miss?" "Not more than one in five."

no doubt, in one sense, successful vaccination; the system is infected, and it will be impossible at the moment to infect it any further; but, still, the result is so far *un*successful, and so far *un*satisfactory, that it is much short of that which was aimed at, and of that which was necessary for *fully* accomplishing the object of vaccination, viz. for protecting the patient *as completely as possible* against small-pox. Here, again, we recognise the want of a standard of comparison. While one practitioner is disappointed if one case out of ten exhibits a number of vesicles short of the number of insertions of lymph which had been made, another is very well content if he get the full number of vesicles in only half his cases.

69. **Marson's Standard.**—Some years ago Marson gave it as the result of his experience, that "with good lymph, and the observance of all proper precautions, an expert vaccinator should not fail of success in his attempts to vaccinate above once in 150 times."[1] Marson's own habitual rate of success is indeed considerably greater;[2]

[1] Medico-Chirurgical Transactions, vol. xxxvi.

[2] Of 1,479 vaccinations performed by him at the Blackfriars' station of the National Vaccine Establishment, in 1863, the operation failed at the first attempt in three cases only: and on a recent visit to this station I found that, of the last thousand operations in which the results had been inspected, there had been only one failure. At the Birmingham station of the Establishment, in 1864, out of considerably more than a thousand inspected cases, there were three failures; in 1865, out of 1,068 inspected cases, there was no failure; and on a recent visit, I found that out of the last thousand inspected cases, three only had failed. Mr. Sheppard, who has charge of the Bristol station of the Establishment, performed and inspected some years ago, when the cases there were far more numerous than at present (the absurd division of public vaccination now existing in that city not having then been adopted), above 2,000 vaccinations without missing on one occasion: and Marson tells me the same thing happened to him once at the Small-pox Hospital at the time when the vaccinations at that institution (before the introduction of the present public system) amounted to some thousands a year.

but this was the conclusion to which his experience had led him as to what might be reasonably expected of vaccinators. And that this is not at all too high a standard is manifest from the results which, on examination of the records kept at some of the stations of the National Vaccine Establishment, I find to have attended their practice. The failures were, on the average of a large number of cases, spread over a considerable time, but one in 170 operations. We may fairly, therefore, adopt Marson's rate as the standard below which no vaccinator, vaccinating from arm to arm, has any right to be satisfied with his performances. With regard to the *degree* of success, it appeared from the records of the stations above referred to that, in their practice, vesicles had risen at *every* point of insertion of lymph, in considerably more than ninety per cent. of the children operated on, while the proportion of cases in which a single vesicle only had resulted from the four, five, or more insertions made, was about one in a hundred.

70. A Standard when Stored Lymph is used.—But the operation in all these cases was done under the circumstances most favourable for success—with selected lymph, inserted direct from arm to arm. When the operation has to be done with stored lymph, the same amount of success cannot be looked for (§ 53), and so many circumstances affect the successful use of stored lymph (particularly, when the lymph is dry-stored, the length of time it has been kept) that it is much more difficult to fix a standard. But if a practitioner be careful to use his points or glasses within a week or ten days of the lymph being taken (and it is presumed that, in this country, lymph need never be older, and scarcely ever so old as this, before it can be employed), and to put the lymph well on by abrasion, he certainly ought not to

fail in more than five per cent. of his operations, or to obtain in less than three-quarters of his cases the full results he aimed at.[1]

71. Skill of the individual Vaccinator the most important of all the conditions for success. Necessity for special Instruction.—But whether the vaccination be done from arm to arm, or whether it be done otherwise; whether it be performed under the circumstances most favourable, or under circumstances less conducive, to success, surely the first of all things necessary for its being well done is that those who have to perform it shall have been duly instructed in their work, and shall be possessed of a competent knowledge of that which they have to do. Jenner always strongly insisted—and it was a point equally dwelt upon by all who obtained early distinction as vaccinators, as Ring, Dunning, Bryce, &c.—that no one ought ever to take upon himself to perform vaccination who had not been *specially* instructed in it. "Although," says Jenner, "vaccine inoculation does not inflict a severe disease, but, on the contrary, produces a mild affection scarcely meriting the term *disease*, yet, nevertheless, the inoculator should be extremely careful to obtain a just and clear conception of this important branch of medical science. . . . . A *general* knowledge of the subject is not sufficient to enable or to warrant a person to practise vaccine inoculation; he should possess a *particular* knowledge, and that which I would wish strongly to inculcate, as the great foundation of the whole, is an intimate acquaintance with the character of the true and genuine vaccine pustule."[2] And again: "I expect that cases of

[1] Mr. Vincent's successes were greater than these, and the lymph he used was in some of the cases three weeks old.

[2] Varieties and Modifications of the Vaccine Pustule, p. 13.

this sort [failures of so-called vaccination to protect against small-pox] will flow in upon me in no inconsiderable numbers; and for this plain reason: a great number, perhaps the majority, of those who inoculate are not sufficiently acquainted with the nature of the disease to enable them to discriminate with due accuracy between the perfect and imperfect pustule. This is a lesson not very difficult to learn, but unless it is learnt, to inoculate the cow-pox is folly and presumption."[1] And the Royal College of Physicians of London, in their memorable Report on Vaccination in 1807, remark that "those who perform vaccination ought to be well instructed, and should have watched with the greatest care the regular progress of the pustule, and learnt the most proper time for taking the matter."[2] With such injunctions, proceeding from such authorities, it seems strange that a thorough acquaintance with vaccination should never have been required by any of the colleges and corporations who are authorized to license for medical practice in this country, as one of the conditions for receiving their licence, and that at this very day there is not any test of medical proficiency in England which implies a competent knowledge of vaccination. Till within the last few years, students who were candidates for the licence—whether of the College of Surgeons or of any other of the licensing boards—were not called on

[1] Jenner in Letter to Lord Berkeley, Baron's Life of Jenner, vol. ii. p. 13. In various parts of his correspondence, Jenner refers to mischief of different kinds that had arisen from want of proper knowledge of the subject on the part of vaccinators. In one letter (Baron's Life, vol. ii. p. 373) he tells Moore, the Director of the National Vaccine Establishment, that he ought to open a vaccine school.

[2] Papers relating to the History and Practice of Vaccination, p. 8.

to produce evidence of having received any instruction whatever in vaccination. Accordingly, students have, within my own knowledge, been admitted to practice, and even been appointed public vaccinators, who, so far from having learnt the niceties connected with the proper performance of vaccination, had never even *seen* the operation done. And although regulations made by some of these boards within the last few years (and since public attention has been prominently called to their omission) now require that each student presenting himself for examination should produce the certificate of some member of the particular licensing body, or of some "registered medical practitioner," as to his proficiency in vaccination, a certificate that can be thus miscellaneously obtained conveys, assuredly, no guarantee of the student's real competency. For, apart from other obvious considerations, it must manifestly depend on whether the practitioner giving the certificate were a good or a bad vaccinator, whether his instruction and certificate of competency were worth anything or not. But this is, so far as I am aware, the only test attempted. Further, it was not till 1859 that any authorized places for the practical teaching of vaccination existed. In that year, the Lords of the Council having been required by one of the provisions of the Public Health Act, 1858, to take security "for the due qualification" of persons to be thereafter appointed public vaccinators, certain of the stations of the National Vaccine Establishment were selected as places for instructing, or for testing by practical examination, the qualifications of all candidates for the office of public vaccinator, and of any other professional persons who desired to possess themselves beforehand of evidence of their fitness for that office. These stations, which combine the two

essential requisites of a competent teacher and a sufficient number of cases for instruction, are now open to all medical students, and it is greatly to be desired that all students, whether they are likely or whether they are not likely to become public vaccinators, should avail themselves of the opportunities of sound practical instruction in vaccination which they afford.[1] There are few students, whatever their opportunities of seeing vaccination elsewhere may have been, who will not derive advantage from carefully following, for some weeks, the practice of these stations, and *there working under instruction*, for it is only by practically working that the discrimination and dexterity necessary to make a good vaccinator can properly be acquired.

72. Advantages which would attend the appointment of professed "Vaccinators."—"The advantages which would result from confining the practice of vaccination to such persons only, even among those of the medical profession, as are duly qualified to undertake it," along with other considerations, induced one of the most distinguished of the early vaccinators, Mr. Bryce, to propose that vaccination of rich and poor alike should be carried on entirely by a special class of medical practitioners, not otherwise occupied in medical practice,—by "vaccinators" to be appointed for the purpose.[2] The benefits which would

[1] The National Vaccine Board—at that time consisting of the Presidents of the Colleges of Physicians and Surgeons, the Senior Censor of the College of Physicians, and the Medical Officer of the Privy Council—had hoped and anticipated that attendance at the stations appointed by them would have been required by the Medical Licensing Boards of all candidates for their respective licences. But this hope has not hitherto been realized.

[2] Practical Observations on the Inoculation of Cow-pox, 2d Edition, Appendix, p. 5.

have resulted to the public, had such a course been adopted, are in my opinion incalculable: nor must I withhold the expression of the strong conviction, to which my experience has led me, that the best of all things that could be done to protect the population well against small-pox would be to adopt this course now. At all events, it is indispensable that all who vaccinate should be trained to the work. In the inquiry, already referred to, which was made by myself and Dr. Buchanan into the state of vaccination in London in 1863, we compared the results obtained by various vaccinators, as shown by the cicatrices on the arms of large numbers of children, and could not but express ourselves as "struck with the great difference of results of different operators, working under apparently the same conditions. This difference," we stated, "was quite irrespective of general professional attainments, and depended altogether on special knowledge and special practical skill; for, however trifling as a surgical operation vaccination may be, there is nothing more certain than this, that careful observation, practical experience, and painstaking accuracy are indispensable for securing its proper results. We do not hesitate for a moment to express our strong conviction that the vaccination of London would be best done by a few thoroughly trained vaccinators who devoted themselves exclusively to the work."[1]

73. Consequences that have resulted from want of proper Instruction and of an Authorized System of Vaccination. (a) **Marson's Statements.**—Nearly fifteen years ago (in 1853) Mr. Marson called the attention of the profession, in a paper read to the Medico-Chirurgical Society of London,[2] to the large

[1] Sixth Report of Medical Officer of Privy Council, p. 118.

[2] Medico-Chirurgical Transactions, vol. xxxvi.

amount of unskilful vaccination that was to be met with in England, and to its consequences as shown in the experience of the Small-pox Hospital. Persons were found to present themselves frequently with small-pox at the hospital who stated they had been cut five, six, or eight times or more for cow-pox without effect; "an evil," he said, "which could happen rarely in careful hands. Such persons," he continues, "think it of no use having the operation tried again, that it will not take effect if they do, and ultimately they are attacked by small-pox, and perhaps die; whereas had they fallen into the hands of a good vaccinator, their lives would most likely have been saved." A large proportion of the English admitted to the hospital, in whom the vaccination *had* taken effect, were shown by their cicatrices to have been very imperfectly done, and their small-pox was severe and often fatal: while Swedes, and Danes, and Norwegians, and Prussians, of whom many had been brought to the hospital with small-pox, had, from having been thoroughly vaccinated, the small-pox in its light varicelloid form. Three years afterwards (in 1856) he again referred, in a petition to the House of Commons, to the "large amount of very insufficient, almost useless, vaccination performed in England," traceable chiefly to no authorized system of vaccination having been established, but to every one having vaccinated in the manner he or she might think proper.[1]

(b) **Official Inquiry.**—These allegations, proceeding from such authority, and confirmed as they were by many circumstances, were far too serious to be overlooked; and one of the most important objects of the inquiry which the Lords of the Council, in 1859, directed to be made

[1] Papers relating to the History and Practice of Vaccination, p. 25.

by the Medical Department of the Privy Council into the state of vaccination in England, was to ascertain fully how far this unsatisfactory performance of vaccination was diffused over the kingdom, and to trace more minutely its causes, with a view to their remedy. In the course of that inquiry, which, under the instructions of the Medical Officer, was made by Drs. Stevens, Buchanan, Sanderson, and myself, personal observations, by one or other of us, were extended to every vaccination-district in England. The facts ascertained by each of us, respectively, will be found in the reports presented to Parliament.[1] In stating generally the results of that inquiry, so far as regards the imperfect performance of vaccination in England—results which entirely bore out the statements of Mr. Marson—it will be most convenient to trace these from their causes upwards.

In the first place the rule, which was laid down fifty years ago by the National Vaccine Establishment, and has never been departed from in the practice of the Establishment,[2] viz. thoroughly to infect the system in vaccinating by making at least four punctures, or by production (if vaccination were not done by puncture) of equivalent local results, was carried out by comparatively few only of the public vaccinators of the kingdom; secondly, facts of the utmost practical importance relative

[1] See, in the Annual Reports of the Medical Officer of the Privy Council, iii.—vii. inclusive, the Appendices concerning "Local Inquiries as to Vaccination."

[2] The National Vaccine Board, in their Report for 1820, state that the principle of the practice they adopt and inculcate is "to affect the constitution of each individual very completely with the vaccine disease;" and, adverting to their directions to their own operators to make four punctures, they add "from extensive experience and numerous reports the Board have become most earnestly desirous that more rather than fewer vesicles should be produced."

to vaccination, which had been brought to professional notice, through the ordinary channels of publication, years and years before—such facts, for example, as those noted by Marson with regard to the influence exercised on the small-pox death-rate by the quality of the vaccination performed (§ 92, a)—were found to be absolutely unknown to a large majority of vaccinators; thirdly, the rules about the proper period for lymph-taking, about herpetic and other eruptions as affecting the course of the vaccine vesicle, &c. were extensively unknown or extensively disregarded, some thinking it a matter of no moment whether Jenner's "golden rule" were observed or not, and others taking the lymph by *preference* at the very periods at which he had specially pointed out that it ought not to be taken;[1] and lastly, storage of lymph and the use of stored lymph were but very imperfectly understood. There was, in fact, a state of things which could never have existed, had only Jenner's injunctions been regarded, and had there been proper authorized teaching on the subject.[2]

It was found that, partly as the natural consequences of the above defects, but also partly because of the imperfect arrangements about lymph-supply, on which I have before commented, vaccination was carried on, in a very large number of districts, extending all over the kingdom, with an unwarrantable amount of failure, or with the production of results which, though in one sense successful, still left the vaccinated persons but very imperfectly protected against small-pox. It was, indeed,

[1] Some important evidence on this point had been communicated to the Epidemiological Society in 1851-2.

[2] The above statements, it must be remembered, represent things as existing in 1860-4. The inquiry itself produced improvement in many respects, and there is, on the whole, a much better state of things now existing.

a very common thing that children should have been cut two, three, or four times before they took, or without even taking then. Children on whom such trials had been made, but who still had no marks of vaccination, were met with repeatedly in attendance at public schools; frequently, children growing into manhood or womanhood told how many times they had been done, and said it was no use their being done any more, "for they wouldn't take."[1] And many grown-up men and women, under similar circumstances, had the same belief. Vaccinators, generally, had a very low standard of success; and while some thought, as has been already said, that for four operations to take out of five was a satisfactory result, others thought two successful cases out of three was as much as could reasonably be expected, and others regarded success to be very much a matter of chance. "Sometimes they'll take, and sometimes they won't, you can't exactly tell which," were the words of the vaccinator of a large metropolitan district; and they describe, not unfairly, the exploits of a certain class of vaccinators. Failure to raise a number of vesicles corresponding to the number of lymph-insertions was still more common,[2]

[1] Many children are brought every year to some of the Establishment stations to be vaccinated who have been cut three, four, five times, sometimes six or seven times, elsewhere, without effect. But there is hardly an instance (I do not know one) of failure to infect these children at the Establishment, and almost always at the first operation. An excellent public vaccinator in the West of England, on his first appointment to a district some years ago, found *a large number* of children in the district whom his predecessor, having made various attempts to vaccinate, had pronounced "insusceptible;" but there was not one of them whom he found any difficulty in infecting.

[2] The failures were, of course, by far the most frequent with stored and conveyed lymph, but even in vaccinating from arm to arm the results of many vaccinators were far from what they should be. The failures with dry lymph in some hands were really surprising.

and in a large number of districts the imperfect *character* and *quality* of the cicatrix attested the inferior quality of the lymph that had been used.[1] In striking contrast,

One vaccinator had in one year 46 failures out of 155 vaccinations, and in another year 94 out of 171. In a district in South Wales, I found great complaints of the people that they "got such a bad pock;" which did not in the least mean that their children had suffered any ill-consequences from vaccination, but that they had to have them done again and again before the operation would succeed. The following note of results met with in certain districts in Yorkshire will give some idea of the failures of dry lymph in unskilled hands. Taking eleven districts in which the vaccination was performed almost exclusively with dry lymph, and in none of which was it the custom to insert lymph in less than two places, while in some it was inserted in three, four, or more places, I found that upwards of 30 per cent. of the children examined (446 out of 1,465) had but one mark. In a district in which it was the practice to make six insertions, only 74 out of 147 children had more than two marks; several children had been cut again and again; and one four times. In my notes are repeated entries of this kind: "Mr. P. (vaccinator) says they take very badly, have often to be done two or three times over." "Of 54 children 15 had but one mark, three had been tried twice without effect, and one three times." "Mr. R. (another vaccinator) says he has often to do them a second time before they will take, and sometimes three or four times." "Mr. W. (another vaccinator) says they take very badly; the number of vesicles varies much; he always inserts six points, but often only one or two take," &c. &c. These entries have not reference to wild country districts, in which it might be supposed the use of preserved lymph was a necessity; the very first of them, for example, was the statement of a public vaccinator of the city of York.

[1] In speaking of inferior lymph or bad lymph, I beg that it may be most distinctly understood that I mean lymph of inferior infective power, lymph that does not "take well," and therefore leaves the persons vaccinated with it but poorly protected against small-pox. Of bad lymph in any other sense of the term, of lymph that has conveyed any disease or done any other harm, I know nothing. I have never met with a single instance of mischief arising in this way, nor do I think has any one of my colleagues. I have investigated several instances where there was allegation of it: but in no one of them was there a tittle of proof, or even of probability.

indeed, with such results as the foregoing were those met with in a large number of districts fortunately possessed of vaccinators who had been well trained to their work. A group of children, of various ages, and vaccinated at various times by one vaccinator, would by their scars show themselves, with rare exceptions, thoroughly protected against small-pox; while in an adjacent district, similarly situated in all other respects, or in an adjacent school—probably, side by side with the former children, in the same school or district—would be found another group, whose vaccination had been the work of another hand, few of whom were really well protected against small-pox, and in many of whom the vaccination had been little more than a sham. The difference was so great that it was often difficult to persuade a vaccinator of the latter kind that such marks as he looked upon with surprise were but the ordinary results of good vaccination.[1] Taken on the whole, imperfect or incomplete vaccination was found to have so far prevailed over England that, on examination of the arms of nearly half a million of vaccinated children, it was found that about one in eight only had been so vaccinated as to have the fullest protection against small-pox that vaccination is capable of affording; that not more than one in three could be considered as even tolerably well protected; and that at least one in four had been so imperfectly done as to run no inconsiderable risk of, at some time or other in their lives, contracting small-pox, and having it badly, probably even fatally.[2] In fact, in

[1] See Fourth Report of Medical Officer of Privy Council, p. 63; and Sixth Report, pp. 141-2.

[2] The children on whom these observations were made were generally of the class that attends public schools. Most of them had been vaccinated by public vaccinators, but a large number by private practitioners. Without affording statistical evidence of the fact,

the words employed by Dr. Stevens in one of his reports, "A very small proportion of the supposed-to-be-vaccinated population had received such protection from death by small-pox as efficient vaccination is known to give."[1]

Thus it is that we are able to read without surprise that, of 150 cases of small-pox treated in the practice of the Lincoln General Dispensary during a recent epidemic of the disease, no fewer than 18 were in persons who said they had been vaccinated, but that the vaccination had not taken![2] In 20 years—from 1836 to 1855—there were 370 persons admitted to the Small-pox Hospital, with small-pox, who said they had been vaccinated, but who had no mark of it, and in 101 of them the disease was fatal. In the same 20 years, there were more than 4,000 persons admitted with small-pox who had a mark or marks of vaccination, and 298 of them died;[3] but only 5 of these deaths took place among that portion of these persons (544 in number) whose marks showed them to have been vacci-

a strong impression was left that, as a rule, the latter were less well done than the former. Among the upper and middle classes in England, I know, from my own opportunities of observation, that the vaccination, in many instances, has been very imperfectly done. If the vaccinated in these classes do not contract small-pox so frequently as the vaccinated among the lower orders, it is not because of their better vaccination, but because of their less exposure to the infection.

[1] Fifth Report of Medical Officer of Privy Council, p. 66. The imperfect way in which, frequently, vaccination had been performed, was noticed also by many of the Metropolitan Medical Officers of Health in their examination of school-children during the epidemic of small-pox in London in 1859-60 (Third Report of Medical Officer of Privy Council, p. 59).

[2] British Medical Journal, Jan. 14, 1865.

[3] Article "Small-Pox," in System of Medicine, edited by J. R. Reynolds, M.D., vol. i. p. 473.

nated in the best way. Though it belongs to a future section (§ 92, a) to state in detail the important facts collected at the Small-pox Hospital, it was necessary to advert to them in this place, because, until the consequences that may result, indeed are almost sure at some time or other to result, from the bad and unskilful performance of vaccination have taken thorough possession of the professional and public mind, we are not likely to have the operation done so well as it ought to be. "If," says Marson, "a little operation—little apparently in practice, but very important in its results—well performed, can save many lives, as most certainly it can, and prevent much suffering and sorrow, it should surely always be done with the greatest care, and in the best known way. The success of all operations depends on nice care and management. Operations for hernia and for stone, for instance, if roughly, carelessly, and badly done, end badly: so it is with vaccination; and, so far as the public are concerned, it is quite as objectionable to them, no doubt, to die of small-pox because they have been carelessly and badly vaccinated, as it would be to them to die of hernia or stone, because the operations for these complaints, respectively, had been badly performed. In the latter cases the day of retribution would come immediately; in the former, unfortunately for its correction, it is delayed for perhaps twenty years or more; otherwise it would soon be set right."[1]

74. **Insusceptibility to Vaccination.**—Insusceptibility to the infection of cow-pox, even for a very limited period, is an occurrence of excessive rarity. For in the few cases in which good operators fail to infect at the

[1] Article "Small-Pox," in System of Medicine, edited by J. R. Reynolds, M.D., vol. i. p. 470.

first operation, they rarely fail at a second trial ;[1] but now and then, however, a second attempt may not succeed, and even a third operation may not take. But supposing vaccination to have been performed by a practised hand, *and with lymph direct from the arm*, three successive weeks without result, it may be fairly assumed that there is temporary insusceptibility. Cases are recorded, and others have been stated to me on authority on which I can rely, but I have never met with any myself, in which persons have by skilful hands been vaccinated, again and again, at intervals of months and years, without the vaccination taking effect. We are not, however, to infer from this that the insusceptibility was permanent, and still less that the person was at all safe from small-pox. We do not know even that, while the insusceptibility to vaccination lasts, there is in all persons corresponding insusceptibility to small-pox, though this may very probably be the case.[2] But supposing this to be so, a change of constitution may assuredly, at some quite indeterminate and unknown period, render the hitherto insusceptible person suscep-

[1] Of upwards of 9,000 vaccinations performed at the Blackfriars' station of the National Vaccine Establishment since 1859, there has been but one case which on a second trial was unsuccessful. In this case a third attempt was made, but the child was not brought back for inspection, and the result is unknown.

[2] The late Mr. Spurgin, of Northampton, forwarded some years ago to the Epidemiological Society the particulars of a case in which, in 1825, a boy fourteen years old, whose family were greatly opposed to vaccination, was inoculated with variola six or seven times without any result, that disease being then prevalent. The father then allowed vaccination to be tried, and the boy was vaccinated six or seven times, but equally without effect. About a year after, when at a distance from home, he contracted natural small-pox of the discrete kind, and went through the disease favourably. And the late Mr. Marshall, of Kington, Herefordshire, in a communication to the same Society, stated that in two cases which resisted vaccination he tried small-pox inoculation and found it equally resisted.

tible to one or the other, probably to whichever he may be first exposed, of these infections.[1]

In the very interesting returns of the Registrar-General for Scotland, relating to the vaccination of children under the law in force in that kingdom, I find that rather more than one in 200 of the children vaccinated (0.69 per cent. in 1864, and 0.47 per cent. in 1865) are returned to the Registrars as constitutionally insusceptible of vaccination. The term, of course, in these cases is only to be taken as used in a legal sense, and as merely implying that the children have undergone the three successive vaccinations which the Act requires to be performed before a parent is entitled, under a certificate of insusceptibility, to exemption from the penal provisions of the law. No doubt, the insecurity of these children against future small-pox was well explained by the medical practitioners to the respective parents. Still, such a proportion of failures as this return shows is a misfortune; it indicates, even with every allowance for the disadvantages under which, from the scattered nature of the population, vaccination must be carried on in a great portion of Scotland, a performance of vaccination which is not satisfactory. The very considerable diminution, however, in the proportion of these cases in the second of the two years, is gratifying and encouraging.

[1] See Marson's Article "Small-Pox" in System of Medicine (*op. cit.*); especially the very interesting case, related at p. 450, of a woman, aged 83, dying of confluent small-pox, who had nursed her own children and her grandchildren with the disease, and had otherwise often been exposed to variolous infection, but never before taken it. She had never been vaccinated nor inoculated.

CHAPTER X.

Of alleged Degeneration of Lymph, and of recurrence to the Cow.

75. Will Lymph degenerate if due Care be employed? Jenner's opinion on the subject.—It has been held by many that vaccine lymph degenerates, deteriorates, or loses something of its active power, merely by passing through a succession of human bodies. This hypothesis dates from a very early period of the history of vaccination, and applications for lymph "as recent from the cow as possible" were made to Jenner within two or three years from the promulgation of his discovery.[1] He thought it of no importance whatever to comply with the exact terms of such requests, for he was well satisfied from his experience at that time that no such deterioration had then taken place. Nor did he think it likely that with proper care it would occur at all; though this, he said, was a point which "time alone can determine."[2] Further experience—a careful watching of vaccination for upwards of twenty years more, during which lymph, successively transferred from subject to subject, had undergone no change whatever in its

[1] Ring, *op. cit.* p. 458.

[2] Continuation of Facts, &c. 1800, p. 162.

qualities—fully satisfied him that the hypothesis was groundless.

But, in so deciding, he was most careful to draw the essential distinction between deterioration of lymph by mere successive transmissions (the subjects for transferring it having been proper ones), by mere lapse of time since it was taken from the cow, on the one hand,[1] and deterioration by transmission through unselected subjects, through subjects not fit for transferring it, on the other. And while he regarded the former as an utterly erroneous notion, a conjecture which, as he said, "he could destroy by facts," he did not fail to point out he danger of deterioration from want of proper care in the choice of subjects. "The matter," said he, writing in 1816, "may undergo a change that may render it

[1] "Lively arguments," says Simon, "for the *necessary degeneration of the vaccine contagion* have proceeded on a belief that the original cow-pox at each vaccination *simply dilutes itself with certain passive juices* of the vaccinated body, that it thus of course gets weaker and weaker at every stage, till at its thirty-fifth succession it is reduced—according to Dr. Nicolai—to at least the 8,809,458,688th fraction of its original power. This argument founds itself on a radical misapprehension of the infective process in question. What essentially marks the infective action of cow-pox, small-pox, and similar morbid poisons, is, that under their *fermentative influence* some ingredient of the infected body converts itself into their likeness. The material contained within certain vaccine vesicles is not a something which has been transfused into the body, but a something which has been generated within it by a specific decomposition of its own proper substance; and the original lymph, which acted as a ferment to this process, has very probably completed its decay and altogether passed from the scene before those new vesicles begin to show themselves. Successive *dynamical infections* do not imply a perpetuation (with corresponding infinitesimal subdivision) of the original efficient; or Nicolai's argument might equally have been used to prove that the power of human procreation could not but cease soon after the days of Adam." (Preface to Papers relating to the History and Practice of Vaccination, p. xxix.)

unfit for further use by passing even from one individual to another, and this was as likely to happen in the first year of vaccination as in the twentieth;" but that, with proper care and attention, lymph underwent no change, was proved, he held, by the fact that the vesicles he was then producing were "in every respect as perfect and correct in size, shape, colour, state of the lymph, the period of the appearance and disappearance of the areola, its tint, and finally the compact texture of the scab, as they were in the first year of vaccination; and to the best of my knowledge, the matter from which they are derived was that taken from a cow about sixteen years ago."[1]

76. The Vesicles produced now by Jenner's lymph have the same character and course as he described.—Now, if lymph could thus undergo from eight to nine hundred transmissions without giving any evidence of change, it seems difficult to understand why, in equally careful hands, and with similar opportunities of choice, it should not remain equally unchanged after an indefinite number of transmissions. Accordingly, numerous trustworthy observers, who had watched the vaccine disease at the introduction of vaccination, on comparing what they had then seen with the effects produced by lymph of the earliest stocks after a lapse of thirty or forty years, were unable to detect the slightest difference either in the course or character of the vesicles.[2] Exactly the same is the case if we compare with Jenner's description the course of the vesicle induced at the present day with lymph of Jenner's stock. Marson says he has frequently produced lately, "with lymph brought

[1] Baron's Life of Jenner, vol. ii. p. 398.

[2] See Aikin, London Medical Gazette, vol. xiii.; also Rapport de l'Académie Royale de Médecine sur les Vaccinations pendant l'année 1841.

into use by Jenner more than fifty years since, vaccine vesicles which, on comparison, exactly correspond with the vesicles sketched in Jenner's original work.[1] Mr. Steele, the able and experienced teacher of vaccination at Liverpool, states that the lymph he is now using was supplied by Jenner himself, and is producing still precisely the results it developed at first.[2] After it had been more than fifty years in use there, it was compared side by side with lymph which Ceely had taken from a cow six years before, and which he guaranteed to have lost none of its activity; but no difference between the effects of the two lymphs was detectible.[3] The lymph now in use throughout the stations of the National Vaccine Establishment is, if not exclusively, nearly all of Jenner's original stock, and, from daily opportunities of observation, I can affirm that it has not lost anything of its infective power,[4] and that the vesicles produced by it correspond accurately in their character and course with Jenner's description. Other stocks have at times been introduced into use at the Establishment, but they were found to present no advantages, and it was not therefore felt necessary to take any particular pains to maintain them.[5] So far as the correct character and course, and

[1] Art. "Small-pox" in System of Medicine (*op. cit.*), vol. i. p. 476.

[2] Steele in Liverpool Medico-Chirurgical Journal, 1858.

[3] British Medical Journal, 1862, vol. i. p. 275.

[4] I have before adverted (§ 69) to its not failing on an average above once in 170 times.

[5] Strange notions appear to be entertained abroad, and I have seen, I think, similar statements made even in this country, that lymph has only been kept alive and in a state of energy, in England, by renewals from the cow—that typical vesicles are only seen in consequence of such renewal. But this is a very erroneous notion. The lymph chiefly in use throughout England is Establishment lymph, which is, mainly, Jenner's lymph. Ceely, who has more knowledge

the energy (if I may so say), of the vaccine vesicle are evidences of its prophylactic power against small-pox, I cannot but concur entirely, from personal observation, with the statement which the National Vaccine Board made in 1854, "that the vaccine lymph does not lose any of its prophylactic power by a continued transit through successive subjects, and that it is a fallacy to predicate the necessity of resorting to the original source of the cow for a renewed supply.[1]"

77. And leave the same kind of Cicatrices.— Marson states, however, that he has found the *cicatrices* left by some lymph which he has had many years in use, to be now not so good as the same lymph produced formerly.[2] Whatever may have been the cause of this change, its extent, I apprehend, is not such as to make him doubtful of the essential qualities of the lymph remaining unaltered, or I am quite satisfied that he would have discontinued the stock. The observation, coming from such a quarter, is important: still I cannot think it generally applicable. During the last eight years I have examined the vaccine cicatrices on the arms of more than a hundred thousand persons, of all ages, but chiefly children in schools. Taking the results generally, I have not found them by any means indicative of progressive deterioration in the character of the vaccine scar. And taking particularly districts which had good vaccinators,

of the cow-pox in the cow, and the effects of cow-lymph on the human subject, than any other man in England, was requested by the Medical Department of the Privy Council, in 1862, to inspect all the stations from which lymph was contributed to the Establishment. He "met with abundant evidence of the perfectly satisfactory character of the lymph in use." (Fifth Annual Report of Medical Officer of the Privy Council, p. 9).

[1] Annual Report of the National Vaccine Establishment for 1854.

[2] Art. "Small-pox" in System of Medicine (*op. cit.*), vol. i.

men who knew their work thoroughly well, and who did it with lymph got originally from the Establishment, *i. e.* with lymph of Jenner's stock, I have found the marks corresponding exactly to Willan's delineation, and in no respect inferior to cicatrices which I have seen on the arms of persons vaccinated by Jenner himself, or by his well-known cotemporary Dr. Walker.

78. Lymph accidentally degenerated should always be at once changed.—As I have stated elsewhere,[1] I have repeatedly, in the course of my official and other inquiries into vaccination, met with lymph in use of a comparatively feeble and inactive kind. It would be strange indeed if this had not been so, considering the very miscellaneous way in which practitioners have been frequently content to get their lymph from others, and the unfavourable conditions under which they have sometimes been content themselves to take lymph.[2] But in recommending a change of stock, I have always felt it enough to take care that the stock substituted should be good active lymph, and have never troubled myself as to the time which had elapsed since it had come from the cow. Does the lymph produce the effect which has been described (§ 34) as the normal effect of the introduction of vaccine lymph into the system? That is really the only practical question. My experience tells me that vaccinators, who have to depend on others for lymph, should be very careful to whom they apply: and it tells me still more, that when they have got some good lymph they should be very careful through what subjects they transfer it.

79. Particular lymphs. The Passy lymph.—In 1836, a stock of lymph was obtained at Passy, in the environs of Paris, from the hand of a milker who had

[1] Art. "Vaccination" in System of Medicine (*op. cit.*), vol. i.

[2] See for illustrations, pp. 133, note, 139, note, &c.

contracted the cow-pox casually from the cow.[1] It manifested in the most marked manner, and through many transmissions, the peculiarities already described as attending the early transmissions of primary lymph (§ 42). When compared with the old stock then in use at the Académie de Médecine, it was found to be more infective, to develop vesicles which were manifestly finer, to produce a more marked and more durable areola, and to leave better cicatrices. But the lymph with which this comparison was made, was evidently lymph which, from some cause or other, had become deficient in those qualities which characterise active lymph. When we are informed that the vesicles produced by it had their complete development with commencing areola by the seventh day,[2] were at this date of *softish consistence, so that the slightest touch of the lancet would make them empty themselves, and yield a virus which had already lost some of its transparency* (pour peu qu'on y touche avec la lancette, elle se vide, et le virus qui en sort est déjà un peu louche), had commenced desiccation by the ninth day, completed it by the twelfth, and somewhere from the fifteenth to the eighteenth day threw off small crusts, leaving cicatrices which at the end of some months were scarcely to be discerned, we see at once that we are dealing with a lymph very different from the ordinary lymph-stocks of England, and one which could not too soon be changed. And probably, some recent revelations with regard to the mode of collecting lymph for the

[1] Bousquet, Nouveau Traité de la Vaccine, pp. 403-416.

[2] I am doubtful from M. Bousquet's description whether he means the seventh day *including* the day of vaccination, according to our mode of counting, (or the day before the day-week), or the seventh day *after* the vaccination (which, as we count, would be the eighth day, or the day-week itself). If the latter, the course would in this respect be quite normal.

service of the Académie may throw some light on the cause of this degeneration.[1]

When this Passy lymph of 1836 was compared with some lymph which had been in use for twenty-nine years at Tours, it exhibited during its first transmissions considerably more local intensity of symptoms, but in a very short time this peculiarity declined, and, at the end of a year, there was scarcely the slightest difference perceptible in the action of the two lymphs; when, in 1838, it was compared with a stock then obtained new from the cow at Rouen, such difference as was noted was in favour of the older (the Passy) lymph; when, in 1841, after from 200 to 250 transmissions, it was compared with a stock

[1] The following statement by M. Blot, publicly made at a meeting of the Académie (January 15, 1865) has not been challenged: "Je sais, en effet, comment les choses se passaient à l'Académie jusqu'à dans ces dernières années, et même peut-être encore aujourd'hui. Nourri près du sérail, j'en connais les habitudes. Comment croyez-vous qu'est recueillie une grande partie du vaccin qui sert à l'Académie? A quelles sources pensez-vous qu'on aille le puiser? Par quelles mains cette récolte si importante est-elle faite? Je vais vous le dire. Jusqu'en ces derniers temps, voilà comment les choses se pratiquaient. On vaccinait ici deux, trois, quatre, ou cinq enfants envoyés par la surveillante du service de la clinique d'accouchement, puis ils retournaient à la clinique. Au bout de huit jours on allait à l'hôpital recueillir ce que chacun de ces enfants avait pu produire de liquide vaccinal. Or, Messieurs, qui croyez-vous qui allait faire cette récolte, dont le produit devait servir à inoculer d'autres enfants, soit à l'Académie, soit dans Paris, soit en province? M. le directeur de la vaccine, peut-être? Jamais. A son défaut, M. le sous-directeur? Pas davantage. Eh bien, alors, direz-vous, un des membres de la commission permanente de vaccine? Pas du tout. Alors quelque jeune médecin distingué, ou tout au moins un interne? Vous n'y êtes pas davantage. C'était . . . un simple employé des bureaux de l'Académie, un vieillard valétudinaire, complétement étranger à l'art de guérir, et de plus atteint de tremblement sénile. Je n'ai pas besoin de dire si ce brave homme était capable de choisir les sujets, d'examiner et d'interroger les mères. En tout cas, en eût-il été capable, il ne s'en inquiétait nullement."

from the cow near Dijon, or with some lymph from Stuttgardt, at the first, third, and twelfth removes from the cow, it was as active as either of them; and when, three years later, and after some 400 transmissions, or more, it was used, in 1844, side by side with some lymph just obtained from a cow belonging to M. Majendie, there was absolutely no difference in the action of the two lymphs. On comparison, by various experimenters, of the action of lymph from some of these more recent stocks—the Rouen stock, and Majendie's—with lymph of the original stocks which was in use in various places, no difference was detectible.[1]

A lymph-stock, which was set in circulation by Mr. Estlin, of Bristol, in 1838,[2] produced in its earliest transmissions much of that extreme local irritative effect which Jenner and others describe as attending the use of unhumanized lymph, and which, so far from regarding as an advantage, they were always anxious to control. It was so exceedingly irritative, that I know that life was endangered in some instances by the use of it, and I rather think a fatal case or two occurred.[3] When, after some transmissions, this virulence abated, it was a

[1] See Bousquet, Nouveau Traité, &c. pp. 415-6: also Rapport de l'Académie Royale de Médecine de Paris, sur les Vaccinations pratiquées en France pendent l'année 1841; ibid., 1844; ibid., 1845.

[2] It was obtained at the second remove from a little child aged five years, who had been inoculated with a needle with the discharge proceeding from the hands of a milker in a dairy, in which there was cow-pox. (London Medical Gazette, vol. xxii.)

[3] The late Mr. Gilham, of the National Vaccine Establishment, having vaccinated a number of children with Estlin's lymph, during its early transmissions, when it was producing severe local effects, tested them afterwards by variolous inoculation, and, for comparison's sake, inoculated with variola an equal number of children who had been vaccinated by him with lymph of Jenner's old stock. Both series resisted equally the action of the variolous inoculation.

fine and good stock, and was regarded by Mr. Estlin and others who employed it as superior to the lymph they were then respectively using. As the stock, however, which Mr. Estlin was then using is described by him as producing small vesicles, running a rapid course, and yielding little lymph of diminished infective power, it is clear again that the comparison was made with lymph very different from that which now, thirty years later, may be found in current use at our best public stations, producing perfect results, and not failing once in a hundred and seventy times.[1] When Mr. Aikin compared Estlin's lymph with some he had in use from Jenner's original stock, he could not detect any difference.[2]

In the dairy farms of the Bridgewater Level, and of the Vale of Gloucester, the natural cow-pox is still not unfrequent; and inoculations direct from the cow have been practised in several districts with success. "Al who have employed such lymph agree in stating that, after the first or second transmission, the results obtained do not differ from those of ordinary vaccination, either in respect of the progress or character of the vesicle."[3]

[1] Mr. Estlin considered it important testimony that at the Vaccine Institution at Glasgow his lymph had not failed once in 43 trials, while in the preceding 43 vaccinations there had been 10 failures and 9 spurious or imperfect results, and at the time the new supply reached them, "all the children vaccinated on the day-week preceding, presented, instead of true vesicles, raw surfaces resembling spots that had been vesicated and then denuded of their cuticle." Surely there is nothing here proved, but the worthlessness of the stock of lymph (?) they had in use. I do not know what is the Institution referred to as the Vaccine Institution at Glasgow, but I do happen to know that at the Royal Infirmary of that city in bygone days an occasional, if not a frequent, performer of the vaccination was the hospital porter.

[2] London Medical Gazette, vol. xxvi. p. 189.

[3] Sanderson, quoted in Sixth Report of Medical Officer of Privy Council, p. 10.

The comparison of the Passy lymph with other lymphs direct from the cow tends indeed to show, that all primary stocks are not identical in their local action on the human subject; but there is nothing whatever to show, or to lead even to a probable inference, that the points in which they differ are in the least essential. Mr. Ceely, writing in 1841, tells us that during the preceding three years he had observed and noted the effects on a variety of subjects, of more than fifteen different stocks of vaccine lymph, of which six had been from the natural disease, either taken direct from cows or from vesicles on the hands of milkers, and seven artificially produced in the cow. These stocks had all varied in their effects, both locally and constitutionally, but none had lacked the essential qualities and properties, nor had any possessed them in a superior degree to those indicated in the description and illustrations of Jenner. This is the "standard," he says, "to which we may at all times confidently appeal." [1] "My own repeated applications to the cow [for lymph]," he tells us elsewhere, "have been chiefly for the purpose of experiment, for the satisfaction of patients, or the accommodation of friends, not from any belief in its superior efficacy over active humanized lymph." [2]

[1] Trans. Provincial Medical and Surgical Association, vol. x. p. 261.

[2] Ibid. vol. viii. p. 376.

CHAPTER XI.

Of the Protection which Vaccination affords against Small-pox.

80. What Small-Pox was before the Discovery of Vaccination.—Until the close of last century, small-pox was by far the most formidable and fatal of all the diseases that afflicted mankind. The great and eloquent modern historian of England, comparing the ravages it made in this country towards the close of the seventeenth century—when, amongst others, Mary, the wife of William III., fell a victim to it—with the ravages of the plague, justly assigned to small-pox the foremost place, as "the most terrible of all the ministers of death. The havoc of the plague," says Macaulay, "had been far more rapid, but the plague had visited our shores only once or twice within living memory, but the small-pox was always present, filling the churchyards with corpses, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."[1] This description applied with at least equal force a hundred years later. Few indeed, then, were those who were

[1] Macaulay, Hist. of England, vol. iv. p. 530 (8vo. edit. 1855).

not at some time or other of their lives attacked by this fell disease: and happy was it for any one so attacked that he should escape with life, or with unimpaired health, or without serious disfigurement. I must refer to others for a description of the ravages small-pox made in other countries:[1] in England, according to the calculation of Dr. Lettsom, the average annual deaths from it were about 3,000 out of every million of the population;[2] a death-rate which, with the present population of the kingdom, would give an average of considerably more than sixty thousand deaths from small-pox a year. Nearly one-tenth part of all the persons who died in London, within the bills of mortality, during the last half of last century, died of this one cause.[3] The younger part of the population were peculiarly its victims: in some of our great cities it was found that, on an average of long series of years, nearly, or more than, one-third of all the deaths which took place in children under ten years of age arose from small-pox.[4] The mutilations which it caused, when it did not slay, were so frequent and so considerable, that we have it on record that, at the period of which we are speaking, two-thirds of the applicants for relief at the Hospital for the Indigent Blind owed their

[1] See particularly the most interesting account given by Simon, Preface to Papers relating to the History and Practice of Vaccination, pp. ii.–vii.; see also Baron's Life of Jenner, vol. i. pp. 256-272; and Moore's History of Small-pox.

[2] A calculation, separately made, by Sir G. Blane corresponded very closely with Lettsom's. (See "The Evidence at Large, as laid before the House of Commons," &c. by the Rev. G. C. Jenner).

[3] 96 per 1,000: see Report on Small-pox and Vaccination, presented to the President and Council of the Epidemiological Society, by the Small-pox and Vaccination Committee, 1853 (8vo. edit.) p. 42.

[4] In Glasgow from 1783–1792, 36 per cent., and from 1793–1802, 32 per cent., of all the deaths under ten years of age were deaths from small-pox. (See Cowan's Vital Statistics of Glasgow.)

loss of sight to small-pox :[1] and we need but refer to the writings of physicians of that time to see how frequently it was followed by deafness, and, in constitutions disposed to scrofula, by glandular swellings, obstinate ulcerations, and other evidences of the development of that disease.

81. The Characters of Small-Pox, when uncontrolled by Vaccination, are still the same.—It is quite necessary to recall these facts, because, as has been well remarked, since by the introduction of vaccination small-pox has almost ceased to be a fatal disease among the civilized classes of society, there is to them "a temptation to forget how their fathers and grandfathers regarded it."[2] If we could only for a moment suppose that the protection against small-pox which our population now enjoys from vaccination were all at once removed, it is beyond a doubt that we should find ourselves thrown back into all the horrors of last century. For the small-pox itself appears to have lost nothing of its malignancy and fatality, either by lapse of time, or (since Sydenham's day) by any improvement in medical treatment. We find from the records of the Small-pox Hospital that, during the last 25 years of last century, the death-rate in the Hospital (the patients of course being all unvaccinated) was 32½ per cent. of the admissions.[3] In the same Hospital, during the years 1836-51, the deaths *excluding the vaccinated* were 35 per cent.[4] Dr.

[1] Sir G. Blane in Medico-Chirurg. Trans. vol. x. p. 326.

[2] Simon, *op. cit.* p. ii.

[3] As given in Appendix to the Annual Report of the National Vaccine Board, printed by order of the House of Commons, March 2, 1826.

[4] See Table I. in Marson's Paper on Small-pox and Vacc. in Medico-Chir. Trans. vol. xxxvi. I apprehend it is hardly necessary to say that it would not be at all a fair inference from the somewhat higher

Jurin, writing early in last century, laid it down as the result of his investigations "that of persons of all ages, taken ill of natural small-pox, there will die of that distemper one in five or six."[1] From returns made to the Epidemiological Society in 1852, by 156 medical practitioners in various parts of England who had kept numerical records of their small-pox experience, it appeared that the proportion of deaths to cases which they had met with in the natural form of the disease, was 19·7 per cent., or as nearly as possible one to five—a result which closely corresponds with, and is certainly in no degree more favourable than, that of Dr. Jurin.[2] And the same sequelæ which Willan describes, as attending the natural small-pox in his time, attend the natural small-pox now. If, further, we look to see what has happened when in recent times small-pox has invaded, or invades, populations among whom vaccination has been but little practised, we find its ravages to be exactly like those met with in Europe during last century. This was the case in 1846-8, in an epidemic which occurred in the Argentine Confederation, and which is described by Dr. Makenna—a British physician then practising at

death-rate of the later period, that the small-pox had become *worse:* probably, in the earlier period, some cases of the *inoculated* small-pox (a comparatively little fatal disease) are included. But these would have constituted but a small proportion of the whole, and it is a fair inference from the figures, as they stand, that the fatality of the natural disease has undergone no essential change.

[1] Moore's History of Small-pox, p. 243.

[2] Seaton, Protective Power of Vaccination, San. Rev. vol. ii. p. 354. These returns must be looked upon as very favourable, because they did not include any severe epidemics in large towns. In such epidemics the proportion of fatal cases is frequently one in four, or greater. (See p. 212, note.) In the Small-pox Hospital the mortality is still higher—partly, no doubt, because it is for the severer cases of disease that hospital accommodation is peculiarly sought, and partly also on account of hospital influence.

Monte Video—as sweeping with the wings of death over that enormous tract of country which extends from the seaboard of the Atlantic on the east to the Corderilla of the Andes on the west. "Throughout this whole space," he observes, "it may be said that hardly a single house or rancho escaped its fearful visitation, wherever the current of human intercourse reached: and such was its fatality, that I have known thirty children taken in one morning from the houses of one quadra of a street 150 yards long, and I have seen two men above seventy years of age, and deeply pitted with a former attack, carried off by it. Whole families were swept away, and in short, the terrors of the plagues of former times were, if not surpassed, fully equalled by this horrible scourge. . . . But that which struck me as most truly remarkable was that not one of those English people who had been vaccinated at home, and who had the large deep oval thimble-mark on one or both arms, ever took the disease."[1] In Japan, at the present time, where, though vaccination is known, it is practised to a very limited extent only, "small-pox is endemic and extremely prevalent. It is very rare indeed," says Mr. Dickins, "to meet a man on whose face there are not some marks of the disease left. A very large proportion die, and a much larger proportion are horribly marked, as a very short walk through the town or country will convince the inquirer. . . . . It very frequently attacks the eyes, and, when it does, blindness is almost an inevitable result. Almost every 'Amma,' or blind beggar, of whom I made inquiry as to the cause of his blindness, told me that it was the result of small-pox."[2]

[1] Australian Medical Journal, January, 1858.

[2] Statistical Report of the Health of the Navy for 1864, pp. 242, 243.

82. Introduction of Variolous Inoculation: its Results.—An attempt made early in the last century to mitigate the ravages of this disease, was found but to extend its deadly influence. The practice of inoculating into the skin the matter of small-pox, which had been long known in Eastern countries, was introduced into England in 1721, through the advocacy and example of Lady Mary Wortley Montague.[1] It purposed, by inducing small-pox at will in a mild and little dangerous form, to impart artificially, and at slight risk, the same security which one attack of the disease in its natural form is known to give against future attacks. And, so far as regarded the individuals inoculated, it was shown by ample experience to fulfil its purpose: although, as Simon justly remarks, "to the present time it remains one of the most interesting and least explained facts in pathology, that the specific contagion or ferment of small-pox, so uncontrollable in its operations when it enters a man in the ordinary way of his breathing an infected atmosphere, becomes for the most part disarmed of its virulence when it is artificially introduced to the system through a puncture of the skin."[2] The disease induced by the

[1] Inoculation by rubbing the matter of small-pox on the skin of the arm, or pricking the skin with pins or other pointed instruments first infected with variolous matter, is said to have been long before this in use in South Wales, and to have been known there as far back as tradition would reach. It was there called "buying the small-pox," the superstition being that it would not produce the proper effect unless the person from whom the matter was taken received a piece of money, or some other present, in exchange. In the Highlands of Scotland a kind of inoculation had long been practised by tying worsted threads, moistened with variolous lymph, round the wrists of children. See the copious and very interesting article, "Inoculation," in Rees' Cyclopædia.

[2] Simon, *op. cit.* p. vii. Equally strange and inexplicable is the further and greater change which this ferment undergoes in passing through the textures of a cow; a change which renders it incapable,

inoculative process was, indeed, far from being absolutely void of danger ;[1] but, relatively to the natural disease, the danger was so slight, and the obvious advantages of inoculation to the individual were consequently so great, that the practice, having been at first hesitatingly accepted, afterwards made considerable progress. But just in proportion to this progress did the one great and fatal drawback to the use of variolous inoculation become apparent. It was found that it multiplied the foci of contagion : the small-pox produced by inoculation was as capable of conveying infection as the natural small-pox itself ; and as it was not in most instances severe enough to confine the patient either to his bed or to his house, while free exposure to the air was justly regarded as the best mode of treatment, it is obvious how, especially in large towns, the chances of infection must have been multiplied. Besides, as small-pox could thus be set agoing anywhere by merely sending a bit of cotton thread dipped in variolous lymph for the purpose of inoculation, it was constantly being introduced into places from which otherwise it might have been long absent. Hence the *general* mortality from small-pox after the practice of inoculation had become diffused was considerably greater than it had been before that practice was known. "However beneficial," say the Royal College of Physicians of

when re-transplanted to the human system, of any longer propagating itself by effluvia, while it retains its capability of propagation by inoculation, and its power of protecting the system against its own further action thereon (§ 29).

[1] In the early experiments with inoculation in England, the deaths resulting from the process were two per cent. of the operations performed ; but this death-rate was subsequently greatly diminished when the management of inoculation became better understood, and Dr. Gregory gives three in a thousand as the average of deaths from inoculation at the Small-pox and Inoculation Hospital.

London, in their Report on Vaccination (1807), "the inoculation of the small-pox may have been to individuals, it appears to have kept up a constant source of contagion, which has been the means of increasing the number of deaths by what is called the natural disease. It cannot be doubted that this mischief has been extended by the inconsiderate manner in which great numbers of persons, even since the introduction of vaccination, are still every year inoculated with the small-pox, and afterwards required to attend two or three times a week at the places of inoculation, through every stage of their illness."[1] It is stated by Dr. Heberden that while, out of every thousand deaths from all causes within the bills of mortality, the small-pox deaths during the first thirty years of the eighteenth century, before inoculation could yet have had any effect upon them, amounted to seventy-four, they amounted during an equal number of years at the end of the century to ninety-five, showing an increase in the proportion of about five to four. It was becoming evident, therefore, that unless inoculation could be made by compulsion universal, it would be better for the community that it should be abandoned altogether.

83. Discovery of Vaccination.—Such was the apparently hopeless condition of things when, towards the close of the century (in 1798), Jenner made known to the world that he had discovered and matured a process by which persons might be protected against small-pox, without any danger to themselves and without any risk of infecting others.

[1] Papers relating to the History and Practice of Vaccination, p. 7. In France, in consequence of the multiplication of foci of infection through inoculation, a royal decree prohibited, in 1763, the practice altogether, "dans l'enceinte des villes et des faubourgs." (Rapport de l'Acad. Imp. &c. sur les Vaccinations en 1858-9.)

Thirty years before, when he was apprentice to a surgeon at Sodbury in the county of Gloucester, a young countrywoman had said in his hearing that she could not take small-pox, "for she had had cow-pox." These words riveted his attention, and the impression they made was never effaced. He found that in that county, where cow-pox was frequently met with among the dairies, and where the milkers were continually getting accidentally infected from the sores on the cows' teats, the notion was widely diffused, though apparently of no very long standing, that such of them as had been thus infected were insusceptible of small-pox.[1] A careful investigation of the grounds of this belief enabled him both to establish its general truth, and satisfactorily to explain and account for the apparent exceptions; and it was during these inquiries, continued for many years, that his genius conceived the idea that not only might the cow-pox be given at will to man by the process of inoculation from the cow whenever opportunity offered, but that it might be transferred and continued by that process from one human subject to another, and that in this way protection against small-pox might be imparted to mankind in perpetuity.

As early as 1780, he communicated to his friend

[1] "At what period the cow-pox was first noticed here is not upon record. Our oldest farmers were not unacquainted with it in their earliest days, when it appeared among their farms without any deviation from the phenomena which it now exhibits. Its connexion with the small-pox seems to have been unknown to them. Probably the general introduction of inoculation first occasioned the discovery." (Jenner, Inquiry into the Causes and Effects, &c. p. 64.) The belief among dairy-folk of the antivariolous powers of cow-pox existed in other parts of England, as well as in Ireland, parts of Germany, &c. (See Ring, Treatise on the Cow-pox; and see also Simon, *op. cit.* p. xii.)

Edward Gardner the views he had been led to entertain on this subject: but it was not till sixteen years later that (in 1796) he was able to put these views to experimental proof. With what trembling anxiety must Jenner have watched these first experiments! What delight must he have felt when he saw that the great anticipations he had expressed to Gardner were about to be realized! Circumstances, however, obliged him to suspend his experiments for a while, but early in 1798 he was able to resume them; and by the summer of that year he had established his great discovery on so ample a basis of observation and experiment, that he felt the time was come for making it known to the world.

84. Its Protective Power against Small-Pox demonstrated.—The "Inquiry into the Causes and Effects of the Variolæ Vaccinæ"—for so the first tract he published on the subject was entitled—has been justly called by one well qualified to judge a "masterpiece of medical induction."[1] In this treatise Jenner proved that the natural cow-pox, casually communicated to man, rendered him insusceptible of taking small-pox, whether by inoculation or by infection; that this protective power was not lost by lapse of time, but manifested itself at the end of twenty, thirty, or even fifty years; that it was possessed by the genuine cow-pox alone, and not by other eruptions to which the cow was subject, and which might be confounded with it; that the cow-pox might be communicated at will, to man, by the hand of the surgeon, whenever the requisite opportunity offered; that, once ingrafted on the human subject, it might be continued from individual to individual by successive transmissions; and that so transmitted it conferred on each individual the same immunity from small-pox as

[1] Simon, *op. cit.* p. xii.

was enjoyed by the one first infected direct from the cow. The disease had then, indeed, only been conveyed from human subject to human subject, through five successive transmissions; but as the child last vaccinated had been submitted to the variolous infection, and resisted it, equally with the one who had been vaccinated direct from the cow, reason and analogy rendered it difficult to doubt that this transmission might be perpetually maintained. In two years more Jenner was able to report that upwards of 6,000 persons had been inoculated with the virus of cow-pox, conveyed through a succession of human subjects, "and the far greater part of them have since been inoculated with that of small-pox, and exposed to its infection in every rational way that could be devised, without effect."[1] It is in the successive transmission of cow-pox through human subjects that the practical usefulness of Jenner's great discovery lies; and since the process was first made known by him, all ordinary vaccinations have been thus carried on.

85. Jenner's opinion as to the Degree of Protection it afforded.—The protection which vaccination would afford against small-pox was held by Jenner to be exactly that—neither more nor less—which an attack of small-pox, either taken naturally or induced by a completely successful inoculation, would confer against a subsequent attack of the same disease. Whatever phrase may be picked out of his writings here and there to show that he looked on the security which cow-pox would impart against small-pox as *absolute*, that he believed that the human system which had once felt genuine cow-pox was "never afterwards, at any period of its existence, assailable by small-pox,"[2] must be read with

[1] A Continuation of Facts and Observations, &c. by E. Jenner, M.D. Lond. 1800.

[2] Ibid.

this limitation. Any other reading would be quite inconsistent with the doctrine he invariably held of the identity of cow-pox and human small-pox. The system of a person who had been vaccinated was regarded by him as having already passed through small-pox, and as being, *quoad* future small-pox, exactly in the condition of a person who had had small-pox in the ordinary way (§ 25). And as he was well aware, and indeed constantly urged, that the small-pox itself did, in some individuals, recur, and that the having passed through one attack was not, in every instance, a security against a future attack, so he looked for similar occurrences after vaccination. What, in short, he really claimed for vaccination is thus stated by him:—"Duly and efficiently performed" (for this, of course, was indispensable), "it will protect the constitution from subsequent attacks of small-pox as much as that disease itself will. I never expected it would do more; and it will not, I believe, do less."[1]

86. Small-pox after Natural Small-pox.—That small-pox may occur twice in the same individual is a fact now so well known, and so universally admitted, that it is a matter of some astonishment that any physicians should ever have been found to express a doubt on the subject. There have been those, indeed, who denied altogether the possibility of it; but generally the possibility was fully allowed, the difference of opinion being as to the frequency with which the occurrence took place. On this point medical authorities have been most divided. While Mead and others looked on a recurrence of small-pox as of the utmost rarity, many physicians regarded it as by no means extremely infrequent. Perhaps the discrepancy is not wholly inexplicable. Those, probably, who held a second attack of small-pox

[1] Baron's Life of Jenner, vol. ii. p. 135.

to be so extremely rare, did not consider any attack to be small-pox which had not the full course and character of a primary attack. Certain it is that when, soon after the discovery of vaccination, the modified form in which small-pox occasionally presented itself among the vaccinated began to attract attention, it was found that the same modifications were also sometimes seen in persons who had been variolated. Further, before the diagnostic marks of variola and varicella were well made out and generally recognised, there was, no doubt, much mutual confusion; and as, in the present day, wherever the distinction between these two diseases is not acknowledged or not well attended to, cases of varicella are frequently recorded as modifications of small-pox, so, conversely, no doubt, when the modifications of small-pox were little thought of, many modified secondary cases of this disease might be ascribed to chicken-pox. Except on some such grounds as these, I cannot understand how it is that the variolous fever without eruption—the "febris variolosa"—seen at this day, so far as I know, only in protected persons, should nevertheless be so well described by Sydenham, who appears to have met with many cases of it,[1] though I cannot find that he refers to the circumstance whether those attacked by it had had small-pox before or not.

87. Small-pox after Inoculated Small-pox.—Although the occurrence of secondary small-pox is established by numerous writers before the period when inoculation of small-pox was first introduced, it is much more frequently referred to by those who have written since that date. And this, indeed, is what might have been anticipated, for it seems to me scarcely to be doubted that cases of small-pox must have occurred with

[1] Sydenham's Works, trans. by R. G. Latham, vol. i. p. 152, seq.

greater relative frequency among individuals to whom small-pox had been given, or was believed to have been given, by inoculation, than among those who had had the disease in the natural way. The process of variolous inoculation is liable, like the vaccine process, to accidental disturbances and interferences in its course, and to irregularities, arising either from the state of the matter used or from the state of the child in whom it was inserted, that must have rendered inevitable, as it seems to me, the occasional occurrence of such cases as the following, described by Mr. Earle : In a general inoculation he had made in the village of Arlingham, in 1784, he had inoculated five children with variolous matter which was undoubtedly genuine, though it had been taken at a late period of the disease ; infection was produced, but peculiarities arose in the progress of the cases which led Mr. Earle to consult an elder practitioner, who, however, *pronounced the children safe;* nevertheless, four out of the five children took small-pox afterwards, and one of them died ; the only one who escaped an attack had not, at the time the account was published, been exposed to infection. And it was only the lesson which Mr. Earle had learnt from this occurrence that made him, on a subsequent occasion, test, and by this testing inoculation save, three children whose inoculation had been followed by results which, to most, would have been considered satisfactory.[1] Other writers record instances in which the results following inoculation, though peculiar, were yet such as, according to the highest authorities in inoculation, justified the practitioner in pronouncing the patients safe, and yet small-pox was subsequently taken

[1] Jenner, Further Observations, &c. 4to. 1799.

[2] Kite, Memoirs of Med. Soc. of London, iv. 114. The inoculation took local effect early, and ran a hastened course, the case

nor were cases wanting in which the progress of the inoculation so closely indeed resembled that which was normal and regular, that the most experienced could not distinguish it, but in which the process was yet unprotective, true natural small-pox manifesting itself in the children within a few weeks after the phenomena had subsided.[1]

88. Frequency or Infrequency of Recurrent Small-pox.—Ploucquet gives a list of seventy-four writers who record cases of second, and some of them even of third, or of several, attacks of small-pox in the same individual :[2] Dr. Hennen gives a still more copious list.[3] Half a century and more ago, when small-pox was much more common than now, cases were certainly not rare. Jenner refers to the very large number of which

being exactly analogous to one of spurious vaccination. But Dimsdale, who was familiar with cases of this kind, used to regard them as safe.

[1] Kite's cases showed conclusively that this might occur where the inoculated small-pox had gone through such a course as the most careful and experienced practitioner could not distinguish from the regular course—the local phenomena being the same, the fever commencing at the regular period, and continuing the normal length of time, and the eruption duly following; the only possible point of distinction being that most of the pustules did not completely maturate—which, as he remarked, is repeatedly the case in the real small-pox when the eruption has been moderate. The matter used in some of these inoculations had been taken at a late period of the pustule : there was no record of that used in the others. But Mr. Kite speculates whether variolous matter, if not properly taken, or if not properly kept, may not have undergone, or may not undergo, changes which enable it to produce a *certain degree* of variolous infection, but not enough to produce the disease fully and completely. A similar, most interesting, question arises with regard to the effects of vaccination under the like circumstances. (See p. 78, note 1.)

[2] Literatura Medica Digesta, tome iv. and Supplement.

[3] Edin. Med. and S. Journal, vol. xiv. p. 460.

there were authentic accounts, no fewer than seventeen of them in the families of the nobility.[1] But even with the diminished prevalence of small-pox since that period, innumerable cases have been put on record. The Provincial Medical and Surgical Association collected, in 1839, from various correspondents, 239 such cases; and in the inquiry made by the Epidemiological Society of London, in 1851, which has been already referred to, numerous practitioners reported cases of second small-pox, and some even of third attacks, with a circumstantiality of detail which left no ground for doubting the accuracy of the statements. More than 200 cases of second small-pox were thus communicated, the evidence of the primary attack being generally the full and characteristic marking of the patient, and the second attack being watched through its course by observers whose competence to discriminate accurately could in most instances be relied on. In the official inquiries relative to small-pox which I have been called on to make since 1859, and notably during the recent epidemic (1863-6), the occurrence of cases of second small-pox has been brought to my notice on numerous occasions; not only in most of the large towns which I have had occasion to visit, but also in small towns and rural districts. As regards many of these cases the sufficiency of the evidence was quite beyond question: one or two of them I had the opportunity of seeing in progress, and in several instances, though the attack was over, I was able to examine and interrogate those who had suffered. Experience abroad coincides with experience in this country. Haeser states, on the authority of Regoni-Stern, that at Verona in the ten years 1829-38, twenty-four cases of second small-pox had been noted, eight of which were

[1] Baron's Life of Jenner, vol. ii. p. 159. See also pp. 29 and 363.

fatal ;[1] and Heim reports in the epidemics in Wirtemberg, 1831-5, fifty-seven cases of recurrent small-pox, of which sixteen died, and, in subsequent epidemics, eighty-six cases, twelve of which were fatal.[2]

Data do not exist for determining in what proportion variolated persons may afterwards take small-pox. The proportion will no doubt be affected by the same circumstances as will hereafter be referred to (§ 92) as influencing the extent to which small-pox may be taken after vaccination, especially by the presence of epidemic influence. The calculation which was made by the Société de Médecine of Marseilles, that one per cent. of the variolated portion of the population of that town suffered from second small-pox during the epidemic that prevailed there in 1828,[3] can only be taken as a very rough approximation. All that is certain is, that twenty cases of second small-pox, or what was held to be second small-pox, were noted during a part only of that outbreak. Other observations which have more numerical precision have been made on special classes of the community. Thus, of the 1950 boys admitted into the Royal Military Asylum, Chelsea, between the years 1803 and 1831, who, at the time of their admission, were recorded as having marks of small-pox, twelve (or 6·15 per thousand) contracted small-pox during the period of their residence at the Asylum.[4] In answer to some inquiries

[1] Haeser, Die Vaccination und ihre neuesten Gegner, p. 52.

[2] Heim, as quoted by Simon, Papers relating, &c. (*op. cit.*), pp xxvii. and xxxv. [3] Bousquet, Nouveau Traité, &c. p. 269.

[4] It is just possible that in some of these cases the marks which the children exhibited on their admission might be marks of chicken-pox. The distinction between such marks, and the marks left by small-pox when these are few and scattered, as they would generally be in cases of the inoculated disease, is not always easy, nor even always possible: and a knowledge of the history and

which were made by the Epidemiological Society of London, in 1851, of various medical practitioners in the United Kingdom, as to their personal protection against small-pox, thirty-two who had had natural small-pox when young had none of them suffered from any second attack, but of ninety-five who had been inoculated, and were considered to be safe, three had since contracted small-pox: and in reply to a further set of inquiries on this subject, afterwards more extensively distributed by the Society, fifty-four practitioners stated that they had had natural small-pox in childhood, of whom one had suffered from a second attack; two, who had been vaccinated in childhood, had since had small-pox *more than once;* of five who had had small-pox in childhood, either naturally or by inoculation, but did not state which, none had since had small-pox; and of 279 who had been inoculated successfully, seven answered distinctly that they had had small-pox at a subsequent period of their lives, and six more stated that they had had small-pox, but the wording of the answer was so ambiguous that it was not certain whether the attack referred to was that which resulted from the inoculation or was of subsequent and independent occurrence.[1] These facts, so far as they go, tend to the conclusion that natural small-pox is more protective against a second attack than the inoculated form of the disease. And it is quite possible that, now that the practice of inoculation has been so long forbidden by law, and so long discontinued, cases of second small-pox will be less common than they were during the latter part of the last and the earlier part of the present century.

circumstances of the first attack is often necessary to make the diagnosis sure.

[1] Further inquiries were made on this point, but the necessary information not elicited.

Marson regards second small-pox as very rare—more rare than my own observations, or my own inquiries among my professional brethren, or the facts above cited would lead me to consider it. Still, one per cent. of all the admissions into the Small-pox Hospital are cases of second attacks of the disease. In the Annual Medical Reports of the Army and Navy many indisputable cases of second small-pox will be found: among the small proportion of the troops serving in the United Kingdom whose protection against small-pox was the having already had that disease, three such cases occurred in the six years, 1859-64.[1]

89. **Small-pox after Vaccination.**—The lapse of a few years from the promulgation of Jenner's discovery was enough to bring to light cases in which vaccination failed to give complete immunity from small-pox. As early as 1806, the Medical Council of the Royal Jennerian Institution stated that a few cases had been brought to their notice of persons having the small-pox, though generally of a mild description, who had apparently passed through the cow-pox in a regular way ;[2] and in the same year Willan recorded, in his most interesting and useful treatise "On Vaccine Inoculation," various cases in which a very trivial eruption, but of true variolous character, appeared, in children who had been vaccinated, at intervals which had varied from five months to seven

1 The proportion of recruits who are protected by variola is now about one-eleventh; but some years ago, from 1846-55, it exceeded one-fifth. I apprehend that scarcely any of the troops now serving can have had the *inoculated* form of variola.

2 Papers relating to the History and Practice of Vaccination, p. 5. The Council states also "that cases, supported by evidence equally strong, have also been brought before them, of persons who after having once regularly passed through the small-pox, either by inoculation or natural infection, have had that disease a second time." This interesting report (signed, amongst others, by Lettsom, Babington, Denman, and Baillie) is well worth perusal.

years after the performance of the vaccination. The singular modification which the small-pox underwent, and the harmless and insignificant character it usually assumed, in those protected by vaccination—thus early noted—attracted much more attention when, in the great epidemic of small-pox which prevailed in 1817 and the years immediately following, cases of post-vaccinal small-pox became more common. It was then remarked, and the observation has been confirmed by the experience of all subsequent epidemics, that though some vaccinated persons may contract small-pox at an early period after vaccination—even, as Willan showed, within a few weeks or months—post-vaccinal small-pox was met with in much larger proportion among those who are grown up; and that it was exclusively among these latter that it assumed (and even among them in only a relatively small proportion of cases) a serious, and especially a fatal, character. Many cases of the small-pox which manifested itself in those who had been vaccinated were clearly assignable to imperfect vaccination, but in others the vaccination appeared to have been regular and complete. The difference in its symptoms and course which the small-pox assumed in those who had been vaccinated was so striking, that the late Dr. John Thomson of Edinburgh was induced to propose for this form of the disease a distinguishing name, calling it "varioloid." The name, as Marson justly observes, though it has been very extensively adopted, is ill-chosen: "The disease is not simply 'like' small-pox, as the name implies; it *is* small-pox; it will give the disease in the most severe form, in the natural way, by infection, to the unvaccinated, and will produce small-pox by inoculation just as a case of small-pox uninfluenced by vaccination will do."[1] The

[1] Art. "Small-pox," System of Medicine (*op. cit.*), vol. i. p. 472.

term "modified small-pox" which Marson proposes to apply to all the post-vaccinal cases which exhibit the characteristic modification, is very much better, and will, I trust, wholly supersede it.

90. Modes in which the Power of Vaccination over Small-Pox is manifested.—It is not solely then in the way that Jenner appears to have first anticipated, that the benefits of his immortal discovery are felt by mankind. Nearly seventy years' use of vaccination has proved beyond doubt that, "duly and efficiently performed," its power of influencing small-pox is indeed almost absolute,—but that it acts, not invariably by preventing, but sometimes only by controlling that disease. The vast majority of those who have gone regularly through the vaccine process are saved thereby from any future attack, however modified or slight, of small-pox. In the minority, who have not been rendered by it completely proof against the influence of the small-pox poison, the action of that virus on the economy is yet so modified by it that the small-pox, as a rule, is deprived of all danger to life, and does not leave behind it those disfiguring traces which are not the least of the terrors of unmodified variola.

(a) By conferring on the large majority of the Vaccinated complete immunity from that disease.—There is certainly no subject on which medical testimony is more unanimous than on the very large immunity from attacks of small-pox which successful vaccination will confer. While there are exceedingly few unvaccinated persons who reach the average duration of human life without having sustained an attack of variola, and while the very great majority of such persons are attacked by it in childhood, the vaccinated are, as a rule, entirely exempt from that

disease. The first question, says that distinguished medical philosopher Dr. Alison, which we have to consider, is "whether or not we have at this time, in the matter of cow-pox, a power at our command capable, if duly employed, of depriving the poison of small-pox of all fatal influence over an immense majority of mankind. And on this subject there has been quite sufficient information collected, since the date of the papers which were held decisive of the question fifty years ago, to show that the same inference is still inevitable, and that he who disputes it is equally unreasonable as he who opposes, in like manner, any proposition in Euclid. Of course, when I say that there has been ample evidence to decide this question statistically, I mean to refer to cases where we have not only the negative evidence of large numbers of persons duly vaccinated not having subsequently been affected with small-pox, but the positive evidence of such duly vaccinated persons having been subsequently, most of them repeatedly, or for a long time together, exposed to the contagion of small-pox, *i.e.* placed in the same circumstances in which unvaccinated people have been very generally affected, and many of them died of the small-pox; these vaccinated persons have nevertheless escaped, most of them without any indication of disease. To show that this is the light in which I have always regarded such collections of facts, I quote one sentence from my own lectures, written as long ago as 1820-1821, and repeated almost every winter since then :—'You will remember that the question is, not how many vaccinated persons never take small-pox, but how many vaccinated persons are fully exposed to the contagion of small-pox and escape without any disease; and our assertion is, that, so far as is yet known, absolute protection of the human constitution is the rule, and the occurrence of any

disease is the exception.'"[1] A vast body of evidence which was collected by the Epidemiological Society, in 1851-2, from all parts of the kingdom and from abroad, fulfilled exactly the conditions which Dr. Alison has so justly pointed out as essential for proof,—evidence of vaccinated persons (children or grown up) living in crowded and ill-ventilated dwellings in which the small-pox infection was, occupying the same rooms, and sleeping in the same beds with small-pox cases, mothers nursing their babies who were suffering from the disease, —all placed in circumstances in which no unvaccinated or otherwise unprotected person, or scarcely any such, escaped, and yet themselves remaining entirely unscathed. One of the most striking proofs of the protective power of vaccination is that which has been repeatedly afforded by cases in which pregnant vaccinated women were the means of passively conveying the variolous infection to the fœtus in utero, themselves remaining entirely unaffected by it.[2] But this general immunity of the vaccinated from small-pox is such an established and admitted fact, that in a professional work it would be idle to dwell upon it any longer.

(b) **By modifying the course of the Small-pox, or otherwise diminishing its danger, in those in whom the protection has not been absolute.**—The modifying power of vaccination—its power of so altering the course and character of small-pox as to convert it from a disease usually severe, confluent, and in a large proportion of cases fatal, into a

[1] Papers relating to the History, &c. p. 119.

[2] See a Paper by Jenner in Medico-Chir. Trans. vol. i. ; Rapport de l'Acad. Roy. de Médecine, 1842 ; ibid. 1846. Some cases of this kind were communicated to the Small-pox Committee of the Epidemiological Society. The same occurrence has been noted in women protected by having had small-pox.

disease for the most part slight, unimportant, and void of danger—is equally well established. The degrees in which small-pox may be modified by vaccination are various, depending on various circumstances, but chiefly, as we shall see presently, on the way in which the vaccination has been done. There may be absolutely no eruption at all, the disease being cut short in the stage of primary fever—"febris variolosa;" or there may be a mere efflorescence, without papulation or vesiculation; or there may be a few scattered vesicles; or a full discrete eruption, or an eruption which is semi-confluent or confluent, but yet which is modified in its course. Modification, indeed, does not occur in *all* cases of post-vaccinal small-pox: in some, particularly where the vaccination has been imperfect, the small-pox is observed to run its usual course. The following table will show in what proportion cases of post-vaccinal small-pox were found to be modified or unmodified, in the practice of the Small-pox Hospital of London from 1836 to 1851 inclusive, as compared with the disease when it occurred in unprotected persons:—

Per 100 Patients of each class respectively.	Eruption of Small-pox unmodified.				Eruption of Small-pox modified.			
	Confluent.	Semi-confluent.	Distinct.	Total.	Confluent.	Semi-confluent.	Distinct and Varicelloid.	Total.
Unprotected . . .	68.6	22.5	6.3	97.4	0.635	0.635	1.32	2.6
Vaccinated with mark or marks .	15.3	8.3	3.2	26.8	17.5	15.0	40.5	73.0

But even in a large proportion of the cases in which the *course* of the eruption was apparently unmodified by the

vaccination, the controlling power of that process (imperfect as the vaccination had in most instances been) still manifested itself in the death-rate, which in the *unmodified natural* cases was very nearly the double of what it was in the *unmodified post-vaccinal* cases (38 per cent. of attacks, as compared with 21 per cent.). In the *modified* cases, the death-rate scarcely exceeded 1½ per cent. Hence, when the total mortality arising from small-pox in the Hospital in the patients who were unprotected was compared with the total mortality of the disease in those patients who had any mark of vaccination (all cases of superadded disease being deducted from either of the two classes), it was found that in the former it was nearly seven times as great as in the latter, that the death-rate of natural small-pox was in fact 35.55 per cent. of the cases, while the death-rate of post-vaccinal small-pox was but 5.25 per cent.[1] A similar difference is met with whenever and wherever small-pox prevails. While, as has been before stated (§ 81) the mortality of natural small-pox is seldom below 20 per cent. and often greatly exceeds that rate,[2] post-vaccinal small-pox, as recorded by observers who have been careful not to include cases of varicella, is fatal in proportions varying from 3 to 5 and 6 per cent. only.[3] Not

[1] Marson in Medico-Chir. Trans. vol. xxxvi.

[2] *E. g.* in the Edinburgh epidemic (1818-9), 24.3 per cent.; in an epidemic at Chelsea (1838-9), 27.9 per cent.; in one at Wandsworth (1844-5), 27.5 per cent.; in five epidemics at Copenhagen (1824-35), 25.7 per cent.; in the practice of the Glasgow Infirmary, 31.7 per cent. (Seaton, Protective Power of Vaccin. &c., Sanitary Review, vol. ii. p. 354.)

[3] The returns to the Epidemiological Society, when summed up, gave the death-rate of post-vaccinal small-pox as about 3 (2.9) per cent., and many of the deaths on which this rate was calculated were not really from small-pox, but from superadded disease. But these returns included a number of cases of the post-vaccinal small-pox *of*

to dwell on a point which really does not admit of dispute, and which will besides be abundantly illustrated in the course of this chapter, it will be sufficient here to state that, of 658 cases of post-vaccinal small-pox which occurred during the six years 1859-65, among the troops stationed in the United Kingdom, thirty-eight only, or 5.8 per cent., were fatal; and that, in observations which have particular value on account of the large scale on which they were made—viz. those made for twenty-one years in Bohemia, on four millions of people—the death-rate among vaccinated persons who happened to contract small-pox was found to be but $5\frac{1}{16}$ per cent., while the death-rate from the same disease in persons who were unprotected was $29\frac{4}{5}$ per cent.

91. Testimony of the Medical Profession as to the Protective Power of Vaccination.—The Epidemiological Society, in the course of the inquiry it instituted, in 1851-2, into the state of small-pox and vaccination in England, elicited from nearly 2,000 medical practitioners the results of their experience as to the protective value of vaccination. Various differences of opinion were expressed by these correspondents with regard to the exact extent to which, and the time during which, the successful vaccination of a person was protective against small-pox, some holding this protection to be much more absolute and durable than others did; but there was the utmost unanimity of expression respecting the existence of the protective power, and there was not a single practitioner who did not look on vaccination as a practice which ought to be universally adopted. And when, some years later, the

childhood (almost always a trivial affection). In comparing the records of different observers with regard to the fatality of post-vaccinal small-pox, this is a point that must not be overlooked.

Medical Officer of the then Board of Health (now the Medical Officer of the Privy Council) addressed to distinguished members of the medical profession, at home and abroad, the question, "Have you any doubt that successful vaccination confers on persons subject to its influence a very large exemption from attacks of small-pox, and almost absolute security against death by that disease?"—of 542 respondents, only two expressed any doubt whatever.[1]

92. Circumstances which influence the Protective Power of Vaccination.—Various circumstances exercise more or less of influence on the protective power of vaccination. The principal of these are (*a*) the quality of the vaccination, (*b*) the age of the individual, (*c*) personal, hereditary, or family susceptibility, (*d*) change of climate, (*e*) frequency and extent of exposure to infection, (*f*) intensity of epidemic influence. Each of these demands separate consideration.

(a) **Quality of the Vaccination.**—It need, one would suppose, scarcely be said that no case of small-pox should ever be recorded as post-vaccinal, until the practitioner has taken care to ascertain that the vaccination has been an effectual one. My experience, however, shows me that this care is by no means always taken. I have repeatedly known cases of small-pox put down as post-vaccinal on the mere statement of the parents or the patients that "they had been vaccinated,"

[1] One of these gentlemen distrusted vaccination, and "would gladly inoculate his own children with small-pox;" according to the other, the eccentric Dr. Hamernik, of Prague, neither cow-pox nor small-pox, when once passed away, has any influence on future events, and a person who has had small-pox itself is no more protected thereby against future attacks than he would have been by, say, an attack of measles! (Preface to Papers relating to the History, &c. p. lxxx., and Papers, p. 127, seq.)

without any inquiry being made as to the results of the operation—cases in which a few questions, subsequently put, elicited at once that the vaccination had not taken effect at all. The terms "vaccination" and "vaccinated," as popularly used, so frequently refer to the mere performance of the operation irrespective of its results,[1] that, in any case of small-pox in a child or other person said to have been vaccinated, the practitioner should never omit (1) to get the best information he can as to what the immediate results of the operation were, and (2) to examine for himself the character and the number of the cicatrices. The typical character of the cicatrix is our best available test, and it is a most reliable one, of the vaccination having been genuine and perfect.[2]

In order that persons should have from vaccination the fullest protection against small-pox which it is capable of imparting, it is necessary that the vaccination should not only be perfect in character, but that it should be sufficient in amount—that the system should not only be

[1] This is one of the reasons of the erroneous entries respecting vaccination frequently occurring in the Death-Registers; see *postea* (p. 224, note 2); see also *ante* (p. 106, and note) as to another source of error, and the points for inquiry when the alleged vaccination has been of recent occurrence.

[2] Foveated cicatrices, closely or exactly resembling the vaccine, may occasionally arise from other causes than vaccination; but it is rare indeed for them to be seen on the spots on which vaccination would have been performed, unless as the result of that process: and though, in above 100,000 observations, I have met with here and there a case in which, on superficial examination, I might have hesitated, I do not remember one in which, by a little attention, I was not able to discriminate. On the other hand, cases are more frequent in which, though the vaccination has gone through a complete and satisfactory course, the cicatrices left are, after a time, indistinct or imperfect. But these cases are still quite the exception, and do not affect the validity of the rule laid down in the text.

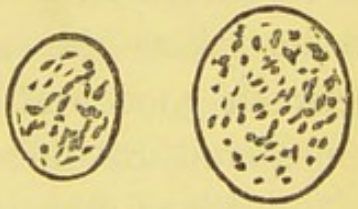
infected, but that it should be well infected. By observations, of unsurpassable interest and value, made for upwards of thirty years at the Small-pox Hospital, it has been demonstrated that the extent to which small-pox, if it should be contracted at all after vaccination, is modified by the vaccination, is determined by the character and number of the cicatrices; that it is in the exact ratio of the excellence and completeness of the vaccination, as determined by these tests. Persons whose vaccination has resulted in their having one genuine vaccine vesicle, and one only, are, as a class, much less protected than those who have had two, those who have had two than those who have had three, &c.; and the protection against fatal small-pox which is afforded by four or more genuine vesicles is almost absolute. The subjoined table, giving the results of Marson's observations on nearly 5,000 post-vaccinal cases which occurred in the twenty years from 1836 to 1855 inclusive, will show, at a glance, the influence exercised on the course of small-pox by the character and number of the vaccine marks :[1]—

Classification of Patients affected with Small-pox.	Number of Deaths per cent. in each class respectively.
1. Unvaccinated	35
2. Stated to have been vaccinated, but having no cicatrix	23·57
3. Vaccinated—	
a. Having one vaccine cicatrix	7·73
b. Having two vaccine cicatrices	4·70
c. Having three vaccine cicatrices	1·95
d. Having four or more vaccine cicatrices	0·55
α. Having well-marked cicatrices	2·52
β. Having badly-marked cicatrices	8·82
4. Having previously had small-pox	19

[1] Art. "Small-pox" in System of Medicine, ed. by J. R. Reynolds, M.D. vol. i. pp. 448 and 473. The death-rate among those having

It is in the classes which had only one or two cicatrices that the influence of *character* of the cicatrix was most remarkably seen. In those who had one cicatrix only, if this cicatrix were thoroughly well marked, the death-rate per cent. was 3.83 ; but among cases in which the single cicatrix was badly marked, the death-rate was 11.91 per cent. And while among cases which had two well-marked cicatrices the death-rate per cent. was 2.32, among cases which had two badly marked cicatrices the rate was 8.34.

It is probable that a modification of Marson's observations which should have taken into account the area, as well as the number, of the cicatrices, would have told still more for character as distinguished from mere number of marks. No size of cicatrix will convert a bad one into a good one, nor is any kind of mark to be more distrusted than a large one, if it be smooth and irregular : but, on the other hand, it is impossible that two cicatrices of typical character like these should represent the same amount of local effect, or that it can make any difference whether the two or three vesicles which must have combined to produce the larger of these marks, should have been produced together on one spot of the skin, or singly on two spots.



Recurring, however, to Marson's observations as they stand, we see at once that the statement previously made, that in the Small-pox Hospital post-vaccinal small-pox was fatal in from five to six per cent. of the cases that occurred, requires a great deal of qualification. It is true in the gross, if we take good and bad vaccination

previously had small-pox is not given in this Article, but is taken from Marson's Paper in Medico-Chir. Trans. vol. xxxvi.

together, but in the gross only. It represents much too favourably the results of bad vaccination, and much too unfavourably the results of good vaccination. Let an unvaccinated person contract small-pox, and the chances are more than one in three that he dies ; let a very badly vaccinated person (a person with one imperfect cicatrix) contract small-pox, and the chances are not quite one in eight that he dies ; let a person with two good vaccine cicatrices have small-pox, and his chances of dying are less than one in forty : but persons who have been vaccinated in the best and most complete way will, if they ever get small-pox afterwards, not die of it at the rate of much more than one in two hundred. The small-pox death-risks of no-vaccination are to the death-risks of the very worst vaccination as three to one, to the death-risks of the best vaccination as seventy to one : and a well-vaccinated person has not one-twentieth part the risk of dying of small-pox that a badly vaccinated person has. Nor is the death-risk the only thing to be taken into account in estimating the difference between good and bad vaccination ; there is also to be considered the difference in the amount of suffering and in the risk of disfigurement.

"Small-pox after vaccination," says Marson, "has, in fact, various degrees of severity and modification : from the slightest form, in which there is none, or hardly any eruption at all, to the most severe confluent cases, closely, almost exactly, resembling the disease in the unvaccinated ; and it also assumes the petechial and malignant types after vaccination, just as in the unvaccinated state. All this depends in a great measure on the way in which patients have been vaccinated. Those who have been fortunate enough to have been vaccinated in four or more places with lymph that leaves

good, easily perceptible cicatrices, have almost invariably a slight form of small-pox when it occurs; but those who have only one or two marks from vaccination, such as are hardly visible, will probably have a severe form of the disease; and those who have no marks at all are in still worse circumstances. Now, although this rule holds good *generally*, almost *invariably*, still it is not an invariable rule; and perhaps more exceptions will be found—we may say, will certainly be found—in those who have been indifferently vaccinated, than in those who have been well vaccinated. Persons seemingly indifferently vaccinated will oftener afterwards have a light form of small-pox than well-vaccinated persons will have a severe form of the disease. So far it is fortunate. But what we contend for, and always have contended for, is that, if possible, all should be vaccinated in the *best way;* at least the attempt should be made to vaccinate all in the best way, that there should be as little as possible of haphazard vaccination, done with a view that if the operation takes effect badly it can be done again. By such a proceeding persons often take vaccination badly, and cannot be made to take it properly afterwards; the imperfect success prevents its taking fully again, and yet some day they may take small-pox severely, and perhaps die of it. Every effort should therefore be made that there may be as few imperfect vaccinations as possible."[1]

The necessity of thoroughly infecting the system in vaccinating had been inculcated by many before Marson. But it is to him that we owe the complete demonstration of this necessity: and the importance of his labours it is impossible to exaggerate. It is a thing to be thankful for, that the resources of the Small-pox Hospital—the

[1] Art. "Small-pox" (*op. cit.*), p. 472.

only field of observation, I think, in which any inquiry of this kind could ever have been carried to such a complete demonstration—should have fallen to hands so competent to turn them to account. And, now that the fact is established, it is not too much to affirm, that no practitioner will have done his duty in any case in which he is called upon to vaccinate, unless, besides taking all requisite precautions with regard to the genuineness of the lymph he employs and the means of insuring success, he has also taken care to vaccinate sufficiently, *i.e.* to produce, so far as in him lies, four or five genuine good-sized vesicles, such as result from separate punctures; or if vaccinating otherwise than by separate puncture, to produce equivalent local results.

Whether the amount of local effect produced in vaccinating has the same relative influence in altogether *preventing* the occurrence of small-pox afterwards, that it has been proved to have in modifying the character of the small-pox if it should be contracted—whether persons with four good cicatrices are more able to *resist any* action of the variolous infection, than persons with only one good cicatrix—there are not facts sufficiently numerous and precise to determine. Analogy would lead us to believe that it must be so: and facts, so far as they go, tend to confirm the belief. An attempt was made in 1851-2, by the Epidemiological Society, to throw some light on this question by inquiring of medical practitioners as to the marks they personally had of vaccination, and as to their having suffered or not from any form of variola subsequently. But the replies given were too few in number, and, in some instances, too vague in their information, to justify any positive conclusion being drawn. Out of 347 practitioners who stated that they had been vaccinated in

childhood, 44, or 12.6 per cent., said that they had subsequently contracted some, generally the most modified, form of variola; but these included some cases in which the variola, as it was called, had been a mere local affection taken by inoculation from small-pox corpses in the dissecting-room. Some of the 347 practitioners had no cicatrix of their vaccination; in others the cicatrices were imperfect, or were only one or two in number: but 57 of them had three or more good vaccine marks; and of these 57, only two, or 3.5 per cent., had had subsequently any form of variola.[1] In 1863, during the epidemic of small-pox then raging in London, Dr. Buchanan and I, in the course of an examination of upwards of 50,000 children in national and infant schools, workhouses, &c. with the view of ascertaining what proportion were unvaccinated, what proportion had been vaccinated, and how, among these latter, the vaccination had been done, took occasion also to note how far the children, in each of these classes respectively, had marks of small-pox. Forms of variola which any of the children might have had, which left no traces whatever behind, we were obliged to leave out of account, because, unless we had carried our inquiries to the homes of the children, it would have been impossible to ascertain precisely the number of such cases. They had been comparatively very few: but among the vaccinated children there had been some. Hence the investigation did not give us exactly the information we had been desirous to obtain as to the relative effect of different kinds of vaccination in *absolutely* preventing

[1] Seaton on the Protective Powers of Vaccination (*op. cit.*), p. 351. It deserves note that this proportion very closely corresponds with the proportion in which those who were protected by variolous inoculation had small-pox afterwards.

any manifestation of the action of the variolous poison —the totally preventive, as distinguished from the modifying, power. But it brought out very strongly the different degrees in which different kinds of vaccination control small-pox. The following were the results of our observations :—

Classification of Children.	Number examined of each class.	Number in each class that had traces of Small-pox.	Proportion having traces of Small-pox, per 1,000 children, in each class respectively.
1. Without any mark of Vaccination	2,837	1,010	360
2. With doubtful mark of Vaccination	508	30	59
3. With mark or marks of Vaccination	49,570	88	1.78

And, on further classification of the vaccinated children with reference to the kind of vaccination, the results were these :—

Classification of Vaccinated Children.	Proportion having Marks of Small-pox, per 1,000 Children, in each class respectively.
a. Having one vaccine cicatrix	6.80
b. Having two vaccine cicatrices	2.49
c. Having three vaccine cicatrices	1.42
d. Having four or more vaccine cicatrices . .	0.67
α. Having cicatrix or cicatrices of bad quality .	7·60
β. Having cicatrix or cicatrices of tolerable quality	2.35
γ. Having cicatrix or cicatrices of excellent quality	1.22

The extremes were represented by children having four or more vaccine marks of perfect character, of whom only

0.62 per 1,000 had a trace of small-pox, and children having a single vaccine mark of bad quality, of whom we found 19 per 1,000 with marks of small-pox. But these numerical statements by no means bring out the whole difference that existed between the vaccinated and the unvaccinated, or between the well-vaccinated and the ill-vaccinated. For the marks which small-pox had left on most of the vaccinated children, and particularly on the well-vaccinated, were very slight—such as without some care might have passed undetected—and in only exceptional cases were in the least disfiguring : while of the unvaccinated, a very large proportion were seriously marked and disfigured, some being really hideous to look at, and several suffering from permanent blindness and deafness, the consequences of the small-pox.

It has often occurred to me that probably the returns of the army, in which service no doubt both the character and number of the vaccine marks presented by each recruit on entering are exactly recorded, may eventually give us data for determining precisely to what extent the *amount* of vaccination imparted to individuals determines their relative subsequent immunity from *any degree* of action of the variolous poison.

(b) Age.—It is a mistake to suppose that post-vaccinal small-pox may not take place in early childhood, or within a comparatively short period from vaccination. In those in whom that process has not completely exhausted the susceptibility to variola, the modified effects of the variolous infection may manifest themselves at any period—even, as Willan showed, within a few weeks or months of the vaccination.[1] In the returns made to the Epidemiological Society in 1852, many cases

[1] Willan on Vaccine Inoculation.

of post-vaccinal small-pox in children under ten years of age were included—occurring at various intervals after the vaccination. But the modified small-pox of young children is generally a very trivial affection, and of the light varicelloid form. In some cases it is not indeed the disease small-pox at all, but a mere local affection, without the usual premonitory symptoms of small-pox, resulting from inoculation by sleeping with, or playing with, children infected with the disease. In others, when it arises from infection, there may, probably with severe premonitory symptoms, be half a dozen, or a dozen, or two or three dozen pustules only, running a modified course: or the eruption may in some cases be more copious but still modified. And severe cases at this early period of life are very rare. "We have satisfactory evidence," says Dr. Gregory, "that under fifteen years of age the deaths by small-pox after vaccination are scarcely noticeable;"[1] and Marson also, speaking from his unequalled experience, tells us that among children under 14 years of age, who have been vaccinated, small-pox hardly ever proves fatal.[2] After the change of system

[1] As quoted by Simon, *op. cit.*, p. lxix.

[2] Petition to the House of Commons in Papers relating to the History, &c. (*op. cit.*), p. 25. Exceptions to this rule are often more apparent than real—death, when it does occur, being due, not to small-pox, but to some concurrent or superadded disease. I may notice that the not infrequent entries in our death-registers of death from "small-pox after vaccination," in young children of all ages, often when only one, two, three, four years old, are almost invariably incorrect and misleading. Some years ago, on personal investigation of a number of these entries, with a view to ascertain their real value, I found that in every case included in my inquiry, except one, either (1) there had been no attempt at vaccination, the parent having given a false answer to the Registrar's question, under fear that he should be subjected to penalty if he gave the true one; or (2) that vaccination had been indeed attempted, but had never

which takes place at puberty, not only is post-vaccinal small-pox of more frequent occurrence, but the disease, though still in the immense majority of cases light and modified, runs in some cases a severer modified, and in some an unmodified, course—depending chiefly, as has been seen in the preceding sub-section, on the quality of the vaccination. The table given at page 211, showing the different forms in which post-vaccinal small-pox manifested itself at the Small-pox Hospital, may be taken as referring substantially to cases after puberty, the post-vaccinal cases received for treatment in the Hospital before that period of life being comparatively very few.[1] This much more frequent occurrence of severe post-vaccinal small-pox in persons who are grown up than in children, has been held by some to give countenance to the hypothesis that the influence of vaccination in the individual is but temporary, that it diminishes by lapse of time, and tends gradually to wear out:[2] and there have been all sorts of

taken effect; or (3) that the vaccination had been performed while the patient was incubating small-pox. One child only, between 11 and 12 years of age, whom the mother stated to have been successfully vaccinated when an infant, and to have retained a mark on the arm, appeared to have died of the hæmorrhagic form of small-pox. As the child was buried I had no opportunity of seeing the mark, and the doctor who attended the case had never thought of looking at it.

[1] There are obvious reasons why young children affected with small-pox, especially if the disease be not severe, would be treated at home rather than sent to a hospital: still, in the years which the return includes (1836-51), a great number of *unprotected* young children were admitted.

[2] The hypothesis itself dates from the earliest days of vaccination, before there could be facts to establish it. The same hypothesis had been advanced with regard to variolous inoculation, by the opponents of that practice. Jenner had answered it, as regards cow-pox, by anticipation in his "Inquiry," showing that milkers who had

arbitrary assumptions that vaccination holds good for seven years, or for ten years, or for fourteen years, &c. Dr. Gregory pointed out, upwards of thirty years ago, that no real grounds had ever been shown for the doctrine thus propounded, and the facts which have since accumulated satisfactorily prove that it is not *in this way* that the greater frequency and severity of small-pox in vaccinated persons after puberty than in childhood is to be explained. For, if the influence leading to this result consisted in a mere wearing out of the protection by lapse of time, it would be steadily progressive, and in observations on large masses of vaccinated populations at different ages we should find the liability to small-pox becoming greater, the greater the age, or the longer the time that had elapsed since the performance of the vaccination. But that this is not the case is shown by observations made for a long series of years on the troops of the British Army serving in the United Kingdom; for while the deaths from small-pox among every 10,000 soldiers serving under twenty years of age were 3.4, and among every 10,000 soldiers from twenty to twenty-five years old were 3.1, the deaths from this cause among soldiers above twenty-five years of age were but 1 per 10,000.[1] In like manner, the great bulk of admissions of cases of post-vaccinal small-pox into the London Small-pox Hospital is found to take place between the ages of fifteen and twenty-five: after the age of twenty-five there is a remarkable diminution.[2] And, correspondingly, observations which were collected by Heim

contracted the cow-pox thirty or forty years before were as safe as those recently infected.

[1] T. G. Balfour, on the Protection against Small-pox afforded by Vaccination, in Medico-Chir. Trans. vol. xxxv.

[2] Marson in Medico-Chir. Trans. vol. xxxvi. table v.

of 1,055 cases of small-pox in vaccinated persons, with special reference, not so much to the age of the individuals, as to the number of years that had elapsed since the vaccination, showed that while the average annual number of cases in the first twelve years after vaccination was twelve, and in the next thirteen years was over fifty-one, the average for the following ten years was under twenty-five. The facts find their best explanation, as Dr. Gregory suggested, in the disturbing influence of puberty, and they point to the importance of renewing the vaccine process after that change has taken place.

(c) **Personal, Hereditary, or Family tendency.**—Some persons appear to be peculiarly susceptible of the action of the variolous poison. I have alluded before to recorded cases of persons having small-pox three times and oftener. A friend of my own, one of the most careful and observant of practitioners, saw a case of small-pox in a vaccinated person, and saw this attack succeeded after an interval of years by another attack: and I have been furnished with notes of a case of a naval officer who was vaccinated in infancy, got confluent small-pox in South America, and had another confluent attack afterwards at Bath. One vaccinated medical practitioner of my acquaintance gave, on each epidemic of variola to which he had been exposed, some manifestation of the action on his system of the variolous poison, though once it amounted only to an efflorescence following on the premonitory symptoms, and once was altogether limited to the premonitory symptoms. But the misfortune is, that we have no outward signs whereby to recognise beforehand these particularly disposed individuals. If a dozen children be vaccinated, and the vaccination go through its course regularly in all, we know for certain that nine, ten, or eleven of them will be

safe for life against *any* assault of small-pox, while possibly in one, two, or three the susceptibility to *some degree* of future action of the variolous infection may remain : but there is nothing to tell us beforehand which are the permanently and completely, and which the less completely, protected. One thing, however, which would lead us to anticipate a special liability to post-vaccinal small-pox, would be the previous occurrence of such an event in more than one member of the family. There can be no doubt that the variolous diathesis exists more in some families than in others. Dr. Kendrick of Warrington, in an account of 434 cases of post-vaccinal small-pox with which he favoured the Epidemiological Society, noted that 276 of these were single cases, no other members of the family being attacked, but that there were 37 families which had 2 cases, 13 which had 3, 7 which had 4, 2 which had 5, and 1 which had 7 cases ; and in a similar communication of 125 cases of post-vaccinal small-pox, Mr. Grove, of Wandsworth, related that 28 only were single cases, there being 14 families which had 2, 10 which had 3, 7 which had 4, 1 which had 5, and 1 which had 6 cases.[1] Mr. Marshall has recorded the circumstance of twelve brothers and sisters, of ages varying from five to twenty-four years, all of whom had been vaccinated when infants, being all attacked together, during an epidemic of small-pox, with the mildest and most modified form of that disease ; the father and mother also sustaining a mild attack, though the former had been twice vaccinated with

[1] Of course, in the different families inquired into, whether by Dr. Kendrick or Mr. Grove, there were differences in the degrees of exposure to infection, some persons being much more careful as to isolation, &c. than others, but this did not explain the whole difference.

effect, and the latter had had small-pox when she was five years old; the only person in the family who escaped was the grandfather, who was seventy-eight years old, and who had been vaccinated at the age of forty-eight. He also states that during the same epidemic in which he witnessed this occurrence, he attended no fewer than five cases of second small-pox, four of which were in two branches of the same family.[1] Simon relates a case, communicated to him, of three brothers, vaccinated in infancy, who all contracted small-pox subsequently, one by infection from without and the other two by infection from him, when their ages were respectively thirteen, eleven, and seven years, and who all had a further attack some years afterwards. He gives, on the authority of Dr. Arnott, a case of post-vaccinal confluent small-pox, in a patient whose father had had small-pox twice, and an uncle three times, another uncle having died from a first attack of the disease; and he refers to an instance of three brothers and sisters having post-vaccinal small-pox, one of them once, another twice, and the other three times, the third attack in the last proving fatal.[2]

Medical friends have, on various occasions, informed me of cases—especially during the severe epidemic of small-pox which has prevailed since 1863—in which, while some members of families were suffering from post-vaccinal small-pox, some other member of the family, who had had small-pox before by inoculation or otherwise, had been again affected with that disease. And several instances have come to my knowledge in

[1] Mr. Marshall in *Lancet*, vol. xxxvi.

[2] Simon, Preface to Papers relating, &c. (*op. cit.*), p. xxx. The last case is reported by Dr. Webster in the *Lancet*, vol. i. for 1851, p. 271.

which *brothers* vaccinated in infancy have each soon after puberty had post-vaccinal small-pox.

(d) **Change of Climate.**—The protection which vaccination gives against small-pox is seen in all races of mankind, and in all climates (§ 94); but *change* from one climate to another, when that change involves considerable variation of temperature, would seem to render vaccinated persons in many instances more susceptible of small-pox. It is certainly often noted that persons get that disease soon after passing from a temperate to a tropical or very hot region—as from England to India—or *vice versâ*, especially when the cicatrices are not very well marked. The influence of climatic change is evident, I think—though it is impossible to separate it from the influence of other, and no doubt more powerful, causes (especially those to be noticed in the next sub-section)—in the much more frequent occurrence of small-pox among our soldiers employed in China, and among our sailors serving in China and Japan, than in any other section of the British army and navy. While the small-pox cases in the entire British navy, during the six years 1859-64, were but 4.2 per 1,000 of the mean force; and on the whole force, *if we except the East India and China squadron*,[1] were but 3.1 per 1,000, the cases in that squadron exceeded 13 per 1,000.[2] And during the same six years, while the

[1] By an alteration which took place early in 1864, the East Indies were detached from the China station and added to the Cape of Good Hope command. But "the force employed in the East Indies had always been so very small that, practically, its withdrawal from one station and its addition to the other has had little or no effect, in a statistical point of view, on the returns of either." (Statistical Report of Health of Navy for 1864.)

[2] The difference is probably not so great as these numbers would show, because some of the cases of small-pox, both at home and

cases of small-pox among the troops serving in the United Kingdom were less than one and a half per 1,000, they amounted among the white troops in China to nearly 6 per 1,000.[1] The black troops in China suffered very little from small-pox, the ratio of small-pox cases among them having during the six years been considerably less than one per 1,000 of the force.[2] This arose mainly from difference of stationing, exposing them much less than the whites to the infection of that disease, especially during the epidemic year 1862, which year alone supplied about half the total number of the cases that occurred in the entire force during the whole period. But climatic change had probably, too, its influence: for the general health of the black troops was much less affected by the change of climate than that of the whites.

But change of climate has probably a much greater and more decided effect in influencing the course and character of post-vaccinal small-pox, if contracted, than in disposing the system to contract it. Of 658 cases

abroad, occurred in individuals not vaccinated, and it is fairly presumable that, in the event of men joining who were unprotected, there would be more difficulty in getting vaccination done on the China station than on the Home or many other stations. The Navy is not, as regards small-pox, an *entirely* protected force. The admirable statistical returns, yearly published, frequently mention, in cases of small-pox, that the persons had *not* been vaccinated. But unfortunately the surgeons of a very large number of ships, in their returns of small-pox cases, omit to give any definite and reliable information with regard to vaccination.

[1] The soldiers both in the United Kingdom and in China were an *entirely* protected force. The cases of small-pox in China in the six years were 135; all the individuals attacked had marks of vaccination except two, and these had marks of former small-pox. One of these two died.

[2] See Appendix I., Tables F and G, showing the local distribution of small-pox cases and deaths in the British Army and Navy.

of post-vaccinal small-pox among the troops in the United Kingdom, from 1859 to 1864, 38 were fatal, or 5.8 per cent. (p. 244); but of 614 cases of small-pox among the troops in India, from 1860 to 1864, 90 were fatal, or 14.6 per cent. (p. 249); and of the 133 post-vaccinal cases in the China force, from 1859 to 1864, 20 were fatal, or 15 per cent.[1]

The influence of change of climate in disposing to small-pox is noticeable in persons protected by variolous inoculation, or by previous natural small-pox, as well as in the vaccinated. In them also, Marson tells us, the disposition to contract the disease a second time is promoted by any great climatic change, whether from a hotter to a colder, or from a colder to a hotter region.[2]

(e) **Frequency and Extent of Exposure to the Variolous Infection.** — The influence which these must exercise is obvious. Whatever the protection, or non-protection, of individuals, they cannot contract variola unless they come in contact with its specific cause. Hence our soldiers and sailors employed on various foreign stations, from which small-pox is sometimes absent for long periods together, suffer much less from that disease than those who are employed at home, who are mostly quartered in, or stationed near, large towns, where the infection of small-pox is often prevailing. In Australia and New Zealand, no case of small-pox has occurred either in the army or navy for a long series of years. Again, also, where small-pox is present, the *degrees* of exposure may vary infinitely.

The Registrar-General for Scotland, in his annual

[1] Specific information on the quality and amount of the vaccination in these cases would have been most important: but the facts in the text point to the extreme necessity of renewing the vaccine protection after great climatic change.

[2] Art. "Small-pox" (*op. cit.*), p. 452.

reports, classifies the small-pox mortality of that kingdom in a way which gives a good general illustration of the effect of *frequency of exposure* to the variolous contagion. He compares each year the small-pox deaths occurring among the population dwelling in the islands of Scotland, in the rural districts of the main-land of Scotland including small towns and villages, and in the towns of 10,000 inhabitants or more. The following table, which I have compiled from these reports, shows the results for ten years, per 100,000 of the population, in each class of district :—

Year.	Small-pox Deaths per 100,000, living		
	In Insular Districts.	In Rural Districts and Small Towns.	In Towns of 10,000 Inhabitants or more.
1855	17	34	75
1856	11	26	84
1857	16	11	61
1858	6	8	17
1859	5	10	46
1860	21	33	83
1861	4	16	44
1862	1	6	27
1863	10	37	87
1864	19	48	78
Totals. .	110	229	602

There is no reason whatever for supposing that the insular and rural districts are better vaccinated than the large towns : the probability is that it is just the

reverse. Their small relative mortality from small-pox is due to their being much less exposed to the infection. In the large towns of England, it is a matter of daily observation that much of the small-pox met with occurs in unvaccinated persons who have immigrated from rural districts.

Extent of exposure to the small-pox infection is of no less consequence than frequency of exposure. The degree may vary from the merest chance contact with an infected person or thing, to the occupying the same house, room, or bed, with a variolous patient. Interesting inquiries have at times been made, as to the protection which vaccination afforded to persons exposed to the small-pox infection in the utmost degree. Mr. Cross, of Norwich, during a severe epidemic of small-pox which prevailed in that city in 1819, noted what took place in 112 families, in which he had, between the months of March and August, attended above 200 cases of small-pox, there being at least one case in each family. The following are the results of his observations, reduced to a tabular form:

Protection or non-protection of Individuals.	Number of Persons.	Cases of Small-pox.	Deaths from Small-pox.
1. Protected by former Small-pox	297	—	—
2. Protected by Vaccination	91	2	—
3. Unprotected	215	200	46
Totals in the 112 infected households	603	202	46

The 91 vaccinated persons were continually in the same rooms, and many of them occupied the same beds, with variolous patients, and the only two individuals

amongst them who took the small-pox had it in its most modified form. At the time the epidemic was at its height, Mr. Cross extended his inquiries to families in parts of the town with which he was little acquainted, and found that, "in 31 families, those who had had cow-pox were living in the same room, or lying in the same bed, with others suffering or dying from natural small-pox, yet remained perfectly safe, with the exception only of one child, whose mother reported that it had *ten* pustules." In the whole inquiry 77 families were met with in which the vaccinated *lived in the same room* with small-pox: and not one individual amongst them had any serious disease, and not above one in thirty had any eruptive disease at all.[1] In 1838-9, Mr. Marshall of Chelsea made inquiries respecting 757 persons, who during an epidemic of small-pox which then prevailed in that parish had been exposed in an excessive degree to the contagion, inasmuch as they were all members of infected families, and a large proportion of them had occupied the same rooms with the small-pox cases. Of the 757 persons, 231 were stated to have been vaccinated, and, of these, 27 had suffered from small-pox in some form during the epidemic. Of the remaining 526, Mr. Marshall does not state how many were protected by previous small-pox, or were without protection: but he tells us that of those who were unprotected only 7 escaped attack during this outbreak. There were among the 526 individuals fourteen alleged cases of second

[1] Cross, A History of the Variolous Epidemic which prevailed in Norwich, &c.: 8vo. Lond. 1820. A very interesting and valuable work. In all the cases in which vaccination had been performed, Mr. Cross examined the cicatrices. During the epidemic, *several hundreds* of persons vaccinated, at times varying from the earliest period of the practice to within a few weeks, were tested by variolous inoculation, without the production in any instance of the regular small-pox.

small-pox, the character of the attack in these, as compared with the post-vaccinal cases, being as follows :—

Second Small-pox.		Post-Vaccinal Small-pox.	
Mild Cases	7	Mild cases, unattended with fever, with a few isolated pustules, varying in number from 2 to 70. . .	22
Severe cases, but recovered	4	Modified, attended with constitutional disturbance, but recovered	4
Severe cases, fatal . .	3	Fatal	1
	14		27

The number of alleged cases of second small-pox is so extraordinary, that we can hardly suppose but that there must have been some error of statement to Mr. Marshall with regard to some of them. Five, however, passed under his own observation, four of these being, as already stated (p. 229), in two branches of the same family.[1] Dr. Paine, of Cardiff, during a most severe epidemic of small-pox which prevailed in that town in 1857, made inquiry respecting 1,722 persons living in four streets in which the disease particularly prevailed. Of these persons 1,011 were adults, of whom only 8 contracted small-pox, and 711 were children, of whom 88 contracted small-pox. And respecting the children the following further particulars were made out :—

Protection or non-protection of Individuals.	Number of Children.	Cases of Small-pox.	Proportion per cent. infected.
1. Protected by former Small-pox	33	—	—
2. Protected by Vaccination	608	18	2.96
3. Unprotected	70	70	100

[1] *Lancet*, vol. xxxvi.

The vaccinated children, in many instances, occupied the same rooms, and frequently the same beds, with small-pox cases; and in every one of the 18 among them who were in any degree infected, the disease was exceedingly modified.[1]

Probably the extreme of closeness and constancy of exposure is to be found on board an infected ship: for (1) the cubic sleeping space that can be allowed to each person on board ship is necessarily very limited: and (2) whatever endeavours may be made to isolate infected individuals, when once the atmosphere of a ship has become variolated, there is no escape from it, it must always be breathed. Persons on shore living in infected houses or rooms can generally, at all events for some hours in the day, get away from the specially infected air of the house or room: but there is no running away from the infected air of aboard ship. Where such an atmosphere has to be constantly breathed by adults, whose systems may probably at the same time be particularly predisposed to infection from the action of climatic change and of epidemic influence, the value of a single vaccination in infancy or early childhood is perhaps put to the severest test that can be applied to it. On Dec. 4, 1860, small-pox made its appearance on board H.M.S. the *Impérieuse*, then at anchor off the Peiho, but which sailed that very day for Japan. A fortnight afterwards (Dec. 18), when the ship was at anchor off Nagasaki, two other cases broke out, and these were followed by others in rapid succession till the 25th of January, 1861, after which date no case occurred. Of the 505 men and officers who constituted the force of the vessel, who were nearly all, but

[1] Fifth Annual Report on Sanitary Condition of Cardiff. 8vo. Cardiff, 1858.

not all, vaccinated, 148 gave some evidence or other of having been affected by the variolous poison. In 15, all of them vaccinated, there was simply the variolous fever, without any eruption. The remainder exhibited every form of the variolous eruption, from the mildest modified, to the confluent and malignant form. A hundred and eleven cases, with five deaths, occurred in men with fair vaccine marks (unfortunately the number of marks in the respective cases is not stated), 13 cases with three deaths in men with imperfect vaccine marks, and 9 cases with two deaths in men who had no mark of vaccination whatever.[1] On Feb. 3, 1864, small-pox made its appearance on board H.M.S. *Euryalus*, then stationed off the coast of Japan, and it continued until the 19th of April. During this period there occurred, among the 510 officers and men who constituted the complement of the vessel, and who were with few exceptions protected, 40 cases of a simple fever (which the surgeon considered to be, and which from the description evidently was, variolous fever), with or without an attendant *rash*, but without *any* development of vesicles; and 72 cases of some kind or other of variolous eruption. In 20 cases this eruption amounted to one or two, or a few, umbilicated vesicles only;[2] in 35 there was a discrete, and generally modified, eruption of variola; and in 17 a confluent eruption. The different forms of attack among the vaccinated are reported to have been chiefly influenced by the kind of vaccine cicatrices.

[1] Statistical Report of the Health of the Navy for the Year 1860.

[2] "In two officers who were covered with patches of the peculiar scarlet rash on the trunk and the upper extremities, only one solitary vesicle, which was depressed in the centre and surrounded by a red areola, appeared, in one case on the face and in the other on the back." (Stat. Rep. of the Health of the Navy for 1864, p. 245.)

When these were well marked and foveated, the susceptibility, according to the report of Mr. Morgan, the surgeon of the vessel, was comparatively small: the greater number of persons with such marks having the variolous fever only, with or without rash, or having but a few vesicles. Among the 35 cases of discrete eruption, two occurred in persons who had previously had small-pox, one of them being well pitted from his former attack, and the rest in persons with vaccine marks which were good, but not so good, or so numerous, as in the class of patients just referred to: those, says Mr. Morgan, who had the variolous fever or very slight eruption only, "were all of them well marked on both arms, whereas the majority of these were marked on one arm only." In all the confluent cases vaccination marks could either not be seen, or were ill-defined and not good. Six of the confluent cases died, and one was invalided. Of these seven cases, one was ascertained not to have been vaccinated, three had no vaccination marks whatever, in two the vaccination marks were indistinct, and one had cicatrices on both arms, which, though distinct, were not foveated.[1] An outbreak of small-pox occurred on board H.M.S. *Octavia*, in 1866, which was very remarkable for the rapidity with which the infection spread. The disease was introduced into the ship at the end of February, it began to spread on the 17th of March, and between that date and the 27th of March inclusive—that is to say, in the space of eleven days—no fewer than 164 officers and men manifested some degree of affection from the variolous poison. No case occurred after the 27th of March. The following particulars with regard to the protection of the officers and crew are given in the

[1] Statistical Report of the Health of the Navy for the Year 1864.

journal of the surgeon of the ship:[1]—"On the 1st of March, when the *Octavia* left Bombay for the Persian Gulf, there were on board 610 officers and men; of these, 589 were 'protected' by vaccination, and twenty-one (fourteen of whom were Kroomen, shipped at Sierra Leone when the *Octavia* was on her way out from England in October of last year) were 'unprotected.' Of those protected, 437 escaped altogether, while 147, or 24.9 per cent., were only attacked with symptoms of primary fever, or with the disease in a distinct and comparatively mild form,[2] all of whom recovered; and only five, or 0.8 per cent., were attacked with the confluent form, and those also all recovered. While of the 'unprotected' *all* were attacked, 18, or 85.7 per cent., with the disease in its confluent form, of whom six died; and three, or 14.2 per cent., with severe attacks of the distinct form, all of whom, however, recovered."[3]

(f) **Intensity of Epidemic Influence.**—Like scarlet fever, measles, &c. small-pox not only has its periods of peculiar prevalence, conveniently called epidemic periods, but at some of these it manifests a much greater activity and virulence, and is attended with greater fatality, than at others. This occasional difference in the severity of different small-pox epidemics was remarked on by Jenner, who in his first treatise refers to a

[1] For this extract I have to express my best thanks to Deputy-Inspector-General Mackay, of the Admiralty.

[2] Of these persons 85, or 14.4 per cent., had merely the variolous fever, and only 62, or 10.5 per cent., had any form, however modified, of variolous eruption. See return relating to H.M.S. *Octavia*, Parl. Papers, House of Commons, Sess. 1866, No. 278.

[3] In former epidemic periods, instances of the disease spreading extensively aboard ship had been noticed—in 1825, on board the *Phaeton*, and in 1836, on board the *Hastings*. (See Rep. of Vacc. Sec. of Prov. Med. Assoc., p. 81.)

singularly mild epidemic which he had witnessed some years before in the county of Gloucester.[1] The epidemic which prevailed in the greater part of England in 1858, and which invaded London in 1859-60, was a severe epidemic; but its intensity was much less than that of the epidemic which, beginning towards the end of 1862, has continued more or less to the present time. The mortality in London from small-pox in 1863 was greater than had been known for upwards of twenty years. It occurred, as at all other times, chiefly among the unvaccinated, but a large number of vaccinated persons also contracted the disease; and the mortality of post-vaccinal small-pox, as treated in the Small-pox Hospital, was 9.9 per cent. of the cases, instead of the usual average of 6.76 per cent.[2] But the proportion of deaths also from *natural small-pox* in the Hospital in the same year, instead of being 35 per cent. of the cases, mounted to 47 per cent. So that the difference was due, not to falling off in the prophylactic power of vaccination, but to the greater intensity of the variolous influence. This varying intensity of epidemic influence must be well kept in mind. From overlooking it, the most erroneous conclusions are sometimes drawn as to the decadence of the protection of vaccination. Any time

[1] Inquiry into the Causes and Effects, &c. p. 54.

[2] Of the cases, that is, taken in the gross, and irrespective of the existence of marks of vaccination or of the quality of the vaccination. By deducting cases in which there were *no* cicatrices of vaccination, the death-rate would be considerably reduced both on the average of years (see page 212) and in 1863. Among the *thoroughly* vaccinated patients in 1863, the death-rate was under 1 per cent.; only three in fact, out of 123 deaths that took place from small-pox in the Hospital in that year in persons who had undergone some sort of vaccination, being in persons who had been thoroughly vaccinated. (See Trans. Epidem. Soc. vol. ii. part 1, App. containing Report of Small-pox and Vaccination Committee, 1864.)

the last fifty years that an unusually severe epidemic has occurred, there have been those who have asserted that vaccination was wearing out. It was said as much fifty years ago (in the epidemic of 1818-19) as now. Yet the records of the Small-pox Hospital for 1825 teach the same lesson as the records for 1863 : in 1825, the epidemic being, as Dr. Gregory stated, unusually malignant, the mortality in the Hospital of post-vaccinal cases amounted to 8 per cent., and the mortality of the natural disease correspondingly rose to 41 per cent.[1]

93. The power of Vaccination as exhibited by "protected" classes of the general population.—The annual Medical Reports of the British Army and Navy, to which I have already so frequently referred, afford striking proofs of the protective power of vaccination in adult populations, exposed to the ordinary chances of infection of the countries in which they may be stationed. The troops serving in the United Kingdom may be looked on as, virtually, a wholly "protected" force,—for since 1858 every recruit, whether or not he have marks of small-pox or of previous vaccination, is required to be vaccinated on entering the service, and the soldiers who had previously enlisted, who were without proper marks of vaccination, have also been ordered to be re-vaccinated. The protection of the men employed in the Navy is less complete than that of the Army ; partly, apparently, because the strict rule of the service that all who have not marks of protection should at once be vaccinated does sometimes get evaded (p. 230, note 2), and partly from the absence, if I am not misinformed, of a rule requiring the vaccination of all who enter, whether

1 Paper from Hospital for Casual Small-pox and Vaccination in Annual Report of the Nat. Vaccine Board, printed March 2, 1826.

previously protected or not;[1] and though, relatively to the number of men employed, the number who are unprotected is exceedingly small, the presence of unprotected persons at all cannot but affect the returns whenever small-pox prevails, and will probably account in chief measure for the different small-pox liabilities, particularly as regards mortality, which, as we shall immediately see, the two services have. In upwards of nine-tenths of the men employed in either service the protection against small-pox is that which is afforded by vaccination.[2] Now, if we examine the records of these services to see what havoc is made among them at the present day by small-pox—the disease which, according to Sir G. Blane, was, before the discovery of vaccination, "one of the greatest embarrassments to the operations of armies," and obliged ships of war occasionally to quit the seas[3]—we shall find that on the average of the six years 1859-64, notwithstanding that that period includes two severe epidemics, the annual deaths from it were somewhat less than 1 per 10,000 among the soldiers, and somewhat more than 2 per 10,000 among the sailors; that the cases of variolous affection of any kind did not exceed annually 14 out of every 10,000 soldiers, nor 33 out of every 10,000

[1] By making the rule absolute to vaccinate every person, whatever his marks of protection, not only a great security is obtained against errors of individual judgment, and an assurance provided that could not otherwise have been had that *every one has been vaccinated*, but a large majority of those subjected to the rule are put in the still more advantageous position of having been re-vaccinated. Even this simple rule requires, however, I believe, a good deal of vigilance to see that it is not disregarded; and, as will be seen by the note to the table on next page, individual cases may now and then escape.

[2] See note 1, p. 206, with regard to the proportion of the recruits in the Army who have marks of previous variola. As the Navy is recruited from the same class of the population, the proportion may fairly be assumed to be the same. [3] Med.-Chir. Trans. vol. x.

sailors; the disease being in the great majority of the cases exceedingly modified. In the tables which I subjoin, showing the results for each force and for each year, the reader will not fail to note the effect of presence or absence of epidemic influence; and as it happened that during this particular period this influence was present in the unusual proportion of four years out of the six, the average of cases and deaths is unquestionably largely in excess of what an average for a longer period would give.[1]

TABLE showing the Cases and Deaths from Small-pox among the Troops serving in the United Kingdom for Six Years :—

Year.	Number of Troops.	Cases of Small-pox.	Deaths.	Ratio per 10,000 of strength.	
				Cases.	Deaths.
1859	71,715	175	7	24.3	0.97
1860	85,443	140	9	16.8	1.05
1861	88,955	51	4	5.9	0.45
1862	78,173	64	4	8.1	0.51
1863	75,945	123	6	16.2	0.79
1864	73,252	111	10	15.1	1.36
Totals .	473,483	664*	40	14	0.84

[1] The publication of annual returns for the Army began only with 1859: those for the Navy began three years earlier. The tables are for corresponding periods, but if I had included in the table for the Navy the years 1856-8, the ratio of cases would have fallen slightly below 30 per 10,000; and of deaths to 2.15.

* All these cases were in men who had vaccine cicatrices, except three cases (one severe and two mild), in 1860, in men who had marks of previous small-pox, and three cases (of which two were fatal), in the same year, in men who had no satisfactory marks either of small-pox or of vaccination.

In the Navy, if we except the remarkable return for 1864, to the circumstances of which I shall have occasion by and by to revert, the annual average number of cases would only be 20 per 10,000 as compared with 14 per 10,000 in the Army; but the mortality would still (partly, as already explained, from there being in the force some who were not vaccinated, and partly probably from the less extent to which the deficiencies of primary vaccination had been supplemented by re-vaccination) be more than double.

TABLE showing the Cases and Deaths from Small-pox in the British Navy employed on the "Home Force" for Six Years:—

Year.	Mean Strength.	Cases of Small-pox.	Deaths.	Ratio per 10,000 of strength.	
				Cases.	Deaths.
1859	19,300	51	4	26.4	2.1
1860	23,500	84	12	35.7	5.1
1861	22,900	35	1	15.3	0.43
1862	20,760	8	1	3.8	0.48
1863	21,570	39	2	18.0	0.97
1864	19,630	199	9	101.0	4.0
Totals .	127,660	416	29	33	2.3

These returns, satisfactory as in many respects they are, are much less so than we may hope to receive a few years hence, when the general population of the kingdom shall have received, in place of the slipshod vaccination heretofore too frequently practised, the kind of vaccination necessary for full protection;[1] and when the re-vaccination of the services shall have been completely carried out.

[1] The vaccination that men entering the Army, Navy, &c. have previously received is, of course, the current vaccination of the

In younger classes of the population the evidence of protection is still more striking. In the Royal Military Asylum there has been no fatal case of small-pox among the many thousand vaccinated children admitted since its institution in 1803 : four deaths from small-pox there have been in the Asylum, but they were all in children who, being believed to have already had small-pox, had not been vaccinated.[1] Among an annual average of 550 boys in Christ's Hospital there occurred, during the last half of last century, thirty-one deaths from small-pox; among an annual average of 800 boys there was, during the first half of this century, but one death from this cause—a death which occurred in the year 1820.[2]

94. The Protective Power of Vaccination extends to all climates.—The protective power of vaccination against small-pox extends to every race of mankind, and is exhibited in every climate and in every part of the habitable globe. Natural small-pox, severe and fatal as it is in Europe, is frequently a much more severe and fatal disease in tropical climates and among dark races. But, relatively to this greater severity, vaccination appears to be in them fully as protective. A person vaccinated in a temperate climate may sometimes, there is reason to believe, by *change* to a tropical climate, become somewhat more liable to small-pox (§ 92, d); but a person vaccinated in India, and remaining in India, if the course of his vaccination have been regular, is

country, and we do not know how many of the fatal small-pox cases were in men who had only the one, two, or three marks insufficient for full protection. It would be very desirable if in all cases of post-vaccinal small-pox, in both services, the number and the quality of the vaccine marks were noted.

[1] T. G. Balfour, Medico-Chir. Trans., vol. xxxv.

[2] Communication from Mr. Stone : Papers relating, &c. (*op. cit.*), p. 153.

probably just as safe relatively as a person vaccinated in England. "It is the opinion of every medical man we have consulted," say the Small-pox Commissioners appointed by the Indian Government in 1850, "and we believe it is that of every educated man in India, that when properly and successfully conducted, vaccination is just as efficient a safeguard here as it is in England."[1] Sixteen medical correspondents of the Epidemiological Society in India, dependent all of them on vaccination for their protection against small-pox, had been with two exceptions greatly exposed to its infection, some of them almost living for a length of time in variolated atmospheres, but none of them had ever taken it. As in the East Indies, so also in Ceylon, in the Mauritius, in the West Indies, on the West Coast of Africa, in Brazil, and other similar climates, whenever small-pox has prevailed, exemption from attack has been the rule among the vaccinated, the rare exception among the unvaccinated, population; and the disease, if contracted by the vaccinated, has put on precisely the same kind of modifications that have been noticed in Europe. But in tropical climates there are sometimes difficulties in keeping up supplies of active vaccine lymph (§ 39) at certain seasons of the year, which render attention even more necessary there than here to ascertain that the vaccinations performed have been really genuine and effective. Whenever an apparently high rate of post-vaccinal small-pox mortality has obtained, investigation has never failed to show that there has been defect in the quality of the vaccination. This was well ascertained by Dr. Kinnis in the very interesting and instructive inquiries he made into the circumstances of two epidemics in Ceylon (the two first of the epidemics included in the following

[1] Report of the Small-pox Commissioners (*op. cit.*), p. 41.

table), in both of which epidemic influence must, judging from the high death-rate of the cases of the natural disease, have been very intense.

Epidemic.	Natural Small-pox.			Second Small-pox.			Post-Vaccinal Small-pox.		
	Cases.	Deaths.	Rate per cent. of Deaths to Cases.	Cases.	Deaths.	Rate per cent. of Deaths to Cases.	Cases.	Deaths.	Rate per cent. of Deaths to Cases.
Ceylon (1830) . .	123	58	47	4	2	—	189	34	18
Ceylon (1833-4) .	228	88	38.5	2	—	—	197	21	10.6
Mauritius (1840-1)	281	120	42.7	—	—	—	421	30	7
Jamaica (1851-2) .	477	75	16	11	2	—	120	4	3·33

In reference to the first of the Ceylon epidemics it was found on inquiry that, out of the 189 cases of alleged post-vaccinal small-pox, there was in 56, including 18 of the fatal cases, not the slightest evidence whatever that vaccination had at any time been successfully performed; and that, of the 133 remaining cases, 57, with 15 deaths, were among persons whose marks of vaccination were unsatisfactory, "not such as are left by vaccination when undisturbed in its course: while in those (76) who had good marks of vaccination the disease was rendered so mild that only one died." In the other Ceylon epidemic, of the 197 professedly vaccinated persons who contracted small-pox, 86, including 19 of the 21 fatal cases, had either no marks at all of vaccination, or marks which were not satisfactory, and only 2 deaths took place among the 111 cases in which there were genuine vaccine marks.[1] And in the interesting account which Mr. Gardner has given of the Mauritius epidemic

[1] Kinnis, Report on Small-pox as it appeared in Ceylon, &c., 8vo. Columbo, 1835.

it is stated that in 13 only of the 30 deaths alleged to have occurred from post-vaccinal small-pox were the evidences of vaccination satisfactory.[1]

Among the native soldiers in India, whose wives and families are frequently the subjects of virulent and fatal small-pox, the protection resulting from the vaccination to which the regulations of the service have obliged the soldiers themselves to submit is most strikingly seen. The ratio also of small-pox cases occurring in the European troops stationed in India from 1860 to 1864 inclusive, as exhibited in the following table, though somewhat higher than that noticed among the troops stationed in the United Kingdom (p. 244), is not more so than is explicable by the greater and more frequent exposure to which they are liable in some of the stations in India to the specific cause of the disease; the *greater relative mortality* is due, probably, partly to vaccination having in a few cases been omitted, or not repeated in cases in which the marks were imperfect, and partly to the influence of climatic *change*.

Province.	Aggregate strength (5 years).	Cases of Small-pox.	Deaths from Small-pox.	Annual ratio per 10,000 of strength.	
				Cases.	Deaths.
Bengal	201,677	482	71	24	3·55
Madras	59,580	31	4	5.2	0.67
Bombay	56,620	101	15	17.8	2.65
Total . .	317,877	614	90	19.2	2.83

The valuable statistics which Mr. Leith has published respecting the Island of Bombay show that for the five years 1848-53, the small-pox deaths among the general population, the majority of which is unprotected, were

[1] Seaton, *op. cit.*, p. 355.

5.8 per cent. of the mortality from all causes—about two-thirds the rate which used to prevail in England before the discovery of vaccination: but among the European community on the island, which is, with comparatively few exceptions, protected by vaccination, the small-pox deaths were for the same period only 1 per cent. of the deaths from all causes.[1]

95. The Protective Power of Vaccination shown in National Statistics of Small-pox.—In consequence of the remarkable power of vaccination in protecting against small-pox, and the adoption of the practice universally by educated people and in annually increasing proportion by the population at large, the present average death-rate from small-pox is scarcely in any European country one-tenth part, and in those countries in which vaccination has been most carefully carried out it is much less than one-tenth part, what it was at the end of the last century. Thus in Sweden, where before vaccination was discovered the average annual death-rate from small-pox was 2,050 out of every million of population, during the forty years 1810-50 it was but 158; in Westphalia, where the small-pox death-rate used to be 2,643 per million, it was from 1816-50 only 114; in Bohemia, Moravia, and Austrian Silesia, it has been reduced in like manner from 4,000 to 200; in Copenhagen, from 3,128 to 286; and in Berlin, from 3,422 to 176. Especially interesting is it to review what has been done in our own country (see the Tables in Appendix I.), and to contrast with the 3,000 annual deaths from small-pox per million of population in England—the estimated death-rate at the end of the last century—the present death-rate from the same cause, amounting only to 200 per million (Table D); or with

[1] Morehead's Researches on Disease in India, vol. i. chap. v.

the 1,780 average annual deaths which took place from small-pox in London within the bills of mortality between the years 1790 and 1800, on a population little exceeding a quarter of a million, the 759 deaths which have been the annual average of the last thirteen years in our present London, containing more than ten times the population (Table E).[1] If the reader will examine these tables, first year by year, and then for series of years, he will see that, when the disturbing influence of epidemic prevalence in special years is got rid of, by taking the years not one by one but in groups, each group comprising epidemic and non-epidemic years, the decline of

1 And this, notwithstanding the intensity of epidemic influence manifested in some of these years (*vide ante*, p. 241). It will be seen from the table (E) that small-pox prevailed epidemically in London in five, if not in six, out of these thirteen years. In this vast metropolis, with its 2,000 births a week, the law with regard to early infantile vaccination requires to be administered in its utmost strictness to give anything like reasonable security against frequently recurrent epidemics of small-pox. As it has been heretofore administered, scarcely ever more than two years together have passed without an epidemic visitation. Whatever may be the various circumstances, some of them unknown to us, which determine why diseases like small-pox, scarlatina, measles, &c. should be epidemic at one time and not at another, *the aggregation of susceptible individuals* is assuredly one of the most influential circumstances in determining the frequency of recurrence. In this we have the most rational explanation why, the observance of infantile vaccination being about the same, London should have epidemics of small-pox every two years or thereabouts, while Liverpool or Birmingham may remain five, six, or seven years without an epidemic visitation, and other smaller towns a much longer time. But take smaller towns in which infantile vaccination is much more neglected than in the foregoing—such towns, for instance, as Northampton—and we find epidemics recurring more frequently than in Liverpool or Birmingham. In Northampton (the like of which for scandalous neglect of vaccination it would be difficult to find in England), though its population little exceeds 40,000, there were very fatal and wide-epidemics of small-pox in 1856, in 1860, and in 1865.

small-pox mortality exhibits a regular progression, in correspondence with the progress that has been made in the adoption of vaccination. This is seen at a glance from the following summary :—

Periods compared.	Annual Deaths by Small-pox in England and Wales.	Annual rate per million of the Population.
1. Average of thirty years previous to introduction of Vaccination, estimated by Dr. Lettsom and Sir Gilbert Blane	—	3,000
2. Average of three years (1838-40),[1] when Vaccination had become to a great extent diffused, but before any public provision was made for its gratuitous performance	11,944	770
3. Average of nine[2] of the years (1841-53), when public Vaccination was gratuitously provided, but Vaccination was not obligatory	5,221	304
4. Average of the twelve years (1854-65) during which Vaccination has been to a certain extent obligatory	3,967	202

The Registrar-General of England, in his most recent report,[3] states some facts which put in a very strong light the beneficial results which have been obtained from the increased observance of vaccination in England, consequent on the compulsory Vaccination Act of 1853, imperfect as that Act was, and imperfectly as it has been administered. His figures show, that on comparing the mortality of the kingdom from all causes during the last of the periods in the above table with the period immediately preceding, there had been an annual gain of life of 31 per 100,000 of population, and that one-third of this gain had been from small-pox alone. Comparing

[1] Registration of the deaths in England began only in 1837.

[2] During the years 1843-46 the causes of death were not analysed in the Reports of the Registrar-General.

[3] Twenty-eighth Annual Report, for the year 1865.

also the mortality from all causes in London for 13 years immediately preceding, and 13 years immediately following, that Act, it appeared that during the latter period 16 lives had been saved every year out of every 100,000 of the population, and that ten of the lives so saved, or nearly two-thirds of the total gain, had been from small-pox. The annual mortality from all causes in London was, in the two periods, 2,447 and 2,431 per 100,000 living, respectively; the annual mortality from small-pox, 38 and 28 per 100,000 living respectively. Small-pox—which in England thirty years ago was, in one of its years of epidemic prevalence, the fifth most fatal disease—has, in the worst epidemic that has occurred in the last twelve years, occupied no higher than the eighteenth place among the causes of death, as arranged by the Registrar-General.

The time which has elapsed since compulsory vaccination was extended to Scotland has been far too short to enable us to form any complete judgment of its results in that portion of the kingdom. It was not till the middle of 1864 that it began to take effect; and though there has been since then an extraordinary diminution in the small-pox mortality, the connexion of which with the increased observance of vaccination cannot be doubted, an average of many years must be awaited before the full extent of the benefits to be derived from it can be ascertained. The average annual small-pox mortality of the ten years 1855-64 was 1,054, or 366 deaths per million of population.[1] The total deaths from small-pox in 1865 were 123, and in 1866, 280; or 39, and 88, per million of population respectively. In no two previous years is there any record of the small-pox mortality being so low.

[1] Tenth Detailed Annual Report of Registrar-General for Scotland.

96. Theory of Decadence of Vaccine Power.—This progressive decline of small-pox as vaccination has advanced, affords but little countenance to the theory that has at times been propounded, that the protective power of vaccination over populations is wearing out.[1] The very precise statistics of the Army are equally at variance with it. If we compare the number of cases of, and the mortality from, small-pox now, with what these were from thirty to twenty years ago, we find there has been a very remarkable diminution :—

Troops serving in the United Kingdom during the undermentioned years.	Aggregate Strength.	Cases of Small-pox.	Deaths by Small-pox.	Annual Ratio per 10,000 of strength.	
				Cases.	Deaths.
1837—1846* . . .	254,597	557	56	21.88	2.20
1859—1864† . . .	473,483	664	40	14.0	0.84

The small-pox mortality, in fact, of *the worst epidemic year* of the latter period (1.36 per 10,000 troops—see table, page 244), is far short of the *average* of the period 1837-46. Yet the Army is far more dependent on vaccination for its protection now, than it was thirty or twenty years ago (see note 1, p. 206). The *gain*, in fact, is wholly due to the means which have been taken in these latter years to make the protection *by vaccination* more perfect (§ 93). It has been already seen (Chapter X.) that, with due care, vaccine lymph

[1] The facts on which principally this hypothesis has been based have (as already stated) quite another explanation (§ 92, f).

* T. G. Balfour on the Protection against Small-pox, &c. in Medico-Chir. Trans., vol. xxxv.

† Annual Statistical, Medical, and Sanitary Reports of the Army, commenced in 1859.

loses nothing of its essential properties, so far as its immediate effects on the human system are concerned, by successive transmissions through the human subject; and, from this fact alone, it would be a fair inference that it loses nothing of its prophylactic power. But the matter has been repeatedly put to experiment. Sacco, in 1825 (for the theory of decadence had its advocates then as it has now), performed variolous inoculation on a number of subjects who had been vaccinated two years before, with the then current lymph, *i.e.* with lymph that had been upwards of twenty-three years in use, and at the same time on a number of other subjects who had been vaccinated twenty, twenty-two, and twenty-four years before, or with lymph only a very few removes from the cow: in each class of subjects the results were the same, and were local only.[1] Similar variolous testings in England, previous to the time when the variolous inoculation of human subjects was made illegal, gave precisely similar results.[2] But, in truth, we have experiments on a much larger scale made to hand in every epidemic of small-pox that occurs. In each such epidemic—no matter at what epoch since the introduction of the practice of vaccination—it has not been the persons vaccinated with the then current lymph, the lymph farthest from the cow, but those vaccinated some sixteen, twenty, or twenty-five years before, with lymph so much the nearer to the parent source, who have been found to be the chief sufferers from post-vaccinal small-pox.

97. Evidence that the present Small-pox mortality in England is due to Neglect of Vaccination and to its inefficient Performance.—But, if vaccination can so control small-pox, how comes

[1] Sacco, De Vaccinat. Necessitate, Mediol. 1832.

[2] See for examples pages 185, note 3, and 235, note.

it that there should be still, as on the average of the last ten years there have been, above 4,000 deaths a year from this cause in England? First and chiefly, because vaccination is still largely neglected; and secondly, because in many cases it has been inefficiently performed. That these are the real causes, is provable in two ways: (*a*) from analysis of the death returns, and (*b*) from the results of special inquiries.

(a) **From Analysis of the Death-returns.**—If the reader will refer to Table B, Appendix I., showing the ages at which the deaths from small-pox take place in England, he will see at a glance that seven-tenths of this mortality is in children under puberty, at a time of life when the power of vaccination, even of such vaccination as results only in a single characteristic vesicle, to save from death by small-pox is quite indisputable (§ 92, b). In the whole of this part therefore of the mortality, or about 3,000 out of the annual 4,227 deaths, the *non-performance* of successful vaccination may, with rare exceptions in individual cases, be properly assumed. Of the remaining 1,200 annual deaths or thereabouts—the deaths after puberty—there are no means of knowing in how many of the subjects vaccination had been performed, or in how many not; we should probably little err if we stated that not nearly the half of them had been vaccinated, but for our present purpose we may, if we like, assume that the whole had been, as it is called, vaccinated—and the question would then arise, *in what manner* had the vaccination been done? This point, as regards the individuals, cannot of course be ascertained. But we may fairly apply to the group the observations made for twenty years in the Small-pox Hospital on fatal cases of small-pox in individuals believed to have been successfully vaccinated. Of the

total number of 402 such fatal cases, 101 exhibited on their arms no evidence whatever of having ever had effective vaccination; 277 had but one or two vaccine marks, and these in 191 of them were of imperfect character; 16 were in persons who had three cicatrices; and only 5 in persons who had been vaccinated in the way that has been shown to be the most protective,—of which 5 two did not die of the small-pox, but of concurrent or superadded disease.[1] Only one, then, in 80 of these fatal cases among the vaccinated, occurred in patients who had been vaccinated in the best way. Such facts can leave no doubt on the mind of any reasonable being, that the 1,200 adults who die on an average every year in England from small-pox can either not have had vaccination performed at all, or must, with few exceptions, have had it very imperfectly done, and must have taken no after-steps to remedy the imperfection.

(b) **From the Results of Special Inquiries.**—From the official inquiry into the state of vaccination in England made from 1860 to 1864, under the direction of the Privy Council, it appears that the districts into which the kingdom is divided for the purpose of public vaccination exhibit every shade of variety as to the extent to which vaccination is carried out,—from complete observance of the law, to the most culpable and reckless disregard of it. In numerous districts infantile vaccination was found to be carried out either completely, or with such trivial delay as could readily be overtaken at the slightest alarm; and in all these districts not only did the death-registers show

[1] Marson, art. "Small-pox," &c. (*op. cit.*), p. 473. These five deaths occurred among 544 patients, who, having been properly vaccinated, had most of them the small-pox in its light or varicelloid form only.

absence of small-pox mortality of the native population, but the disease itself had never made any serious lodgment, had never to any extent spread. With scores of such districts I am myself acquainted, districts in which, although the population has been exposed again and again to the infection of small-pox, the disease prevailing all around them, and being frequently imported into them, the utmost suffering of the native population has yet been the occurrence of a few modified cases of it, here and there, without any extension. The type of such a district is that of Mold, in the Holywell Union, Flintshire. It is a district comprising a population of nearly 16,000 persons, partly mining and partly agricultural, which, since the passing of the Compulsory Vaccination Act of 1853, has been kept completely vaccinated. It is a district greatly exposed to small-pox, not only from adjacent districts, but from its constant communication with Liverpool. In the fourteen years which have passed since 1853, small-pox has prevailed on various occasions all round it. At such times the disease has been imported into it again and again. During the epidemic of small-pox that pervaded England in 1858-9 there were repeated importations; in 1864 there were at least thirty distinct importations, chiefly from Liverpool, and there were several fatal cases within the district in persons who were strangers. But the utmost suffering of the native population or among the regular inhabitants of the district, in the whole fourteen years, was *four cases* of natural small-pox in children who had not passed the period lawfully allowed for the performance of vaccination; a fifth (fatal) case in a child *born with the disease*, its mother having modified small-pox at the time of her confinement; and a few modified cases in persons

who came directly in contact with the imported cases. Beyond the points of importation the disease has neve spread.[1] In some districts of this kind, in which the younger population were all duly vaccinated, but in which the elder children, who had been born before the enactment of the compulsory law, and who were therefore exempt from its provisions, had remained, many of them, unvaccinated, the first epidemic of small-pox which swept over the districts after the pass-

1 Dr. Hughes, of Mold, who was the Public Vaccinator of the district during the whole of this period, and to whose exertions these great results are due, has been kind enough to furnish me with the complete statistics of vaccination in the district from the date of the Compulsory Act to September 30, 1867, as under :—

Period.	Total entries in Register of Succ. Vaccinations.	Certified as successfully Vaccinated.		Left the district previous to Vaccination.	Died previous to Vaccination.	Had Small-pox previous to Vaccination.	Not Vaccinated.	
		Born in Sub-district.	Not born in Sub-district.				Above 3 months old on Sep. 30, 1867.	Under 3 months old on Sep. 30, 1867.
13 years ending Sept. 30, 1866 . . .	6,925	5,784	324	202	600	4	11	—
Year ending Sept. 30, 1867	729	454	53	22	54	—	61	85
Total 14 years	7,654	6,238	377	224	654	4	72	85

It will be seen that there were at the time of this return only eleven postponed vaccinations of children whose births were registered before September 30, 1866 : ten of these eleven were children registered in the year ending September 30, 1866. Dr. Hughes adds, "No child born in the Mold district, and alive at the date of the registration of its birth, has died of small-pox during the fourteen years. One infant, whose mother was ill of varioloid disease at its birth, died of small-pox when four or five days old." (See further interesting particulars on this district in *Brit. Med. Journ.*, May 11, 1867.)

ing of that law had laid hold of the latter: and very singular it was to note how, under these circumstances, the usual distribution of small-pox deaths, with regard to the age of the patients, had been reversed; instead of more than half the mortality being in children under five years old, there were under that age no deaths at all, or but an occasional death recorded, the mortality being altogether of elder children, adolescents, and adults. Such were the districts at one end of the scale—districts which kept small-pox at bay—not actually few in number, but still in small proportion to the total districts of England: for, taking the kingdom throughout, neglect of early vaccination, of more or less serious amount, was found to be the rule and not the exception.[1] To such neglect anything beyond mere casual small-pox mortality was always traceable. In very many districts this neglect had been allowed to go on accumulating till it assumed considerable, and in some really enormous, proportions; and these specially neglected districts not only themselves contribute most unduly to the large small-pox mortality of the kingdom, but are the means of spreading the disease broadcast. This was strikingly illustrated in the great epidemic of small-pox that set in while the inquiry was in progress. The places in which, in 1864-5, there was a very high rate of small-pox mortality, were all of them places in which there had been the most scandalous neglect of vaccination; and except in the very few of them which the inquiry had not reached till the epidemic was already

1 In the Report of the Vaccination Section of the Provincial Medical and Surgical Association, 1839, and in the Report of the Small-pox and Vaccination Committee of the Epidemiological Society, 1853, the reader will find interesting accounts of the state of vaccination in England at those periods respectively. Great progress had been made since then.

prevailing, the local authorities of each place had been warned beforehand of that neglect and of its inevitable consequences, but had not thought fit to take proper steps to remedy it. Of the 7,684 deaths from small-pox in England in 1864, 648, or a twelfth part of the whole, occurred in 2 out of the 641 Registration Unions into which England is divided: two unions, in which the unvaccinated children literally amounted to thousands. They were the Union of Dudley, with a population of 130,267, in which 420 deaths from small-pox were registered; and the Union of Portsea Island (Portsmouth and its suburbs), with a population of 94,828, in which there were 228 deaths from small-pox. And each of these places was an enormous centre of infection. If the reader will turn back to the Table showing the extent of small-pox in the "Home Force" of the British Navy (p. 245), he will notice the very remarkable entry for 1864, of no fewer than 199 cases of small-pox and 9 deaths. Now more than three-quarters of these cases (151), and two-thirds of the deaths (6), were from infection at Portsmouth. Nor was this all: from infection traced to Portsmouth the disease manifested itself on board the *Duncan*, when on its voyage for the North American Station; 38 men were temporarily disabled by it, and 1 died. In like manner, in the year following, of the 6,411 deaths from small-pox which occurred in England, 1,419, or more than one-fifth, were among the 664,161 inhabitants of 14 unions, which not only themselves suffered the consequences of their neglect of infantile vaccination, but became so many centres of pestilence.[1] Surely the

[1]

	Population in 1861.	Deaths from Small-pox in 1865.
Northampton	41,152	151
Whitehaven	39,950	126
Bath	68,336	106

[Dover

continuance of a state of things like this is not to be regarded as a matter of mere local concern: surely it was time for the Legislature not to leave it optional any longer to local authorities whether to enforce or not the vaccination of the young population; but to impose this enforcement upon them as a positive duty.

	Population in 1861.	Deaths from Small-pox in 1865.
Dover	31,575	73
Burton-on-Trent	41,065	72
Brighton	77,693	70
Shrewsbury	25,784	59
Canterbury	16,643	55
Merthyr	93,008	185
Neath	58,583	153
Newport (Mon.)	51,412	104
Pontypool	30,288	92
Pontypridd	30,387	91
Cardiff	58,285	82

In many of these places this mortality was *but part* of the mortality of the town or union from the epidemic, many deaths having occurred towards the end of the preceding year, as at Brighton, Bath, Shrewsbury, and Burton, or still more especially in the six Welsh Unions, in which there had been in 1864, 244 small-pox deaths: most of these places, besides, had had similar visitations of fatal small-pox but a few years before, which might in themselves have been a sufficient warning. Three of the places in this list—Merthyr, Northampton, and Shrewsbury—are amongst the four unions which (from their gross neglect of vaccination) had exhibited the highest mortality from small-pox among the children living under five years of age in the decennial period 1851-60. (See Table in Sixth Report of M. O. of P. C., p. 8.) I had reported of Northampton in 1860 that it exhibited greater neglect of vaccination than any other place I had up to that time visited: and five years afterwards (at the time of the epidemic here referred to) Dr. Stevens stated it to be the least vaccinated town of the least vaccinated county he had that year inspected; "that it has been, and still is, a centre in which small-pox is constantly present, and from which that disease is largely distributed to the neighbouring towns and villages."

There still exists in the minds of many people a misapprehension on the subject of neglect of vaccination. If in a number of families, or say in a whole district, all the children two years old and upwards are found vaccinated—the parents, in fact, being well disposed to vaccination—and only the children under two years of age are unvaccinated, it might be said (indeed it has, under some such circumstances, been repeatedly said to me) that there is no neglect of vaccination. Even in official documents it used to be argued that the number of vaccinations annually performed in the kingdom was, irrespective of the age at which the vaccinations were done, the test of the efficiency with which vaccination was carried out. To the Epidemiological Society belongs the merit of having pointed out the fallacy and the danger involved in this mode of regarding the subject.[1] The period of infancy being particularly obnoxious to the ravages of small-pox (Appendix I., B and C), any *delay* in the performance of vaccination, beyond the earliest period at which it can properly be done, is *neglect.* Previous to the Report of the Society, and the legislative action taken upon it, more than half the public vaccinations of the kingdom were not performed till children were above a year old: but if half the children born were left to be a year old before being vaccinated, there would on any given day be in England some 300,000 children, or thereabouts, under one year of age alone (at a time of life when small-pox is so peculiarly fatal), unprotected against the pestilence. It is by overlooking this important consideration, that in countries on the continent of Europe, conspicuous for the care with which vaccination is carried out and the good general results derived therefrom, an epidemic of small-pox is

[1] Report of Small-pox and Vaccination Committee (*op. cit.*), p. 19.

found every now and then to carry off many victims. This has been the case in Sweden, where vaccination is strictly compulsory; but the compulsion not taking effect till two years of age, and the vaccination being frequently deferred by parents till then, a number of unprotected and susceptible subjects is kept up. The most conspicuous result in England of the Act of 1853 has been the change that has taken place with regard to the *age* at which vaccination is now performed, and to this is due in great measure the diminution in the mortality from small-pox.

But the neglect of vaccination, which on the recent official inquiries was found to obtain in a very large proportion of the districts into which England is divided, was a neglect which far exceeded the period of infancy. Frequently children who were of age to be in attendance at infant schools were found unvaccinated in the proportion of 15, 20, and 25 per cent. of the school attendance: in some districts the proportion had exceeded a third, and had even mounted up to a half.[1]

The small relative proportion of cases in which, on these inquiries, it was found that vaccination, in its mode of performance, had been carried to the extent necessary for the full development of its protective powers, has already been stated (§ 73, b).

98. Summary.—The evidence then is conclusive that the vast majority of mankind may, by a single properly performed vaccination, be rendered wholly unsusceptible of any subsequent action of the variolous poison; and that in the minority, whose susceptibility

[1] Even in National Schools, attended by much older children, it was not unusual to find 8 or 10 per cent. unvaccinated. Many of these children had already suffered the consequences of neglect, and were marked by small-pox.

to that infection has not been entirely exhausted by the vaccine process, the small-pox will, with rare exceptions, be so modified, that if all the population were completely vaccinated, *i.e.* vaccinated in the best way, serious and spreading small-pox would be but little known among us, and entries of fatal small-pox would be all but banished from our death-registers. What is to be done for those in whom vaccination has not been properly performed, or has not properly taken effect—in what way a larger measure of protection may be extended to those who, though properly vaccinated, are still in some degree amenable to the small-pox infection, are points next to be considered.

It will be well, however, first briefly to recapitulate the more important conclusions established by the facts stated in this chapter.

1. Natural small-pox, though with rare exceptions it protects the human constitution against any further attack of the same disease, does not invariably do so. Persons have had small-pox twice, thrice, and oftener. *Absolute* protection against an attack of small-pox does not exist.

2. Small-pox induced by successful inoculation protects generally like an attack of the natural disease, but—to a certain degree from the imperfections inseparable from an artificial process, and to a much more considerable extent from errors or carelessness in the performance of the inoculation or from disturbance in its course—a larger proportion of those who have had small-pox by inoculation than of those who have had the natural disease, are liable to a second attack of variola.

3. Second small-pox, whether after the natural or the inoculated disease, is very often modified in its course,

and is much less fatal than small-pox in unprotected persons.[1]

4. Though the practice of variolous inoculation is not wholly void of risk, that risk is so slight as compared with the dangers of natural small-pox, that, were there no other way of protecting the system against that disease, it is a practice of which every prudent person would be glad to avail himself. But inoculation, though thus on the whole beneficial to the individual, has the effect of keeping alive and diffusing the variolous poison; whence the effects of it, as noted on the population generally, were not to diminish, but considerably to increase, the small-pox mortality. For the last twenty-seven years the practice has, in England and Ireland, been very properly made illegal.

5. Vaccination, without endangering the life of the individual submitted to it, and without diffusing any infection, entirely and permanently exhausts the susceptibility to small-pox in the vast majority of those in whom it has been properly performed; but leaves an undetermined proportion still subject in a greater or less degree to the action of the variolous poison.

6. In those whose susceptibility has been only partially destroyed, the action of the variolous infection may be manifested at any period, from a few weeks or months to any number of years, after the performance of the vaccination: but it is most frequently not manifested till after puberty, and when manifested before puberty is generally inconsiderable in degree and only quite exceptionally fatal.

[1] Marson gives 19 per cent. as the proportion of deaths to cases of second small-pox in the Small-pox Hospital (Table, p. 216). The returns to the Epidemiological Society gave a much smaller proportion of mortality than this—8.3 per cent. (Seaton, *op. cit.* p. 354.)

7. The degree of severity which post-vaccinal small-pox may manifest after puberty is chiefly determined by the perfection of character and the sufficiency of amount of the vaccination that has been performed. Even when the vaccination has been the most imperfect, leaving but a single mark of indifferent character, the disease is still in most instances modified in its course, and is not fatal in one-third the proportion of cases in which natural small-pox is fatal; but when the vaccination has been done in the best known manner, the modification is so general and so great that the proportion of deaths to attacks is scarcely more than one-seventieth part of that which occurs in the natural disease.

8. It is therefore a matter of vital importance with regard to the controlling small-pox through the agency of vaccination that the vaccination should be always done in the best known manner.

9. The protective influence of vaccination extends to all climates and all races: and in countries where the practice is general, the small-pox mortality has declined under its influence to a fraction of that which formerly prevailed. In England, notwithstanding a very serious amount of neglect, and an average performance of the operation susceptible of very great improvement, it has reduced the death-rate by small-pox to one-fifteenth part of what it was at the close of last century.

10. A strict enforcement of vaccination in early infancy, and the most scrupulous care as to the complete and perfect performance of vaccination, would further reduce to a small fraction of its present amount the still considerable small-pox mortality of this kingdom.

CHAPTER XII.

Of Re-vaccination.

99. Purposes for which Re-Vaccination is necessary.—It was a cardinal rule with Jenner, and has ever been the practice of those who have been careful to follow his precepts, whenever any irregularity had occurred in a vaccination, to warn the parent or other person concerned that such vaccination could not be relied on as securing against small-pox, and that the process must either immediately, or at some suitable time, be renewed: and it would have saved many a disappointment, and added greatly to the confidence of the public, if Jenner's practice of watching vaccinations *throughout their course* with a view to the application, in all necessary cases, of this essential rule, had been uniformly adopted. Many of the cases of post-vaccinal small-pox which are met with in practice are in persons whose vaccination had been irregular or imperfect. When, also, after a lapse of years, it became evident that some individuals, whose vaccination had been normal in its course, might yet afterwards be susceptible of small-pox infection, and that these cases occurred chiefly to persons who were grown up, the idea of renewing the vaccine process, once or oftener, in the lifetime of each individual, naturally suggested itself. When, further, the

necessity of a certain *amount* of local infection in vaccinating was recognised, re-vaccination was looked to for supplying this amount in cases in which in the original vaccination it had been deficient. Hence the present practice of re-vaccination aims at much more than Jenner thought of: it aims not only (1) at repairing whatever was irregular in the course of a primary vaccination, but also (2) at supplying what was imperfect in the *amount* of infection in cases in which the *course* of the disease was regular, and further (3) at extinguishing the susceptibility to small-pox which may remain, or may re-arise, in an indeterminate number of persons whose primary vaccination may have been complete as well as regular.

100. Carelessness in Primary Vaccination not to be excused on the ground that Re-Vaccination will make good its defects.—But before proceeding to consider the rules under which re-vaccination should be practised, one important preliminary observation must be made. No practitioner should ever allow himself to neglect or overlook any means in his power of making a primary vaccination perfect, under the notion that imperfection may easily be made right by re-vaccination. This caution is not offered without ample experience that it is called for: cases having come to my knowledge not unfrequently in which lymph had been used of the efficiency of which the practitioner had himself doubts, in the belief that it *might* take, and that if it did not take, no harm was done, as it was easy to repeat the operation. And what has happened again and again under such circumstances has been this: the vaccination *has* taken, but it has taken badly; either at once, or at some no distant period, the vaccination has been repeated, and perhaps done a third time, but ineffectually (for it will constantly happen

that spurious vaccination will prevent subsequent vaccination from taking effect properly); then no more is thought about it, or the child is perhaps declared "insusceptible;" it grows up, gets small-pox, and very likely dies. Or, probably, the parents were directed to bring the child again at some specified time, and failed to do so, and the same fate as in the other case befalls it. Take it at the best, an originally imperfect or incomplete vaccination is a very great misfortune.

101. Age, etc., at which Re-Vaccination should be performed.—But, supposing it to have occurred, how is the practitioner to act? Is he to re-vaccinate at once, or is he to wait till after puberty, when, as we have seen, the danger of insufficient vaccination chiefly manifests itself? He must be guided in determining partly by the degree of imperfection, and partly by the liability to exposure to small-pox.

(a) **Circumstances under which it is called for in Childhood.**—If a vaccination is found on inspection imperfect *in character*, if it is spurious, irregular, or disturbed and spoilt in its course, the first thing would be to ascertain whether there might not be something in the child's then state of health which had been overlooked, but which might account for these irregularities or imperfections. If such should turn out to be the case, this must be corrected before any attempt is made to re-vaccinate the child; but if there should be nothing of this kind, the vaccination may be repeated at the earliest opportunity. Probably the re-vaccination will not take, at all events will not take properly; but it *may* take perfectly. Anyhow the chance must be given, and given with the utmost care to produce effect. When local result follows, even though it be only the spurious or modified effect generally following the re-vaccination

of a properly vaccinated person, the practitioner will have done all he can at the time, and need recommend no further proceedings till puberty—at all events unless there should arise some immediate danger of small-pox. But if there be no local evidence that the lymph applied on the re-vaccination had been absorbed, the operation should be repeated at intervals until he is satisfied that the child is, for the time at all events, insusceptible. Supposing, however, the defect of the primary vaccination to have consisted, not in imperfection of *character* of the vesicle induced, but in an insufficient *amount*, or dose, if I may so say, of vaccination—that is, supposing one vesicle only to have risen instead of the four or five the operator had desired to produce, but that vesicle a good one—re-vaccination may, except under circumstances of immediate danger, be left with propriety until the child grows up.

We should be guided by similar rules in determining from the cicatrices left on the arms of young children whether re-vaccination is called for. If these be decidedly imperfect in character, re-vaccination should be performed with as little delay as possible: but if the cicatrices be deficient in number only, or if the character, though less strikingly good than it might be, is yet genuine, the child may be considered safe up to the age of puberty, but its re-vaccination at, or soon after, that period of life should be strictly enjoined.

But when there is immediate exposure, or much risk of exposure, to small-pox infection—when children are in a house, or in a crowded court, in which there is a case of small-pox,—re-vaccination may with propriety be carried further: those children who have marks at all imperfect, or who have not at least two decidedly characteristic marks, should, unless re-vaccination have

already been tried upon them with local result, be re-vaccinated.

(b) **It should be performed on all persons after Puberty.**—Re-vaccination about or after puberty is of extreme importance when the primary vaccination has been anything short of Marson's highest class, and is necessary in proportion as it falls short of it: but it seems also certain that a re-vaccination at or after this period of life may give additional security to many whose original vaccination has been complete. In some of these, as we have already seen, the susceptibility to variola is not wholly exhausted, and such may contract the disease, though no doubt with slight comparative danger, after growing up. But even in its most modified form small-pox is a disease which all would desire to escape, and well-conducted re-vaccination appears to afford a very sure and reliable means of such escape. After successful re-vaccination, small-pox, even of the most slight or modified kind, is rarely met with. Thus, Heim found that in five years there occurred among 14,384 re-vaccinated soldiers in Wirtemberg, only one instance of varioloid, and among 30,000 re-vaccinated persons in civil practice only two cases of varioloid (one of which was probably really a case of chicken-pox), though during these years small-pox had prevailed in 344 localities, producing 1,674 cases of modified or unmodified small-pox among the not re-vaccinated, and in part not vaccinated, population of 363,298 persons in those places in which it had prevailed. In the Prussian army, since the introduction of systematic re-vaccination in 1834, the cases reported as "varioloid," and still more those called "variola," have been nearly all of them among that portion of recruits whose turn for re-vaccination had not come, or whose re-vaccinations had

not been successful, or who were incubating small-pox when they were re-vaccinated; in the twenty years which immediately succeeded the adoption of this system there occurred altogether but forty deaths from small-pox in this large army—or an average of two deaths per annum—only four of the entire forty being in persons who (it was said) had been successfully re-vaccinated. So, in the Bavarian Army, in which there has been compulsory re-vaccination since 1843, there had not, from that date up to the time of a report made by the Minister of War in 1855, been a single case of unmodified small-pox, and only a very few cases of modified small-pox without any deaths. And other national experiences might be cited to the like effect.[1] Nothing can put in a stronger light the value of re-vaccination than Marson's statement of his experience at the Small-pox Hospital. He tells us, firstly, that during the period of his connexion with the Hospital, not one of the nurses or servants had taken small-pox during her residence there, each one of them who had not already had small-pox having been carefully re-vaccinated before being allowed to enter on her duties; and, secondly, that when the new hospital was built (some thirteen or fourteen years ago), and a large number of workmen were there employed for several months after the arrival of the patients, most of the workmen consenting to be re-vaccinated, not a single case of small-pox occurred among those so consenting, while two cases of the disease did occur *among the few* who were not re-vaccinated.[2] In places where small-pox has been epidemic, the total, or

[1] See Simon, Papers relating, &c., pp. xxxv. xxxvi.

[2] Marson in Medico-Chir. Trans., vol. xxxvi. (*op. cit.*). He had then been connected with the Hospital above seventeen years: but the statement with regard to the nurses holds equally good now, after a connexion of more than thirty-two years.

all but total, exemption of re-vaccinated persons, when others who had been vaccinated in childhood, but not re-vaccinated since, were in some proportion attacked, has been matter of quite familiar observation among medical practitioners. The Reports of the Académie Impériale de Médecine abound with such cases;[1] and from them, and other sources, many instances might be cited precisely parallel to Marson's observations on the workmen at the Small-pox Hospital—instances in which the re-vaccinated members of an infected family escaped any form of infection, while those who had declined re-vaccination had to sustain an attack of small-pox. Nor wherever small-pox has broken out in public institutions, and means have been at once taken to re-vaccinate those adolescents or adults who had not before been re-vaccinated, and those children who properly required it, am I aware of a single instance in which the disease has not been summarily brought to an end.

From these considerations we draw the important practical rule that every person should take care to be re-vaccinated about, or soon after, the period of puberty. Under ordinary circumstances, about fifteen years of age is the best time for it to be done; and it should not be left much beyond this, for the age of most danger from post-vaccinal small-pox is from fifteen to twenty-five. On the other hand, where there is any unusual risk of small-pox, as in localities in which the disease is prevailing, it would be imprudent to wait so long, and the re-vaccination may be done at any period after twelve years of age, or, in individual cases, even earlier than this. In girls, especially, in whom the changes connected with

[1] Rapport de l'Académie Imp. de Méd. sur les Vaccinations, &c., 1847, p. 16; 1848, p. 21; 1849, p. 19; 1852, p. 50; 1853, p. 14 *seq.*; 1854, p. 14 *seq.* &c. &c.

puberty manifest themselves early, re-vaccination may be performed correspondingly early. The degree, however, in which vaccinated persons, when they are grown up, stand in need of re-vaccination, is, I repeat, very different. Those who have imperfect marks need it much more than those whose marks are characteristic; those who have but one or two good marks much more than those with three or four. Small, indeed, as the risk of contracting the variolous infection in any form is to those who have been thoroughly vaccinated, who have four good marks of their vaccination, and infinitely small as is to them the risk of having it severely, it is a risk not worth the running; and as no individual can tell whether he is one of the wholly protected majority, or one of the but partially protected minority, it is the part of wisdom even for the best vaccinated to seek the additional security of a re-vaccination.

102. Re-Vaccination requires the same care and pains in its performance as Primary Vaccination.—In re-vaccinating—if re-vaccination is to be anything more than a deception and a sham—the same care must be used, and as much pains taken to insure success, as in performing a primary vaccination. Re-vaccination should be done as far as possible from the arm, and the lymph must be always of the very best. No doubtful lymph must ever be used. "L'essentiel," says Bousquet, "est de n'employer à la re-vaccination qu'un vaccin dont on soit parfaitement sûr, sinon l'épreuve ne mériterait aucune confiance ... Cependant nous avons connu des médecins qui se servaient de vaccin sec, conservé sur verre; ils échouaient le plus souvent, et de leur mauvais succès ils concluaient hardiment à l'inutilité de la re-vaccination. C'est aussi pour eux que nous disons qu'elle est sans valeur l'expérience dont on peut rejeter

le mauvais succès sur le vice des procédés ou sur la maladresse de l'artiste."[1] But much worse than the negative mischief arising from the use of dry lymph, has been the positive, as well as negative, mischief which I have known result from using the lymph of re-vaccinations. Several instances of this have fallen under my observation. The practice cannot be too strongly reprehended. Even with the best lymph, and with every care, we shall meet with failure in a very large proportion of cases, probably from a third to a half of those operated upon; and in many or most of these an immediate repetition of the operation may not be attended with success. Such cases should be noted for a further trial at some future time. But persons in whom the re-vaccination has so far taken as to give clear evidence that the lymph was absorbed (§ 47—for it is only in a minority of the operations that the same *degree* of success as attends a primary vaccination is attained), may feel themselves perfectly safe—that is to say, as safe as any human proceeding can make them—against future small-pox. The experience of the Small-pox Hospital with regard to their servants and nurses may be appealed to, confidently, in proof of this. The repetition of re-vaccination every five or seven years, or at whatever other intervals people may choose arbitrarily to fix, or whenever they get frightened because an epidemic of small-pox is about, is mere trifling,—a practice unsupported by reason or by observation. In so far as it may be thought well in particular cases to use it to meet the caprices of a timid patient, I have nothing more to say against it, than that I think it behoves us, as members of the medical profession, to be the leaders, rather than the followers, of the public in these matters. But the

[1] Rapport de l'Acad. Imp. de Méd. 1854, p. 21.

practice is wholly uncalled for. One thoroughly good primary vaccination to start with (for that is, as Marson says, the sheet-anchor), and one careful re-vaccination after puberty, so conducted as to give evidence that the lymph was absorbed, are all that is necessary for complete protection—protection as complete as any known proceedings can give—against small-pox. If the primary vaccination have not been thorough, it must be reserved for medical judgment to determine whether, and when, in that particular case, re-vaccination *before* puberty might be desirable: and in the preceding sub-section I have endeavoured to state what, as it appears to me, should determine that judgment.

103. The performance of Re-Vaccination should not be left to periods when Small-pox is epidemic.—As re-vaccination is, like primary vaccination, a strictly precautionary measure, it is needless to say that we ought not to wait till small-pox is at hand to have it performed. The re-vaccination of persons as they reach about fifteen years of age should be as systematically done as is the vaccination of young infants. My experience of re-vaccination, as it is at present conducted in England, has shown me that, except by an intelligent few, it is only practised at times when small-pox is epidemic, and people under the influence of panic. It is then generally done with very little selection: and more according to the fears of individuals than according to the judgment of the practitioner. It is squandered accordingly where it is not wanted at all or is of very little moment, and is frequently omitted in the very cases in which it is most urgently necessary. Besides which, a pressure for lymph is in this way often put upon the practitioner which it is very difficult for him to meet. If careful arrangements be necessary to carry on a series

of primary vaccinations, most of which will be reproductive of lymph fit for use, how much more to carry on a large series of re-vaccinations, which exhaust, but do nothing to replenish, the operator's lymph-supply. Under these circumstances there is a temptation—a temptation, I regret to say, not always resisted—to use any sort of lymph, and even to employ the lymph of re-vaccinations. If the public can only be made to understand how much worse an article they run a risk of getting by putting off their precautionary measures to a period of panic, they will be more careful, I apprehend, than heretofore to get their re-vaccination done beforehand.

Under the Regulations which are now in force for public vaccination, the vaccinators are authorized to re-vaccinate at the public expense all applicants above fifteen years of age, who have not before (so far as can be ascertained) been successfully re-vaccinated, or, if there be immediate danger of small-pox, all who have attained the age of twelve years (App. II. B, 2).

104. Local results of Re-Vaccination: no indication is derivable therefrom as to the person's liability to contract Small-Pox.—The immediate results of the performance of re-vaccination may be either the complete umbilicated vaccine vesicle (§ 34), or the modified vesicle or papule (§ 47), or entire failure. The following table, exhibiting the results of re-vaccination on each 1,000 individuals re-vaccinated in the Wirtemberg army in 1831-5, and in our own army in 1861, appears to me to represent a larger ratio of complete results (perfect vaccine vesicles) than we ordinarily meet with in civil practice,[1] but there

[1] The proportion of complete successes in re-vaccination reported in the annual returns of the British army, varies greatly in different years, and in the same year in different corps. It has sometimes been

is no statistical record of re-vaccinations in civil practice made on so large a scale as would justify me in presenting it. It shows, at all events approximately, what may be looked for in the re-vaccination of adults generally.

Persons in whom the Re-vaccinations were performed.	Degree of Success of Re-vaccination	In those who bore marks of previous Small-pox.	In those who bore good marks of previous Vaccination.	In those who bore doubtful or imperfect marks of previous Vaccination.	In those who bore no marks of previous Vaccination or Small-pox.
Wirtemberg Army, 1831–5 (13,861 cases)	Perfect	319.5	310.4	280.7	337.3
	Modified	248.1	280.5	259.0	191.1
	None	432.3	409.2	460.4	471.6
		1000	1000	1000	1000
Soldiers in Brit. Army, not recruits, in 1861 (2,053 cases)	Perfect	451.4	484.6	236.8	326 0
	Modified	159.6	157.4	505.3	277.5
	None	389.0	358.0	257.9	396.5
		1000	1000	1000	1000
Recruits in Brit. Army in 1861 (4,395 cases)	Perfect	345.5	407.3	461.3	527.3
	Modified	266.8	240.8	301.3	202.6
	None	387.7	351.9	237.4	270.1
		1000	1000	1000	1000

One important practical conclusion we clearly derive from this table, and from the large experience which is now accumulated on the subject of re-vaccination. The local results obtained by the re-vaccination of any individual give us absolutely no information whatever as to the constitutional condition in which the re-vaccinated person was with

such as to lead to the belief that proper judgment was not exercised in discriminating the perfect and the modified vesicle, and towards the end of 1865 a circular was addressed to the medical officers on this subject by the Director-General.

regard to liability to contract small-pox. It has frequently been argued, and is indeed often to be heard said now, that if a re-vaccination cannot be made to take, or if it take only in a modified way, it is evidence that the constitution would not at the time take small-pox; whereas, if a complete local result follow, it may be assumed that the protection of the primary vaccination had worn out, and that the person was in danger, or at all events in more danger than in the former case, of taking the variolous infection. Now, if this were so, the Wirtemberg results would prove that 319 out of every thousand persons who had had small-pox, 310 out of every thousand who had been well vaccinated, but only 281 out of every thousand who had been ill vaccinated, were in present danger of taking small-pox; and of the soldiers (not recruits) in our own army, 451, 485, and 237 would represent the ratio in the three classes respectively, which is clearly a *reductio ad absurdum.* M. Vleminkx, finding the results of his re-vaccinations of the prisoners in Belgium more successful in those who had marks of small-pox than in those who had good marks of vaccination, in the proportion of 30 per cent. of the former to 19 per cent. of the latter, argued that it was more important to vaccinate persons who had had small-pox than to re-vaccinate persons who had good marks of vaccination:—with perfect logical consistency, if only the premiss were sound that the "taking" of vaccine in a protected person shows anything whatever with regard to the liability to receive variola. Jenner himself distinctly pointed out that this was not the case. "Although," he says in his first Tract, "the cow-pox shields the constitution from the small-pox, and the small-pox proves a protection against its own future poison, yet it appears that the human body is again and again susceptible of the in-

fectious matter of the cow-pox :"[1] and he gives instances in which the cow-pox was thus taken twice or thrice by persons who could not be variolated either by inoculation or by exposure. Further, in one of his subsequent essays, speaking of the vaccination of those who had already had small-pox, he observes that "although the susceptibility of the virus of the cow-pox is for the most part lost in those who have had the small-pox, yet in some constitutions it is only partially destroyed, and in others it does not appear to be in the least diminished. By far the greater number on whom trials were made resisted it entirely; yet I found some on whose arms the pustule from inoculation (vaccination) was formed completely, but without producing the common efflorescent blush around it, or any constitutional illness, while others have had the disease in the most perfect manner."[2] Exactly in the same way, as he pointed out, the perfect *variolous pustule*, a pustule capable of communicating variola to others, may be raised in the skin of a person who has had variola without in the least degree giving him a second time *the disease* variola.[3]

The utility and necessity of re-vaccination do not stand on any speculative reasoning from the local phenomena it develops, but upon broad grounds of observation and experience.

[1] Obs. on the Variolæ Vaccinæ, p. 21.

[2] Continuation of Facts, &c.

[3] "Upon the skin of every human being that possesses a more than ordinary share of irritability, the insertion of the variolous virus (whether the person has previously had the cow-pox or small-pox) will produce either a pustule or a vesicle capable of communicating the small-pox, and frequently attended with extensive inflammation." (Letter to Mr. Boddington in Baron's Life, vol. i. p. 445.)

CHAPTER XIII.

Of Stamping-out Local Outbreaks of Small-pox.

105. Universal Vaccination would render the dangers of Small-pox quite inconsiderable.—If all the children throughout the kingdom were properly vaccinated in early infancy, as the law requires, with due care to watch the process in each instance, and to remedy in any spurious, doubtful, or imperfect case what had been amiss—still more surely if, as each child attained puberty, the vaccination were repeated—we should soon, I apprehend, have little or no small-pox current amongst us. At all events, the risks of importation of the disease into any locality would be as nothing to what they now are, and there would be little or no danger of its ever spreading; for when an importation did take place, our anxieties being limited to that small and manageable part of the population, on whom, on account of their tender age or indifferent health, vaccination had not yet been done, the easy task of vaccinating immediately such of these as ran any risk of exposure to the infection would soon be accomplished.

106. Dangers to which now the Careful are subjected by the Careless.—But, as things now are, with whatever care the local authority or the local officers of particular districts or places may keep their

native populations protected, they cannot avoid the risks arising both from the immigration into their districts of unprotected families, and from the frequent importation of small-pox from other and neglected places. Thirty times in one year, as we have seen, was small-pox imported into the district of Mold, chiefly from neglected Liverpool; and though the precautions taken and the vigilance exercised in that district were quite sufficient to prevent the disease from spreading from any one of these centres of infection,—for nowhere, where due vigilance is used, need small-pox spread,—still the strain at present imposed upon those who are careful by those who are careless is very great.

107. Steps that should be taken immediately on Importation of Small-pox to prevent its spreading.—When a case of small-pox is imported anywhere, the first thing must be to isolate it as far as possible. Whenever an airy room can be given up to it, there will be no necessity whatever to move the case to a hospital, even where the opportunity for such removal exists; but where, as among most of the labouring class, &c. there are no such means of isolation, but the case would have to remain in a room to which many must have access, and in which perchance some part of the family, or perhaps the whole family, might be sleeping, if not altogether living, removal to a hospital, or place of proper isolation, is of the utmost consequence, and wherever it is practicable should never be omitted. It is greatly to be lamented that there are not provided, as there ought to be, within the bounds of every sanitary jurisdiction in the kingdom, and especially in every town, places for the reception of cases of small-pox, and of the other infectious fevers, with a view to their isolation and treatment; and it is to be hoped that the powers which the

Sanitary Act has conferred on local authorities for this object will not be suffered to remain dormant.[1]

The next thing is to take care that those who have to deal with the case, or are likely in any way to come in contact with it, are thoroughly protected. The arms of all in the house must at once be examined; the unvaccinated must be vaccinated without any delay; the inmates above twelve years of age who have not already been successfully vaccinated since attaining that age, should be re-vaccinated, and if all cannot be done at the same time those should be done first whose marks are the most imperfect, or the fewest; and (though this can well afford to be left till the other things have been looked to) the vaccinated children who have not at least two marks of good quality should also be re-vaccinated. When the house is situated in a crowded court, it is well to extend these precautionary measures at once to the other houses in the court.

And the last thing—never to be omitted—is carefully to disinfect every article of clothes, bedding, &c. which have been used for the sick person, and after the disease is over to disinfect the room and the furniture of the room in which the case has been.

These measures, *thoroughly and promptly carried out*, are pretty certain to limit the attack to the imported

[1] This is really a matter of the most urgent necessity. It is often now a very difficult thing to know how to dispose of a case of small-pox when it occurs; and in the anxiety of one parish to get rid of it, and the determination of another not to receive it, I have known the most cruel things done. But besides the means of isolation, so immediately called for, an eventual want is the power of compelling it (not necessarily, of course, in a hospital, but in some way that should be approved by a competent authority); and there should certainly be some severe penalty on concealment of the existence of small-pox.

case or cases, when the surrounding population generally is in a good state of protection, and I have again and again known them successful when the surrounding population generally was but very imperfectly protected. A community imperfectly protected is subject, however, to two great risks of the infection spreading, which all the injunctions of the practitioner with regard to isolation may not suffice to guard against: (1) whether from mistaken kindness or from love of gossip, a case of small-pox really appears frequently to be an attraction to the neighbours, and the infected house a favourite place of rendezvous; and, if it be a mild case in a child, it is pretty certain that some of the neighbours' children will be sent in to play with the patient; and (2) from the great modification small-pox generally undergoes in the vaccinated, there is often so little illness that it is very difficult to keep the patient even indoors, and much less in a particular room or part of a house; and as the disease has, by its modification, lost nothing of its power of infecting others, it is constantly becoming diffused in this way, in spite of all warnings, and in spite of the prohibitions of the law.[1] Hence whenever there is importation of small-pox into a badly protected district, it is a very urgent matter, as soon as the immediate surroundings of the imported case or cases have been looked to, to work up, if I may so say, the general vaccination of the district.

[1] Under the thirty-eighth clause of the Sanitary Act, 1866, persons exposing themselves, or their children, or others affected with small-pox, in the streets, or in any public places, or public conveyances, may be proceeded against summarily; before that enactment, they could only be punished by the tedious and expensive process of indictment. See on this, and on the powers of local authorities with regard to disinfection, "The Sanitary Act, with Introduction, &c., by J. B. Hutchins: Knight & Co."

108. Steps necessary to arrest it when it has begun to spread. Necessity for Prompt Action.—When to the earliest cases of small-pox no such barriers as I have described have been opposed, or when these barriers have been overleapt, and the disease has begun to spread, this spread is at first generally slow, and many weeks elapse before there is anything like epidemic diffusion. And it depends entirely on whether advantage is taken of this interval or not, whether there ensue, even in places in which vaccination had been much neglected, an inconsiderable or a formidable mortality. If we take, for example, the outbreaks of small-pox which occurred in Cardiff and in Sheffield, in 1857, both attended with enormous mortality in unvaccinated young children, and the progress of which was as follows—

1857.	Deaths from Small-pox.	
	Cardiff (town).	Sheffield.
January	1	—
February	1	—
March	5	—
April	8	—
May	42	3
June	35	3
July	19	10
August	14	14
September	14	16
October	13	132
November	7	
December	2	
Total	161	178*

* And these were but the prelude to a still more formidable amount of mortality next year, when the deaths from this cause were 290. There has certainly existed heretofore a very scandalous neglect of vaccination in Sheffield; but active measures, I am informed, are being taken under the powers of the new law to remedy this lamentable state of things.

—we see at once what opportunity there had been in the earlier weeks for repairing the gross neglect of vaccination that had existed in these places, and for thus arresting the further spread of the disease. And whatever town, or whatever epidemic period, might be selected, the same thing would be shown:—Slow progress of the epidemic at first, affording yet a period for repairing neglect, and subsequent progress dependent entirely on the activity or inactivity with which the outbreak had been met.

In 1858, when there were 111 deaths from small-pox in the Union, and chiefly in the town, of Carmarthen, there had, as in the foregoing instances, been plenty of warning of the approach of the disease from adjacent rural districts; and even after it had reached the town there had been plenty of time to prevent the catastrophe which occurred, for it was not till after a four months' sojourn that extensive spread occurred: some forty or fifty cases and eight deaths represented the extent of the mischief done during the first sixteen weeks. In the town and district of Carnarvon, where in 1859 there were sixty deaths from small-pox, and in the city of York, where in 1862 there were above a hundred deaths from this cause, there had been the same warning of approach, the same gradual progress of the disease at first, the same supineness and indifference in dealing with it. But in the official reports[1] in which these and other similar cases are recorded, instances will be found, on the other hand, in which under the like circumstances of antecedent neglect, the activity of the local authorities, or of the local

[1] Annual Reports of the Medical Officer of the Privy Council, iii.-vii. inclusive.

officers, either arrested the outbreak altogether, or limited its spread, and rendered the mortality comparatively trifling. One illustration here must suffice, not selected by any means because it was the most complete in its results, but rather because the local difficulties that had to be met were considerable. When small-pox broke out in Gravesend in 1860, there were great arrears of vaccination. The first step taken was the issuing by the local authority, on the representation of the public vaccinators, of cautionary notices; as soon as the disease began to spread, the managers of all the public schools insisted on the immediate vaccination of any unvaccinated children in attendance; and the Inspector of Police made personal inquiry, founded on the birth-registers and on his local knowledge, respecting unvaccinated children. When these were found, they were not lost sight of till they were vaccinated. The population being thus put in a comparatively well-protected condition, the consequence was that, though the epidemic lasted altogether more than a year, there were but four deaths from small-pox in children illegally unvaccinated: there were eleven other deaths from this cause, but five of these were in adults, and two in young babies born at the time their mothers were suffering from the disease.[1]

Directly, then, that in any district small-pox has begun to spread beyond its points of importation, the utmost vigilance and promptitude of action of the local authority are called for. Whatever arrears of primary vaccination may exist must be immediately dealt with; and all the means with which the law has armed local authorities for *finding out* the unvacci-

[1] The remaining four were in children not subject to the provisions of the compulsory law.

nated population, and obtaining their protection, at once exercised.[1] And those adults or adolescents who have not already, since growing up, been successfully re-vaccinated, should be urged to avail themselves at once of the re-vaccination which is everywhere freely provided for them (page 278). But the essence of the complete success of these measures lies in their being taken *without delay*. So long as local authorities will make light of "a few" cases of small-pox, and hesitate to take efficient steps "for fear of creating alarm," so long will epidemic outbreaks flourish.

109. Steps necessary for its Arrest when it has become extensively diffused.—But suppose these important steps have been thus improperly delayed, and that the place has become *thoroughly infected* before any active measures of suppression have been adopted. Even under these adverse circumstances it is quite possible to arrest within a very short time the fatality of the disease, and in a little while further to extinguish it altogether. But the measures which almost certainly would have sufficed before, will not now be enough, and others must be taken adequate to the emergency. The infected localities must be mapped

[1] Systematic inquiries respecting young children (under two years of age) whose successful vaccination has not been registered is one important means. Hereafter, this is directed to take place regularly every six months, irrespective of whether small-pox be present or not. Another important means is the examining the children attending various charitable schools, especially Infant Schools. If all the managers of such schools would make it an absolute rule not to admit any child without a medical certificate of its successful vaccination, or without having its arms examined by the Public Vaccinator of the district, it would be a very useful check upon neglect. But it is not enough to make a rule: they must see that it is carried out.

out, and systematically visited from house to house, from room to room, and from child to child. Though it is not in the least necessary that this visitation should be made by a public vaccinator, or by a medical practitioner, and though often indeed it would be a mere waste of force to employ medical agency for the purpose, yet when other circumstances admit of such employment there are obvious advantages derivable from the knowledge which medical men generally have of the population and from their influence over them. Much, no doubt, will depend on the kind of population which has to be dealt with. But the person employed, if not a medical man, must at all events know the proper characters of the vaccine cicatrix, in order that he may be able to examine for himself the arms of the children in the houses that he has to visit. His first and most important duty in this visitation will be to see that the cases found illegally unvaccinated are taken, according to previous arrangement, to a vaccinator; and he should at the same time endeavour to procure the immediate vaccination of unvaccinated children who are below the age at which non-vaccination becomes illegal, pointing out to parents the extreme danger of delay. If he meet with vaccinated children whose vaccine marks are doubtful or imperfect, he should induce the parents to send them for re-vaccination. Further, he must not neglect to urge upon adults, who have not already been successfully re-vaccinated, the necessity for being re-vaccinated forthwith. By a judicious exercise of firmness and kindness all this may be readily done. The families visited, however, must not be lost sight of: having received their directions, they must be visited again to see that these have been complied with;

and they must be kept in view until their full protection is obtained. If these measures be thoroughly carried out, and if, as their indispensable complement, measures of thorough disinfection be also steadily pursued, the eradication of the small-pox from the locality will certainly follow. But that they may be completely effectual, they must be systematically undertaken and intelligently supervised. The services of a good Medical Officer of Health are here invaluable. Assuredly no circumstances could have been more difficult or unpromising than those under which, in 1860, the small-pox was routed out of the crowded population of South St. Giles', London, at the height of the very severe epidemic then prevalent in the metropolis. The disease had extended to that district in September 1859, and at first made therein its usual *gradual* progress: but, also as usual, after a three months' sojourn, or thereabouts, the mortality from it leapt up all at once from thirteen deaths spread over a quarter of a year to nine deaths in two weeks. Local inquiries also showing the disease to be then rapidly spreading, immediate authoritative interference was determined on. The representations which, in conjunction with the Medical Officer of Health of the district, I made to the Board of Guardians, led to its directing a most complete visitation, for the purpose of which it offered to put on any amount of force that might be required. The Public Vaccinator of the district, however, undertook himself to get the work done; and so completely and with such energy was it set about that, in a few days, all the infected localities had been thoroughly visited by himself or his deputy; 169 *children totally unprotected against small-pox, many of them in the very houses, and some in the very rooms, with small-*

pox cases, having been discovered and vaccinated, and a number of imperfectly vaccinated children having been re-vaccinated. The impression thus made on the mortality of the small-pox was such that, excepting some cases which were incubating the disease when they were visited, there were but three more deaths from it in South St. Giles' up to the termination of the epidemic in London eight months afterwards, only one of these deaths being in parochial practice, and that one being an accidental case four months after the date of the visitation. Now that this immediate arrest of the mortality was really due to the measures employed, and did not arise from the epidemic having happened to come to a natural termination in St. Giles' just at the period these measures were taken, was not only to be inferred from the large number of unprotected persons discovered to be living within the immediate influence of the infection, who, had they not been thereupon vaccinated, would, we may be quite sure, have had to sustain an attack, but was actually proved by the fact, that for the first three or four weeks following their adoption, the cases of *small-pox in the vaccinated* continued to be as numerous as before,[1] after which lapse of time this class of cases also gradually diminished, till the disease died out altogether. The cases of *post-vaccinal* small-pox which were admitted

[1] In correspondence, in short, with the progress of epidemic force, which, according to the natural history of the disease, would have manifested its continuance among the unvaccinated also at this period but for the interference which had taken place: it should also be explained, in reference to these post-vaccinal cases, that the *primary vaccination* of the localities visited was made *complete;* the re-vaccination, especially of adults, from their being away from home at the times of the visits, or in some instances from their being unwilling to be re-vaccinated, was not so complete as was desirable.

during the month preceding the visitation were twenty-eight, and those admitted during the month immediately succeeding it were twenty-nine. The following abstract of the small-pox register of the district medical officer, for the half-year during which the epidemic lasted in South St. Giles', from October 1, 1859, to March 31, 1860,—arranged in two periods, the one before and the other after the house-to-house visitation had time to take effect,—shows what that visitation accomplished :—

Date.	Cases of Small-pox admitted.							
	In vaccinated persons.				In unvaccinated persons.			
	Confluent.	Discrete	Total.	Deaths.	Confluent.	Discrete.	Total.	Deaths.
Oct. 1 to Jan. 21 . .	2	49	51	1	29	12	41	14
Jan. 21 to Mar. 31 .	—	41	41	—	4	2	6*	—

In reference, however, to the measures of house-to-house visitation which are necessary for thoroughly eradicating small-pox, when it has been allowed to get epidemically diffused, it is very important to remember that house-to-house visitation is not house-to-house vaccination. In the visitation in South St. Giles', though it was made by medical men, they did not dream, except under particular circumstances, of stopping in each room to do the vaccinations required, but had the cases brought to an appointed place by a pre-organized arrangement, so that the vaccinations were done direct from the arms of children. Under no circumstances is it more important that the operation should be done

* Of which three occurred in a part of the district distant from that which had been visited from house to house.

in a way almost sure not to fail, than when it is done under immediate or proximate danger of small-pox.

110. Responsibility of Local Authorities for preventing the Spread of Fatal Small-pox.—Whatever, then, be the circumstances under which we have to encounter small-pox—whatever its stage of diffusion—we have in vaccination (including, of course, re-vaccination wherever this is necessary) the means of assuredly controlling and subduing it, and in vaccination, along with disinfection, the means of eradicating it. But these means will invariably be found to be easy or difficult of application, to be of very trifling cost or a source of heavier expenditure, according as vaccination has been previously cared for or neglected in the population to whom the infection has come, and according to the promptitude with which the disease has been met on its arrival: it is in keeping a population vaccinated *pari passu* with the births that the real economy of life, and health, and money lies. Under the powers which the present Vaccination Law confers on local authorities, the spread of fatal small-pox, let it occur when it may, must be taken as in itself a sufficient indication of the apathy, indifference, or incompetence of the local authority within whose jurisdiction it takes place.[1]

[1] No doubt the law has hitherto been very imperfect and unsatisfactory, but not so imperfect as to leave any excuse for the extreme neglect which has frequently been allowed to prevail (see Chapter XV.). I have lately been inspecting the Eastern Districts of London, in which small-pox may be almost said to be endemic, and in which, last year, it made great ravages. For any special steps that had been taken to arrest it by the local authorities, it could not be supposed that there had even existed authorities having any responsibility whatever in a matter so seriously affecting the lives and health of more than half a million of our population, and possessing powers for the enforcement of vaccination which, if duly exercised, might assuredly have prevented a very large proportion of the terrible suffering and mortality from small-pox that had there prevailed.

CHAPTER XIV.

Of the Objections to Vaccination, and the alleged Dangers of the Practice.

111. Allegation that it has produced New Diseases.—I should deem it a waste of the reader's time to enter on any particular consideration of some of the objections that have been advanced against vaccination. That it has produced new, strange, and unheard-of diseases—that it has caused degeneration, mental and physical, of the human species, diminishing men's stature, incapacitating them for the fatigues of military service or even for the exercise of dancing, and driving them for consolation to tobacco—are assertions that have been very seriously and very vehemently made, but against which it is surely not necessary seriously to argue.[1] The nonsense about degeneration has not, so far as I am aware, found any echo in this country; and here, certainly, since the days of Rowley, and Squirrel, and Birch, the diseases "produced by vaccination" have occupied, "in medical teaching and medical conversation, about the same space as diseases produced by witchcraft and the evil eye."[2]

[1] Verdé de Lisle, De la Dégénérescence Physique et Morale de l'Espèce Humaine déterminé par le Vaccin. Paris, 1855.

[2] Simon, Preface to Papers relating to the History and Practice, &c. (*op. cit.*), p. xliii. To the interesting and admirable Chapter

112. Allegation that it has led to Increase in the Mortality of other Diseases.—Another objection that has been urged, equally destitute of medical support, is, that though vaccination may save from small-pox, there has been no real gain of life after all, but a mere "displacement of mortality," the persons who should have figured in the death-register as dead of small-pox appearing at some time or other, but without living to grow old, in some other column, as having died from some other disease. Of course, in a certain sense and to a certain degree, this statement is quite true. Vaccination does not profess to make mankind immortal—it saves from small-pox and its sequelæ, and from nothing else; and everybody whom it saves therefrom lives to die of some other cause at some future period. One might as well argue on such grounds against saving a man from drowning. To make the objection of any value it would need to be shown that vaccination, either by some positive action of its own, or by depriving the constitution of some advantages consequent on having small-pox, leaves it *more prone* than it would otherwise be to take on other diseases, and more prone to such a degree as to counterpoise the saving of life and health from small-pox. Fever and scrofulous diseases are the diseases especially pointed out as having taken the place of small-pox.

In support of this notion, some statistics,[1] imperfect

"On the alleged Drawbacks from the Advantages of Vaccination," in this Preface, I would refer the reader for an exhaustive discussion of the subject; it is well worthy of the most careful study, and I desire to express my own great indebtedness to it.

[1] "Collected with more zeal than judgment by a former artillery officer, M. Carnot." (Simon, *op. cit.*, p. xlvii.) Carnot's statistics related only to France, and their fallacies were at once exposed to the Académie des Sciences by Baron Ch. Dupin. The reader who is

in themselves and utterly misunderstood, have been advanced to show, that so far is vaccination from having saved life, that the general death-rate of populations has increased since its introduction, that this increase is very notable at particular ages, and that there has been especial rise in the death-rates from fever and scrofulous diseases. Now, supposing all this had been true, there would yet have been wanting a great deal more to show that *post* had not merely been mistaken for *propter*, and that these results had in any way depended on the practice of vaccination; but it so happens that, as soon as the statements were scrutinised (and they were immediately subjected to competent scrutiny, both here and abroad), each one of them was found to be the very reverse of the truth. Thus, on comparison of the present general death-rate with the death-rate of the middle of last century, in any population for which the materials for the comparison exist, it appears that (*after deducting the small-pox gain*) the present rate is greatly below that which obtained before the date of vaccination. In London, for example, the annual death-rate from all causes, at the middle of the last century, was 355 per 10,000 of population, and from all causes, *except small-pox*, 325; but in the middle of the present century it was, *including small-pox*, but 249. In Sweden, in the period from 1755 to 1775, the general death-rate was 289 per 10,000 of population; from 1841 to 1850 it was

interested in this part of the subject, and who has leisure, will find it treated ably and with much detail in a little work by Dr. Bertillon, "Conclusions Statistiques contre les Détracteurs de la Vaccine." The reader who has not leisure may be very grateful to Simon for the pains he has taken to examine and expose, in his own compact and exhaustive way, Carnot's crudities. He has left, in fact, nothing more to be learnt or said on the matter.

but 205. And similar results are obtained from the statistics of other countries. Again, analysis of the death-rates at particular ages, wherever the data for such analysis exist, show that this gain pertains to all periods of life. Between the ages of twenty and forty years—the very time of life when, it was said, the particular liability of those whom vaccination had saved from small-pox to be carried off by other diseases manifested itself—the gain is very obvious. The mortality of early life, and at all ages short of old age, has steadily diminished, and the number of persons who attain a good old age has as regularly increased. Lastly, so far are fevers and scrofulous diseases—the forms of disease specially alleged to have taken the place of small-pox—from having increased in frequency and fatality, that (as has been clearly shown by Dr. Greenhow, in a very able and elaborate investigation of the death-rates of London, at different ages and from different diseases) there has been a most remarkable diminution. The present death-rate of "fever" (if we include with the deaths now registered under that title all those deaths of the present day which might have been included in days gone by under the term, as scarlet fever, and inflammation of the brain, and inflammation of the lungs) amounts only to 385 per 100,000 of population, whereas a century ago its death-rate was close on 539.[1] This diminution in the mortality from fever has been also fully established by the researches of that eminent statistician Dr. Farr, who tells us that this cause of death has progressively subsided since 1771, and further that the combined mortality

[1] Simon, Preface, &c. (*op. cit.*), p. lv. Dr. Greenhow's excellent paper, which is well worthy of study, will be found *in extenso* in these Papers at p. 26.

of small-pox, measles, and scarlatina now is "only half as great as the mortality formerly occasioned by small-pox alone."[1] The smaller mortality occurring nowadays from scrofula and consumption has been likewise satisfactorily shown by both these able inquirers, working from separate data. And to the gain of life in diseases of this class there cannot, I apprehend, be any doubt that vaccination has largely contributed. It is one of the terrors of natural small-pox that, by its depressing influence on the constitution, it frequently develops, in those disposed, the seeds of tubercular and other scrofulous diseases. This is repeatedly noticed by writers on scrofula. Guersant and Blache, in their experience at the Hôpital des Enfants Malades at Paris, were struck with the effect which they noticed small-pox to have in developing scrofula and pulmonary phthisis.[2] "Having often," says Dr. Alison, "seen scrofulous, especially tubercular, diseases, originating during the feeble state of convalescence from bad small-pox, and being aware that small-pox, before vaccination was introduced, was always stated to be a mutilating, when not a fatal disease, I have no doubt that whatever prevents small-pox in a population will save many of that population from scrofulous and tubercular disease, otherwise to be fatal to them."[3] This indirect *prevention of scrofulous affections* was, indeed, among Jenner's hopes when he announced the discovery of vaccination. In various passages of his writings he refers to the notorious frequency with which such affections were excited by small-pox; and he appeals to general consent as to inoculated

[1] McCulloch's Descriptive and Statistical Account of the British Empire, 4th edit. vol. ii.

[2] Dict. de Méd., art. "Variole."

[3] Papers relating, &c. (*op. cit.*), p. 33.

small-pox often occasioning them. "In constitutions predisposed to scrofula, how frequently we see the inoculated small-pox rouse into activity that distressful malady. . . . Every practitioner in medicine who has extensively inoculated with the small-pox, or who has attended many of those who have had the distemper in the natural way, must acknowledge that he has frequently seen scrofulous affections, in some form or other, sometimes rather quickly, showing themselves after the recovery of the patients."[1]

The hypothesis that vaccination, by rendering persons less liable to small-pox, renders them eventually more liable to other diseases, is in fact contrary to the whole current of medical experience. This was clearly brought out when, in 1856, the Medical Officer of the then Board of Health addressed to the same members of the medical profession whom he consulted as to their opinion on the protective power of vaccination, the further question, "Have you any reason to believe, or to suspect, that vaccinated persons, in being rendered less susceptible of small-pox, become more susceptible of any other infective disease, or of phthisis; or that their health is in any other way disadvantageously affected?" Of 542 respondents, there was not a single one who gave the slightest support to the hypothesis.

113. Allegation that Cutaneous and Glandular Diseases may be invaccinated.—Inasmuch as cutaneous diseases and glandular swellings are frequently noticed in children subsequent to their vaccination, parents are often found to allege that these diseases have been introduced by the vaccination. But this again, though a popular, has never been a professional belief. Diseases of these classes are met with constantly

[1] As quoted by Simon, Preface, &c. (*op. cit.*), p. lx.

in infancy and childhood, as well in the unvaccinated as the vaccinated, from the influence of various exciting causes acting on constitutional predisposition. No facts exist to prove, or even to render probable, their greater frequency among the vaccinated than among the unvaccinated of the same ages respectively: observation, indeed, tends to show that there is no such greater frequency.[1] When eczematous and other eruptions manifest themselves, as they may do, shortly after vaccination has been performed, this is in fact usually, if not always, mere coincidence; and the eruption on inquiry is found to be really due to the irritation of teething, or probably to some error in diet, or to some general constitutional tendency. It *may* be, however, that in some cases vaccination, by the febrile action it sets up, may act as an *exciting* cause, just as a common cold would do, and thus be the means of sooner evolving some eruptive

[1] "As regards the relation of vaccination to the infantile skin diseases of chronic character," says Mr. Hunt, "I can confidently say, after examining and recording the history of upwards of a thousand cases of skin disease in children (occurring at the Western Dispensary for Diseases of the Skin), that I find no evidence whatever that vaccination disposes the constitution to cutaneous diseases; these appearing, in fact, to attack indiscriminately the vaccinated and the unvaccinated. Of course, since the Compulsory Vaccination Act has been in operation, we have had more cases of skin disease after vaccination than we formerly had, simply because children are now vaccinated at or before three months instead of at six, eight, ten, or twelve months of age. Therefore, a cutaneous disease which breaks out after the third month, necessarily occurs *after* vaccination. Formerly, it might at that age have occurred *before* vaccination. The date of vaccination has made the disease a *sequence*, not a consequence, of vaccination. Mothers frequently entertain the belief that any disease of the skin occurring after vaccination is caused by it; but I do not remember a single instance in which any reasonable evidence of such connexion could be produced." (Papers relating, &c., *op. cit.*, p. 71.)

disorder that was lurking in the system. But such cases are certainly exceptional: and, assuredly, no professional authorities believe in the *transference* of glandular or cutaneous diseases from one child to another by vaccination. Parental complaints of such communication arise, as Marson very justly states, from the unwillingness of parents "to believe that there is anything wrong in their offspring: and, when other diseases follow, vaccination gets blamed for what is really and truly due to other causes."[1] In corroboration of this statement, and as illustrating the want of foundation of such complaints, and the prejudices under which they are preferred, I may remark that having myself carefully investigated many of them I have never yet in a single instance found that the child from whom the lymph was taken was suffering from the disease it was said to have imparted.

Those who have had most to do with the performance of vaccination, on the one hand, and those who have been most concerned in the treatment of infantile disease, on the other, concur in the belief of the non-communicability of disease by vaccination. Marson stated some years ago that in the performance of upwards of 40,000 vaccinations he had "never seen other diseases communicated with the vaccine disease, nor did he believe in the popular reports that they are so communicated."[2] The experience of the late Mr. Leese, whose vaccinations had been scarcely, if any, less numerous, was the same.[3] Sir W. Jenner has put on record that at University College Hospital

[1] Papers relating, &c. (*op. cit.*), p. 25.

[2] Ibid. His vaccinations now amount to about 60,000, and his experience remains the same.

[3] Seaton on Protective and Modifying Powers of Vaccination (*op. cit.*), p. 365.

and at the Hospital for Sick Children he had, in six years, more than 13,000 sick adults and children under observation, and that in no case had he reason to believe, or even to suspect, that any constitutional taint had been conveyed from one person to another by vaccination.[1] Dr. West's experience, on 26,000 infants and children under his care in seventeen years, was to the like effect; and in stating that he had seen nothing in that time to make him believe that vaccination excites cutaneous eruptions in any but very exceptional cases, he referred such exceptional cases to a disposition in the children themselves, brought out by the vaccination as it might have been by teething.[2] And Professor Paget, speaking from his large experience among children in the out-patients' room at St. Bartholomew's, and enumerating some of the causes which develop cutaneous diseases in young children, says, "Now, vaccination may do, though I believe it very rarely does, what these several accidents may do; namely, by disturbing for a time the general health, it may give opportunity for the external manifestation and complete evolution of some constitutional affection, which, but for it, might have remained rather longer latent." "This is," he adds, "the worst thing that can with any show of reason be charged against vaccination; even this can very seldom be charged with truth."[3]

114. Allegation that Syphilis may be invaccinated. This is not supported (a) by general Professional Experience.—Syphilis differs from any of the other diseases which, it has been alleged, may be propagated by vaccination, in being an inoculable disease; a disease which, in fact, except in the forms in which it

[1] Papers relating to, &c. p. 75.

[2] Ibid. p. 146.

[3] Ibid. p. 139.

manifests itself hereditarily, is *always* the result of some inoculation. But the inoculation which produces it is the inoculation of its own infection: and as small-pox produces small-pox; vaccinia, vaccinia; and glanders, glanders; so does syphilis produce syphilis. The causes of all these and of other inoculable infections are specifically so distinct that it has ever been held by medical authorities in the highest degree improbable that the unmixed inoculable products of any one of them should convey any other infection along with it; and when, after the introduction of small-pox inoculation during the last century, the objection was raised that that process might be the means of conveying syphilis, enlightened medical opinion rejected such a supposition as not sustainable. The distinguished Dr. Mead represents the conclusions of medical observers of that period when, referring to individuals who "infected with an incurable itch of writing, and taking great pleasure in contradicting others to whom they bear envy, . . . still go on to terrify us by saying that there is danger lest, together with the small-pox, some other infection inherent in the blood and humours of the sick person should be transmitted into the sound body; . . . and such, perhaps, are scrofulous swellings and the venereal disease," he says, "yet I can hardly believe that it ever happens that the seed of one distemper should bring along with it mixed the procreative matter of another quite different from it. . . . It is in my opinion more material into what kind of body the venom be infused than out of what it be taken." And Moseley, in one of his diatribes against vaccination, says in reference, not to it, but to small-pox inoculation: "Suppose a subject in the small-pox to have inveterate scurvy, scrofula, itch, syphilitic infection, or consumption, certainly no person ought to take

matter from such a person for inoculation. But it might be done with as much safety as if none of these disorders were present. Peculiar circumstances, which I had no share in creating, have rendered me acquainted with some of these facts, and accident the others."[1] Whatever this objection might be worth as against small-pox inoculation, it would of course be worth as against vaccination; but in reference to this latter process its value has been tested on an infinitely larger scale, for where small-pox inoculations amounted to thousands, vaccinations have mounted to millions, and it may be safely affirmed that—prior, at all events, to recent occurrences which will be presently referred to, and which have caused the question of the communicability of syphilis by vaccination to be re-opened—there was the utmost accordance of medical opinion in rejecting the possibility of such communication. This will be at once obvious to any reader who will take the trouble to consult the replies given by between five and six hundred medical practitioners, comprising nearly every distinguished medical authority in Great Britain, and many or most of those in France and Germany, to the question put to them in 1856 by the Medical Officer of the then Board of Health: "Have you any reason to believe or suspect that lymph from a true Jennerian vesicle has ever been a vehicle of syphilitic, scrofulous, or other constitutional infection to the vaccinated person?" The distinguished and experienced authorities whose opinions I quoted in the previous section, as to the non-communicability of disease generally by vaccination, not only included syphilis with other diseases, but specially included it; Dr. West stating that there had never come under his notice "any instance in which

[1] See Simon, Preface, &c. (*op. cit.*), p. lxv. and note.

there seemed the slightest pretext for supposing that syphilis had been communicated to infants through the medium of the vaccine lymph;" and Professor Paget, that he does not remember "to have heard infantile syphilis ascribed to vaccination, frequent as the instances of it [infantile syphilis] are among the out-patients." Neither Marson nor Leese, in their immense vaccinating experience, ever met with anything to countenance the belief that vaccine lymph had, on any occasion, been the vehicle of conveying syphilitic infection. And Mr. Tomkins, the Inspector of Vaccinations of the National Vaccine Establishment, who has himself vaccinated nearly 50,000 children, and whose experience of the whole operations of the Establishment embraces thirty years of its history, informs me that no instance has ever come to his knowledge of syphilis having been communicated by vaccination. If we pass from the evidence derivable from great experience in vaccination on the one hand, to the evidence supplied by practitioners most conversant with syphilis on the other, we find that neither Acton, nor Lee, nor Langston Parker, daily as they have had to do with syphilis all their lives, have ever seen a case of that disease traceable to vaccination. And though the great leaders of our profession, as Chomel, or Rostan, or Bright, or Latham, or Watson, or Brodie, or Joseph Henry Green, may have had little or no experience in the mere practice of vaccination, and some of them probably little to do specially with syphilis, their vast and intimate knowledge of the nature of diseased processes and the laws by which such processes are propagated in the human subject gives immense weight to the opinion they unreservedly express, that the specific infection of the one disease cannot convey with it the other. "The suggestion

of its being possible," says Latham, in his own forcible way, "amazes me." "I apprehend that persons entertaining such opinions," says Joseph Henry Green, "can be only those who are ignorant of the circumstances under which diseases are ordinarily propagated."[1]

No doubt, so far as regards the argument derivable from professional experience in this matter, it may be said that it is worth much less than at first sight it might appear to be, because vaccinators are careful to avoid syphilitic children as sources for continuing their lymph; and though our vaccinations count now by millions, the vaccinations from syphilitic sources must, after all, have been very few. Unquestionably this is so: comparatively, they must certainly have been very few. We may justly think with pride of the care which for the most part the profession has taken, in this country at all events, to guard the purity of vaccination. Whatever carelessness or looseness in the performance of vaccination there may often have been, it is not in indifference as to *the subjects from whom lymph was taken* that, in professional hands, this carelessness has in England manifested itself. Still, even amongst us, there has been so much miscellaneous and non-professional vaccination, and with many practitioners the strength of the conviction that it was impossible to communicate by vaccine lymph any other than its own contagion has been so great, that I cannot persuade myself but that, in the course of seventy years, vaccinations from children having some hereditary taint of syphilis must have occurred often enough to constitute an experiment of quite sufficient magnitude to give us very positive and very safe conclusions; nor but that, "if syphilis could be diffused by the vaccine lymph of

[1] Papers relating, &c. (*op. cit.*), p. 321-17.

children with an hereditary taint of that disease, this possibility must long ago have been made evident on a scale far too considerable for question."[1]

Assuredly, however, neither our great medical authorities, nor the profession generally, have arrived at the conviction so almost unanimously hitherto entertained by them, of the non-communicability of syphilis by vaccine lymph, solely because there were no well-established cases of such communication having taken place in the ordinary process of vaccination. They relied also on the teachings of pathology, and of direct experiment.

(b) **Nor by Pathological considerations.**—Professor Paget states the pathological grounds for disbelieving the possibility of communication of syphilis by vaccine lymph—supposing always that it is the unmixed lymph of a true vaccine vesicle—to be (1) because *infantile syphilis* (which alone need be here considered), though conveyable in some instances by its own pecu-

[1] Simon, Preface, &c. (*op. cit.*), p. lxvi. But suppose (as we should have to do, if we were to accept unreservedly a number of statements that have been made) that to impart syphilis by vaccination it is not necessary that the child yielding lymph should at the time have any manifestation of syphilis, but that it is quite enough that it should be incubating that disease,—or much more, that it need not even be incubating syphilis, nor have, either before, or at the time of, or at any time after the lymph was taken from it, any indication of syphilis whatever, but only have a parent not then suffering from syphilis, but who *might* at some former time have had it,—or still further, that it should itself be free from syphilis, and remain free, and its parents equally free, and the child from whom it was vaccinated and *its* parents equally free (there being, in short, perfect immunity from syphilis as far back as the lymph could be traced): suppose all this, I say, and at this rate the whole world must have been syphilized long before this. The argument from experience not only then gains *immense* force, but becomes indeed, on the scale on which we have it, in my opinion quite unanswerable. Surely this is the sort of evidence that proves too much.

liar morbid products, does not render the blood of the patient capable of directly conveying the disease; and (2) because, if the blood of a syphilitic child could so modify the vaccine disease within it as that the vaccine lymph should be capable of conveying any other disease, there is every reason to believe that the vaccine vesicle formed in the diseased child would be modified in correspondence with the modified lymph. "All pathological researches," he remarks, "accumulate the evidences of the constant correspondence between the material in the blood, on which each specific disease depends, and the morbid structure, by which each is manifested. Thus the transformations of the syphilitic poison are indicated in the successive external characters of the primary, secondary, and tertiary affections; the transformation of the scarlatina poison by its regular symptoms and its sequelæ. And so, if the vaccine virus were capable of any transformations besides those which mark its regular influence in each patient, such transformations, we may be sure, would be indicated by corresponding and evident changes in the vaccine vesicle. In other words, if the vaccine were changed into any other virus, there would be no vaccine vesicle."[1] The opinions of Hebra, and other distinguished pathologists, are equally opposed to the possible communication of any other infection with vaccine lymph. Who ever heard, in fact, of the virus of small-pox producing anything besides small-pox? or the virus of measles anything besides measles? If cases should be alleged to show that they did so, let anybody ask himself what amount of evidence he would require to establish the point: whether it would not be infinitely more reasonable to conclude that there were fallacies in the cases,

[1] Papers relating, &c. p. 139.

though we might not be able to point them out, than that an event should have occurred so opposed to universal experience.

(c) **Nor by Experiment.**—Direct experiments made on a large scale, at various times, and by many individuals, have led in every single instance to the same conclusion. Vaccination with lymph taken on purpose from syphilitic subjects was experimentally practised quite early in the century: and the experiments have since been repeated again and again by different observers. The inoculations of this kind which Cullerier, Taupin, Heymann, and others have performed, have been very numerous. Within the last half-dozen years, and since the communicability of syphilis by vaccination has been so warmly discussed, occasion has been taken, by several individuals, further to repeat them. Unvaccinated persons who happened to be suffering from chancre have been vaccinated, and vaccine vesicles raised, in close contiguity to the chancre: and from the vesicles so raised vaccinations have been performed. But never has it happened, on a single occasion, that syphilis or that any other result than vaccinia has followed the use of vaccine lymph thus purposely taken from a syphilitic subject.[1] Now, the value of these experiments is immense: for in them we know exactly under what conditions we are acting—whether the vacciniferous child was really syphilitic or not, whether the vaccine vesicle developed on it were a regular vaccine vesicle or not, whether the lymph

[1] I cannot see the advantage, in experiments of this kind, of making the vesicles close to the chancres, and I can see a great disadvantage in the risk that, in taking the products of the vaccine vesicles for further experiments, some of the syphilitic virus might *accidentally* get mixed with the vaccine lymph, and thus lead to syphilitic results and to most fallacious conclusions.

used was mixed or not mixed with syphilitic products, whether it was mixed or not mixed with syphilitic blood. The difficulties with regard to these points that surround our inquiries when a vaccinal origin is ascribed to a syphilitic case are so great, the fallacies to which we are always exposed in our attempts to discover the real origin of cases of syphilis when an unusual origin is suggested are so great, that cases of alleged vaccinal syphilis become, "in contrast with experimental results, almost valueless for instruction." Is it credible that, if syphilis were inoculable through vaccine lymph, it should not have been inoculated on any one of these really innumerable occasions? It is not as though the syphilitic virus were one to which the human system had any repugnance: the exceeding facility with which it is inoculable is well known. Nor would analogy lead us to suppose that syphilis could be thus conveyed. Taupin and others, in their experimental inoculations from diseased subjects, used lymph taken from persons affected with various other contagious diseases besides syphilis; but not one of these diseases were they able to communicate through the lymph. From the earliest days of vaccination it has been, moreover, a matter of familiar knowledge, a matter to which I have before had occasion to advert (§ 36, p. 74), that if lymph be taken from a vaccine vesicle in a patient suffering from variola, with due care to procure it from the vaccine vesicle only, and unmixed with the products of any of the variolous vesicles, nothing but vaccinia is ever produced. "Since, then," says Simon, "it is a quite unquestionable certainty that, even when the system is drenched with that subtlest infection of small-pox, the Jennerian vesicle preserves its own contagion pure and isolated, the argument may reasonably be extended. And, even if there were no evidence in rela-

tion to other diseases, this analogy would have rendered it eminently improbable that any, the most infectious, of their number could admix its contagion with the specific products of cow-pox. Indeed, so definitely and so constantly characterised are those local changes which different morbid poisons severally and specifically produce, that to say of a given phenomenon 'this is a typical Jennerian vesicle' is, I believe, tantamount to saying this is a vesicle, which only one unmodified influence can produce, which no second influence can concur in producing, and in the contagion of which no second principle of infection can possibly reside."[1]

(d) **Of course Insertion of the matter of Syphilis will produce Syphilis. The Harmlessness of Vaccination is dependent on due Care being used.**—Whatever conclusions have at any time been arrived at with regard to the non-communicability of syphilis by vaccination have proceeded always on the assumption, not only that vaccine lymph was used (without which, of course, there could have been no vaccination), but that it was pure, unmixed vaccine lymph. If the matter of syphilis, or of any other inoculable disease, were used, accidentally, *instead of* vaccine lymph, who could doubt that syphilis, or the disease the material of which had been used, would be the disease produced? If the matter of syphilis were *mixed with* vaccine lymph, we had positive experiment to prove to us that syphilis would result. And if a lancet that had been used for syphilization, or had become in any way contaminated with the matter of syphilis, and not properly cleaned, were used for vaccinating, there would of course be the same liability to

[1] Simon, Preface, &c. (*op. cit.*), p. lxiii.

communicate syphilis. Malpractice in performing, or in attempting to perform, vaccination is one thing: the communication of syphilis by vaccine lymph is another thing. Obvious as the distinction is, it seems very necessary to insist upon it, because instances, that were well known and had never been denied, of culpable carelessness in attempting to vaccinate have in recent discussions been made much of, as though they exhibited the results of the real and proper performance of vaccination. There is however one respect, and a very important one, in which recent facts appear to correct views previously entertained as to the effects of mixed syphilitic and vaccine viruses. So far as experiments had gone they had led us to believe that, whenever a mixture of the two viruses was used, the compound fluid would produce syphilis, certainly, but would not produce vaccinia: that syphilis in its inoculable form prevented, within the sphere of its infection, the formation of a vaccine vesicle. In experiments with such a mixture made by Sigmund and Friedinger nothing but syphilis was ever produced.[1] Professor Boëck, also, in his experiments on the syphilization of children, frequently mixed vaccine lymph with the syphilitic matter, but, like Sigmund, never obtained any but syphilitic results; and the children were afterwards successfully vaccinated in the usual way.[2] In the details of one of Friedinger's experiments, however, the pustules which arose from the inoculation of the mixture were noticed as presenting in their development

[1] Simon, Preface, &c. (*op. cit.*), p. lxv.

[2] De la Syphilis Vaccinale (Paris, 1865), p. 386. This is a report of the discussions which took place in the Acad. Imp. de Méd. on this subject in 1864, together with a reprint of various papers, including the very able, interesting, and comprehensive essays of M. Viennois.

some analogy with a vaccine pustule (vesicle);[1] but on this kind of appearance no stress was laid by him, nor indeed ought to be laid, as it might have occurred even if unmixed syphilitic matter had been employed, for we have Ricord's authority that a chancrous pustule, "initial lesion of the primary syphilitic ulcer when it develops itself on the skin," has characters which may readily cause it to be confounded with the vaccine pustule.[2] Similar experiments made by Baumès and Sperino resulted, like those of Friedinger, always in the development of syphilis, but produced also in one case what appeared to them to be like a vaccine effect; and as this case is cited by M. Viennois[3] as proving, in his opinion in the clearest way ("de la façon la plus nette"), that both vaccinia and chancre were communicated together, it is of the utmost importance to note what those results were. The subject of this experiment was a young woman, who had never been vaccinated or had small-pox, and the account of the phenomena produced by the inoculation with the mixed viruses of chancre and vaccine, given by M. Baumès, is as follows:—"Dès le début les pustules ont offert, d'une manière sensiblement prédominante, le caractère vaccinal. . . . Le troisième jour, au point où les piqûres avaient été pratiquées, apparaissent de petits cercles enflammés, rouges, foncés, assez circonscrits, avec sensation de dureté au tact; le quatrième jour, un point central se dessine en forme de pustule par le soulèvement de l'épiderme, renfermant au-dessous une matière moins claire, moins opaline, que le fluid-vaccin, et se rapprochant déjà ce jour là et beaucoup plus le lendemain, de la couleur, de la consistance de la matière

[1] De la Syphilis Vacc. (*op. cit.*), p. 277. [Soc.), p. 54.
[2] Diday, Treatise on Syphilis, translated by Whitley, (New Syd.
[3] De la Syph. Vacc. (*op. cit.*), p. 280.

propre à la pustule variolique et à la pustule chancreuse; le sixième jour, toutes les pustules sont bien formées, nettement dessinées, aplaties, largement ombiliquées, avec cercle rouge foncé, d'un aspect cuivreux, gonflement du derme; le septième et le huitième jour, la dimension des pustules d'inflammation augmente; de fortes douleurs, mêlées de démangeaisons, se font sentir; la malade, par le frottement ou en se grattant, rompt les pustules; celles restées intactes sont déchirées par la lancette pour l'inoculation du pus chancreux à d'autres malades." A vaccination performed on this young woman, two days afterwards, with lymph taken from the arm of a child, produced no effect. If this be indeed a case of vaccino-syphilitic inoculation, of the production of the two diseases by the same operation, if in the peculiarity of pustule noted from the fourth to the sixth day the action of the vaccine virus was manifested, it was surely a case of most irregular vaccination, one which exactly bears out, and exceedingly well illustrates, the statement of Paget that if any other virus were working locally along with vaccine lymph, there would be correspondent and evident changes in the character of the vaccine vesicle. Pus taken from the pustules in this case on the eighth day communicated chancres only. What would have been the effect of matter taken from them two or three days earlier? I cannot say. Possibly some remains of the vaccine virus might have caused some spurious results of vaccinia to be manifested. But if M. Viennois, in citing this as a typical case of vaccinia transmitted along with chancre, means that vaccine lymph, such as might properly be used in vaccinating, could be got from such pustules as these, there would surely, where such doctrines were held, be an easy way of accounting for any amount of accidents.[1]

[1] I am not personally acquainted with the practice of vaccination

On the other hand, there is no reason that one can see why the inoculable materials of two different infections, each having a different period of incubation, should not if inserted together produce each its own specific results. If the two contagions were simultaneously inoculated on different parts of the skin, there can be no doubt, I apprehend, that such would be the consequence; and the like might not unreasonably be expected to occur if they were mixed and inserted together on the same part of the skin. The whole course of vaccinia is over in about three weeks, or before, according to its law of incubation, the virus of syphilis begins to manifest its local action; and in this way (though as yet intentional experiments have not so

in France and Italy, but the accounts one reads of it are not of a nature to give much confidence as to the manner in which a good deal of it is performed. It seems to have been withdrawn to a large extent from professional care, and to have been handed over to farriers and midwives. It is a common thing to read of the same child being used two or three days running for yielding lymph, and of fifty, sixty, or a hundred children being vaccinated off it! In one case 104 children were vaccinated from the same child on three different days! What the kind of vesicles are from which lymph is taken I cannot say. In professional hands there would be no fear in England of anything being taken from any pustules like those, *e.g.* described in the text: but who shall say what might not be taken by ignorant people professing to vaccinate? It is not many years ago that I saw a druggist, who had in his time done a good deal of vaccination, about to vaccinate some children (and but for my interference he would have vaccinated them) with matter taken from an *open sore* on the arm of a child, on which there was not a vestige of a vaccine vesicle having ever been, but which he assumed to be vaccine because he had vaccinated the child on that spot on the arm the week before. It should in justice be stated that the practices above adverted to in the performance of vaccination in France and Italy have come to light in reference to the accidents which (and no wonder) have followed; and may by no means fairly represent the way in which vaccination generally is carried on in those countries.

demonstrated) the two diseases might possibly be implanted together. In some such result of an accidental and undesigned experiment exists certainly the most probable explanation of one or two occurrences in which there seems authentic evidence of regular vaccinia and of syphilis being received at the same operation. A scandalous transaction of this kind took place some two years ago, at the Académie Impériale de Médecine at Paris, when, the Director of the vaccinations being absent, the day's vaccinations were left to a mere *employé* of the establishment,[1] who took, it was found afterwards, the material with which he performed a certain portion of these vaccinations from a child *covered with syphilitic eruptions and ulcerations, and in such an advanced state of the disease that it died the day following.* In eight out of nine children operated on from this source, vaccine vesicles appear to have been developed, and in all the nine unequivocal syphilis manifested itself afterwards. No direct evidence is of course obtainable as to what the material used for these vaccinations really was. But which is the more likely, having regard to the results which have attended every one of the innumerable experiments in which lymph has been taken from syphilitic children, but in which there was no admixture of syphilitic products,—that the lymph he used was so mixed, or that it was mere lymph? There was in this case every facility for such careless mixture. But as in two-fold inoculations of this kind the two infections acting each within its period of incubation would take quite independently one of the other, whatever lymph might be extracted on the eighth day from a vesicle having the character of a normal vaccine vesicle, would of course

[1] Was it the individual whose qualifications are described at p. 184?

convey nothing but the vaccine infection. In 1862, five out of six children vaccinated at Torre del Busi, by M. Quarenghi, with some stuff in a tube which had been lying by for six months, first went through vaccinia in the usual way, and had afterwards syphilitic symptoms of so infectious a kind that their mothers and nurses, and those who handled them, or fed with the same spoons as they used, were syphilized; but yet these children on the eighth day of their vaccination transmitted nothing but vaccine, without any trace of syphilis, to the children who were vaccinated from them.[1]

(e) **Question of Accidental Inoculation of Syphilis by the Blood.**—If, again, syphilis be inoculable through the blood, inoculation of the blood of a syphilitic subject along with vaccine lymph might readily be supposed capable of conveying along with it the syphilitic infection. And this is indeed the explanation usually offered of cases in which some have held that both vaccinia and syphilis were communicated by the same operation, but in which, according to accounts, the vacciniferous child was not at the moment the subject of any external syphilitic manifestation—was in fact only incubating the disease. M. Viennois, who strongly holds the opinion that syphilis may be implanted with vaccinia under such circumstances, does not imagine this to take place through the vaccine lymph, and gives indeed very sufficient reasons why this should not be so; but he holds, and H. Lee and others follow him, that the blood may act like one of the inoculable products of syphilis would do in infecting the system. No doubt this is infinitely more probable than that vaccine lymph should be an agent of such infection; but yet when we reflect (1) that no proof has ever yet been adduced by direct

[1] De la Syph. Vacc., p. 303 *seq.*

experiment of the communicability of *infantile* (or hereditary) syphilis by blood-inoculation;[1] (2) that the inoculation, by the blood, of the acquired syphilis of an adult has been found, in direct experiments, to be a matter of very great difficulty, requiring for success (when it is attained) the exposure of a very large absorbent surface; and (3) that, in the vaccinations which must in the course of seventy years have taken place accidentally from syphilitic children times innumerable, blood must often have been invaccinated, and that in many of the experimental vaccinations from syphilitic children either no care was taken to exclude blood, or blood was purposely mixed, and yet no syphilis resulted;[2] we are justified, I think, in requiring very clear evidence indeed before we can admit that syphilitic infection can be communicated wholesale by the blood which might enter in an ordinary carelessly-performed vaccination, as in some of the cases alleged—evidence, I will venture to say, after a careful study of these cases, far stronger than has yet been adduced in any one of them.

[1] In all the alleged cases of communication of syphilis in vaccinating, the lymph was taken from a child, except in the cases of J. Lecocq: but Lecocq's cases are very inconclusive (see *post*). Heim in some of his experiments took the lymph from adults, but no syphilis followed. (Historisch-Kritische Darstellung der Pockenseuchen, p. 613.)

[2] Cullerier particularly mentions that his experiments were made without any special precaution (Gaz. des Hôpitaux, 1862, p. 99): and Boëck mixed the syphilitic blood of a child on purpose with its own vaccine lymph, and performed with the mixture two re-vaccinations; vaccine effect was produced in one of the cases, but no syphilis in either. (De la Syphilis Vaccinale, p. 386.) In conducting an ordinary vaccination, it has ever been the mark of a slovenly and careless vaccinator to allow any blood to be mixed with the lymph used: but still I do not think that it occurred to many to suppose—at all events before the recent discussions—that there was in the mixture any risk of conveying extraneous infection.

(f) **Consideration of cases of alleged Vaccino-Syphilitic Inoculation.**—Cases which had been supposed to show that syphilis might be introduced into the system by means of vaccination date back to a very early period of the century. They were, however, so few in number—the medical literature of sixty years being unable, when ransacked, to furnish more than a dozen occasions on which such an event was supposed to have occurred—and these when examined were found to depend so much on hearsay and doubtful evidence, and to be so open on all sides to fallacies, that they had done little to shake the belief, entertained till a few years ago by the whole profession at home and abroad, with very rare exceptions, that the two diseases would not pass into the system together. If vaccinia passed, it would be vaccinia only. If syphilis passed (which of course, as then held, could not be without the substitution, or the admixture, of syphilitic matter), it would be syphilis only. I have already stated how far, in my opinion, this belief as to the impossibility of introducing the two diseases at one time, if the inoculable products of both are used, may be open to correction. But such were certainly the opinions generally entertained, till, in 1861, some occurrences which took place in Italy and France caused the whole question of the invaccination of syphilis to be reopened for discussion. The event in Italy was an outbreak of endemic syphilis at a little village called Rivalta, clearly traceable, it was said, to a vaccinal origin; the event in France was the occurrence, in the wards of M. Trousseau at the Hôtel-Dieu, in Paris, of a case which gave, it was said, direct proof of a vaccino-syphilitic inoculation. It so happened that, at the time these events occurred, the medical profession in France was much divided between two rival schools of syphilogra-

phers, and that, from the intimate bearing which the vaccinal inoculation of syphilis, if shown to be possible, would have on the points in dispute, a very large party existed not only ready, but apparently eager, to accept any evidence of it. A discussion began within the walls of the Académie which is not yet terminated, nor is likely soon to be terminated.[1] In the course of it every case then on record was brought out for re-consideration. Other alleged cases of subsequent occurrence have since been added. And there is now a party there who maintain that by vaccination (meaning thereby vaccination performed with the lymph of a genuine Jennerian vesicle) from a subject who has any syphilitic taint, and even from subjects who, so far as evidence can determine, are free from any such taint themselves, and are derived from parents who have no such taint, syphilis may be communicated! The Académie, as a body, is far from having endorsed these opinions. In Germany and in England, the inquiry has been taken up in a much more sober spirit, but certainly with no less determination to arrive at the truth. The necessity of reviewing the whole subject has been fully recognised, but it has also been clearly seen that when we are called on to accept, on the ground of certain alleged facts, conclusions which are opposed to all that pathology and experience had hereto fore taught us, we ought to satisfy ourselves not only that

[1] The patient reader of these discussions (and it requires some patience to read the whole of them) will see that I have not misrepresented their spirit. The vaccinal inoculation of syphilis, as it is called, is hailed in a sort of jubilant tone as giving the "dernier coup" to a certain "école syphilographique." Personalities abound, and are not even excluded from the Official Report, or rather "Projet de Rapport," drawn up by M. de Paul for presentation according to custom, to the Ministre de l'Agriculture, &c., but not accepted by the Académie.

these facts rest on sufficient testimony, but that they comprehend everything necessary for a complete judgment, and that no other interpretation of them is possible.[1]

Among the sources of fallacy against which we have to be on our guard in cases in which syphilis has been said to have been produced by vaccination, one is an erroneous diagnosis. Persons talk very glibly about sores being syphilitic, and eruptions being syphilitic, as though the characters of syphilitic sores and syphilitic eruptions were so made out that there could never be any mistake about them. Yet such mistakes are daily being made by practitioners in general, and are occasionally made by the very highest authorities. About four years ago one of those amongst us most conversant with syphilis, Mr. Henry Lee, announced to the Medico-Chirurgical Society that he had a case under his care in which a syphilitic chancre had been produced on the arm of a child by vaccination. The case was seen by many members of the profession, some of whom agreed with Mr. Lee, while others saw nothing but a sore arm, the result of a degenerated vaccine vesicle. The subsequent progress of the case quite satisfied Mr. Lee that he had been mistaken in his diagnosis, as he publicly acknowledged.[2] Acton tells us that he has repeatedly seen eczema, lepra, and papular eruptions in children ascribed to a syphilitic taint, which

1 As M. Briquet has well pointed out, a competent observer, and a complete observation, *reported with such detail as renders the statements capable of being checked by the reader*, are indispensable requisites for establishing the reality of an ordinary fact in medicine; and if for establishing an ordinary fact, how much more when the facts alleged are confessedly so rare and so contrary to all previous experience as these must be admitted to be.

A case looked on at first as very doubtful, but recognised afterwards to be a simple sore arm, was met with by MM. Bergeron and Cullerier. (De la Syphilis Vaccinale, p. 48.)

were after all eruptions of a simple non-specific kind. And assuredly I have on various occasions myself known (quite apart from any connexion or supposed connexion with vaccinia) eruptions called syphilitic, for no other reason than that they were intractable, and had something of a dusky colour. In all alleged cases of post-vaccinal syphilis great care must be taken in the first instance with regard to the diagnosis.

But, supposing the diagnosis established, the next point is to ascertain the origin. Now there is no medical practitioner who needs to be told, and no medical student can be long in finding out, that, of all subjects of medical inquiry, the ascertainment of the origin of individual cases of syphilis is one of the most perplexing and the most encumbered with fallacies. Hereditary syphilis (unfortunately not uncommon) is yet generally not willingly admitted by either one or the other parent. Its symptoms do not manifest themselves usually till some weeks, and in exceptional cases not till some months, after birth; and if in the meanwhile vaccination should have been performed, what so convenient as that it should be put forward as the cause? Nor is it by any means impossible that, in children with hereditary taint, the vaccination might, by its momentary derangement of the health, actually have been the means of first evolving the disease; or that in some in whom the disease had already manifested itself before vaccination, but had disappeared on treatment, the vaccination might be the means of again evolving it. This we know may be done by the clean cut of a surgical knife used in an ordinary operation, and presumably, therefore, might happen "at the vaccine punctures of a child having latent constitutional syphilis. Under the operation of this constitutional taint they, or one of them,

might become the seat of secondary syphilitic ulceration, and greatly perplex any observer in ignorance of the real cause; especially, of course, if the parents were endeavouring to disguise the previous facts of the case.[1] Where syphilis in children is really *acquired* we know that there are many ways in which this may be brought about; from their nurses, from the persons with whom they sleep," &c. &c.

In investigation, then, of alleged cases of vaccinal syphilis we have to ascertain (1) whether we are really dealing with syphilis; (2) whether, if this be so, the syphilis is not hereditary, and a mere coincidence or evolution of the vaccination; (3) whether, if it be acquired syphilis, this has not some other origin, unconnected with the vaccination or attempt to vaccinate; (4) whether, if the acquisition of the syphilis be reasonably traceable to the vaccination or attempted vaccination, there is evidence, direct or presumable, that the so-called vaccination had been done from a genuine vaccine vesicle, and that the products of that vesicle had not been mixed with some of the inoculable products of syphilis. Not till all this was settled would any question arise

[1] "Some years ago I performed on a little boy, having no apparent ill health, a very trifling surgical operation—that for phimosis. In a few days the incision was, as is usual, all but well. In a few more it had begun to ulcerate. For some weeks there continued in the part an indolent inflammatory process, with considerable swelling, and slow but progressive ulceration. A variety of treatment failed to do good. At length a suspicion occurred to my mind which led me to prescribe iodide of potassium. Within eight-and-forty hours the wound had thoroughly changed its character—every reason for alarm was gone; and within a few days complete healing was accomplished. I now learnt that the child had been born with a strong hereditary taint, and had—long before the operation—required constitutional treatment on account of the usual symptoms of infantine syphilis." (Simon, Preface, *op. cit.*, p. lxvi. note.)

about admixture of blood. The interest and importance, after all, of the cases in which vaccination is alleged to have communicated something besides its own infection, turn entirely upon whether the vaccination had been performed with the unmixed lymph of genuine vesicles, vesicles about which no competent person would make a mistake.

It must obviously be impossible to discuss at length, within such limits as in a general treatise of this kind could be allowed, all the cases that have been cited as evidences of the communicability of syphilis by vaccination. The most satisfactory course will be, I think, to examine carefully three or four cases, typical of the kinds of proof which have been advanced of this occurrence: but the reader will find all the cases—at all events, all on which any stress has been laid by the advocates of vaccino-syphilitic inoculation—referred to in the note below.[1]

[1] Many of the following cases had been long known, amply discussed, and set aside as inconclusive, at the time when the general expression of medical opinion as to the harmlessness of properly performed vaccination, before referred to (p. 305), was elicited in answer to the inquiries of Mr. Simon, in 1856. (1) An endemic of syphilis reported by Cerioli as having occurred in 1821 [inquiry made *eight* months after its origin; the account given of this endemic is of the loosest kind; it was not proved, or even alleged, that the child from whom the lymph, supposed to have been the origin of the outbreak, was taken, had ever had syphilis]; (2) another endemic in 1841, seen also by Cerioli [investigated likewise after a very long lapse of time; the child from whom the lymph was taken never had syphilis, but *it was said* that *a year before* his father had had syphilis —this one child was used for vaccinating sixty-four children, living in four communes]; (3) cases reported by Pitton in 1844 and by Ceccaldi in 1845 [worth referring to as showing the sort of evidence which some practitioners rely on to prove vaccinal syphilis, but not cases, it should be said, to which M. Viennois attaches any importance; he points out that the dates are inconsistent with the syphilis being derived from vaccination]; (4) cases reported by M. Vianit,

The case which is generally cited as that of "Le Vétérinaire B." is a case of undoubted communication of

in which two adults had syphilis, ascribed to re-vaccination, from a little nephew [details quite insufficient for any complete judgment]; (5) case of the Vétérinaire B., in 1850, stated at length in text; (6) case of Hübner, in 1852, also referred to in text; (7) a case at New York, in 1854, of a child having a sore on the arm, and general symptoms believed to be syphilitic, said by parents to have been from vaccination in Ireland (!); (8) the cases recorded by Mr. Whitehead, of Manchester [Mr. Whitehead's book was published some time before Simon's inquiry, but in none of his cases is the evidence at all conclusive, and very little weight, I believe, has ever been attached to them; M. Viennois himself rejects all of them but four]; (9) cases said to have occurred in 1856 in an Italian village to Dr. Marone, but not recorded till six years afterwards [not till after the Rivalta cases, which in circumstances they resemble]; (10) case of two soldiers vaccinated, in 1859, by Jules Lecocq [the lymph was taken from an adult, who, it is said, three months before had had chancre, but had quite recovered; other persons vaccinated from him had vaccinia and no syphilis, but these two had no vaccinia, but sores on the arm, and at the end of six months secondary eruption. In one account, given by Lecocq, these sores are said to have begun on the *fourth* day of the vaccination, in another account, also by him, to have begun on the *eighth* day: either of which dates is inconsistent with their being of really syphilitic character, and the origin of the constitutional affection which afterwards followed, but the discrepancy should not pass unnoticed, as showing how little reliance, in a matter of dates, is to be placed on the testimony even of educated and professional persons, when given from mere recollection. How much more, then, is caution requisite in accepting the statements of ignorant and prejudiced persons as to dates, and sequence of events, relating to the origin and progress of disease]; (11) the Rivalta cases; and (12) Trousseau's case [both given in text]; (13) cases of M. Quarenghi [also referred to in text]; (14) three cases recorded in 1863, one by Chassaignac, another by Devergie, and another by Hérard, of children having vaccine vesicles, and afterwards syphilitic sores on the arms [but in each of these, essential particulars with regard to the vaccination are wanting]; (15) case of two children vaccinated at Alma in 1863, who, according to the very cursory account given, had vaccine vesicles first and syphilitic sores afterwards; (16) case reported in 1864, by M. Sebastian

syphilis by a man professing to vaccinate—one of the cases of culpable carelessness already adverted to—but so far from being a case of syphilis communicated along with vaccination, the account affords not the smallest pretext for asserting that there was ever any vaccination at all. It appears that in a town in Germany twenty-four people belonging to different families were in February 1849 (some on the 13th, some on the 14th, and some on the 15th) re-vaccinated, as they supposed, by him. There is no statement of vaccine vesicles having been produced in one of the cases, but *at the end of three or four weeks* (*i.e.* the ordinary period of the incubation of syphilis) ulcerations of a syphilitic character began at the points of inoculation in nineteen out of the twenty-four persons operated on, and these were followed in due course by constitutional

of Beziers [a case brought forward to show, in conjunction with some experiments, that blood may communicate syphilis, but that lymph will not]; (17) the cases at the Académie in 1865, stated in text; (18) statement of 104 children vaccinated *on three different days* off the arm of one child in 1866, by a midwife—all of them, as well as twenty-three who were vaccinated the week following, having syphilis [certainly one of the most extraordinary cases on record. A case unquestionably of great malpractice in vaccination; but whatever symptoms these children had that were taken to be syphilitic, they all recovered—ninety-seven of them who had no treatment, just as well as thirty who had specific treatment—and there was no secondary eruption in any of them at the end of seventy days. M. Bodélio might well say, "ce serait à faire doubter de la nature syphilitique de cette déplorable vaccination." The child from whom the lymph was taken was ascertained to be quite free from syphilis, and its parents; so also the child from which it had been vaccinated and its parents, which is as far back as the lymph could be traced]; (19) case of some children having syphilis, ascribed to vaccination from a child acknowledged to be perfectly healthy at the time of vaccination, and before, and long after, and never manifesting at any time to the period when inquiry was made a single symptom of syphilis; (20) a similar case.

symptoms. Here was syphilis, but no vaccination; what could have been the cause of it? The vaccinator who was inculpated asserted that the operations were all done with lymph taken from one child, who was "fort et sain," and who, having been vaccinated on the 4th of the month, had regular vaccinia. We shall see immediately how far this statement was borne out: but it must first be noted—and is an illustration of the want of precision generally attending these accounts—that we are nowhere distinctly told whether the so-called vaccinations, or any, or which of them, were done direct from the child, or whether the stuff taken from it might have not been collected on glasses, points, or tubes. For all that appears to the contrary, there was at least the possibility of a mistake (such as has happened many times with regard to the matter of other inoculable diseases),[1] of taking lancets, or glasses, or tubes, charged with one kind of inoculable matter instead of another. But, assuming that the matter used came from the source indicated, what was the state of this source? Though it was said to be from an infant "fort et sain," and that this was "surabondamment démontré par plusieurs témoins,"[2] a different account was given by

[1] In 1854 there was an outbreak of small-pox in a place in France from the unintentional use of variolous, instead of vaccine, matter for inoculation. There had been a similar occurrence about the same time in England. Such mistakes, unfortunately, have on several occasions been known.

[2] I need scarcely say that such evidence as one can get in inquiries of this kind is almost always tinged with great prejudice, and requires to be received with corresponding caution: nor need I point out that evidence may be none the less worthless because it is given without any intention of deceiving. The Vétérinaire's own testimony, however, with regard to the health of this child was just the kind of testimony that proves too much. Before he could think of selecting it as a source of lymph, he made, we are

other witnesses; and a doctor who saw the child on the 21st of February, a week after the lymph was taken off it, when of course no suspicion of anything wrong had yet arisen, testified to the existence of some erythematous eruption, which was said to be like syphilitic roseola, and it died on the 24th, three days after his visit, of hydrocephalus. But, more importantly, what was the state of its arm? It turned out that, according to an eye-witness, there was on the eighth day of the child's vaccination not a vestige of vesicles, "aucune trace de boutons," and yet two days later, the account tells us, several vaccinations were performed from it, and lymph continued to be extracted from it for two days more! Is it really meant that between the eighth and the tenth days vesicles appeared, the products of which communicated syphilis but no vaccinia, but which were yet genuine vaccine vesicles? The supposition is too absurd. But the case is further instructive in my opinion, because, being one which underwent a tolerably early investigation, the statements about the child's health, and its regular vaccinia, could be examined with some degree of hope of getting at the truth. If four or five months had passed, or if, as in some of the alleged cases, a much longer time had elapsed before any inquiry

told, special inquiries about its own health and that of its parents: and having got a very good account of the latter, he took the precaution to strip the child, "tout nu, pour pouvoir découvrir la moindre égratignure sur son corps." Nor was it sufficient to do this once: at the moment of collecting the lymph from him, on the 13th of February, he renewed his scrutiny, "afin, dit-il, de rechercher si l'insertion du virus-vaccin chez cet enfant n'aurait pas favorisé l'évolution de quelque exanthème caché." Did anybody ever hear of such steps being taken before taking lymph from an apparently healthy child who had genuine vaccine vesicles? Is there any person of common sense who will believe that he really did all this, and did not make up the story afterwards?

had been set afoot, how difficult, or how impossible, it might have been to correct the positive averments of a healthy child and a regular vaccination!

In Hübner's case—a case also of malpractice—there could be no doubt of some children having been syphilized, but no investigation of the circumstances was made till *eight months* afterwards, and the account of the so-called vaccinations (in most of which it is quite certain and admitted there had been no proper vaccine effect) was only what could be got from the statements and recollections, at that interval of time, of the mothers.

The case of M. Trousseau is of a different kind, but assuredly very instructive. Its chief strength, in my opinion, consists in the fact that it satisfied that very able and distinguished physician. The circumstances were these. A young woman was under treatment in the wards of the Hôtel-Dieu, for a uterine affection apparently of a non-specific character, at a time when there were some small-pox cases in the hospital, and wished to be re-vaccinated. This was done by three punctures on each arm, from a child, healthy at the time, and which, for anything that was ever known, never exhibited any taint. Four children who were vaccinated with its lymph, at the same time with this young woman, went through vaccinia in the regular way, and never had any subsequent syphilitic affection. On the young woman's arm slight papules only arose, and the re-vaccination was looked upon as having failed. She remained in the hospital a month after the vaccination, fully the time necessary for the syphilis, if there had been any imparted by the vaccination, to have incubated, and she went out without anything the matter on her arms. At the end of another month she attended at the hospital for treat-

ment of her uterine complaint, and then showed two sores on one of her arms, the character of which was not at first recognised, but which turned out to be undoubtedly syphilitic. It was not known at the time, but was afterwards ascertained, that she was a young woman of very loose character. Now, assuredly no one who knows in what extraordinary situations chancres have been met with, such as the cheek, the corner of the eye, in every sort of situation in which there could not be any, and never was any, suspicion of vaccination, can say that this was a case entirely free from fallacy as to the source of the syphilis: especially when we consider that, in the first place, there was utter absence of proof that the child from whom the lymph was taken ever had syphilis, and every presumption (from the children vaccinated from it at the same time with this young woman having assuredly never been syphilized) that it had not; and that, in the second place, the period of syphilitic incubation in this case, if the inoculation really dated from the time of the vaccination being done, was of quite unusual length. But, supposing that the effects were fairly traceable to the operation, which, I would ask, in the name of common sense, is the more probable—that lymph which had vaccinated, without syphilizing, four subjects, should syphilize, without vaccinating, a fifth, or that in an operation of this kind done in the wards of a hospital there might have been some accidental change of instrument, and that syphilitic matter, mixed or unmixed, may have thus found its way into the system? Though the woman had expressed a wish to be vaccinated, it appears she made a great deal of difficulty about it when it came to the point, and it was in fact not done without much urging,—a small circumstance, no doubt, and yet one which may not be wholly immaterial, for it shows that all did not

pass in the easy arm-to-arm way of an ordinary series of vaccinations.[1]

The occurrences at Rivalta, to which so much interest has attached, were of a different kind. In 1861, there occurred in this village a very remarkable syphilitic endemic. Three similar endemics are said to have been noticed in different places before, in 1814, 1821, and 1841; and if we include an account given (though not till some years after the occurrence took place) by a Dr. Marone, a fourth in 1856. It is certainly very singular that all these endemics should have occurred in Italy; and none resembling them met with elsewhere. Whatever their origin, the facts are of the deepest interest—a number of children affected at one time with syphilis, these infecting their nurses and mothers, the mothers infecting their husbands, the children infecting one another by the act of kissing or by the spoons used in feeding, and whole families infecting one another by merely being huddled together in confined and crowded dwellings. For it must not be supposed that only persons who were at the time the subjects of vaccination were the sufferers. Various endemics of this kind, quite as singular and quite as inexplicable, have occurred under circumstances entirely unconnected with vaccination, and indeed before vaccination was known or heard of. Passing by the very interesting accounts of the spread of sibbens and other syphiloid diseases which will be found on record, I refer particularly to outbreaks of undoubted syphilis, attacking large numbers of people at a time, which are

[1] It need scarcely be said that the unintentional inoculation of animal poisons through foul lancets has been known to occur on various occasions, when neither syphilis nor vaccination was in question.

related by various writers, and which Astruc has collected together. Anything more puzzling than the origin of these cases it is difficult to conceive. By some they were attributed to the water in which people bathed: by others, to the use of the same cupping instruments (cupping being in those days a sort of fashionable process).[1] In the five endemics specified at the beginning of this paragraph a vaccinal origin was alleged: and this was made in the Rivalta case the subject of careful inquiry by a scientific commission. Unfortunately, however, the inquiry did not take place till four months after the outbreak; and as in no single case of the children said to have been syphilized by vaccination had any application been made to a medical man on account of the condition of the arm, facts and dates on the exactitude of which everything depends had to be got as they could at such distance of time from the testimony of the villagers, for the most part ignorant and prejudiced. Under these circumstances, it is not surprising that different conclusions were arrived at: and though Dr. Pacchiotti and the other commissioners, after a most careful and painstaking inquiry, reported themselves satisfied of the vaccinal origin of the disease, Sperino, who also went to Rivalta and there investigated the circumstances, and treated some of the cases afterwards at Turin, was equally satisfied that their origin was independent of the vaccination. The story, as regards the vaccinal origin, is this:—

A child (Chiabrera) apparently in good health, but

[1] Astruc very sensibly remarks that he does not wonder that suspicion should have fallen on the cupping instruments, but that he *does* wonder how the momentary contact of the blades should have infused the disease in the manner suggested. (De Morbis Venereis.)

really incubating syphilis, was vaccinated with some lymph obtained in a tube; this child's arm was used *on the tenth day* for the vaccination of forty-six children, and one of these forty-six children, named Manzone, *again on the tenth day*, furnished lymph for vaccinating seventeen children; of these sixty-three children, forty-six had, within two months, a disease considered by the commission to have been syphilis,—the syphilitic symptoms having manifested themselves in some cases *within ten days*, and *as a mean* at twenty days from the vaccination. Now, in explanation of these events, can we admit that the matter taken from Chiabrera's arm contained the contagion of the constitutional syphilis, which at these intervals of time the children manifested? Not, assuredly, unless we are prepared to give up all we have been taught as to the incubative period of constitutional syphilis. For it would have required from three to five weeks for that disease to manifest its primary symptoms.[1] But if this teaching have been erroneous, and true constitutional syphilis can produce its primary symptoms within ten days, then indeed we can understand how, if syphilitic matter was mixed with the lymph, either in the original tube, or through the lancet employed in Chiabrera's vaccination, an irregular vesicle might result, such as that stated in Sperino's experiment with soft chancre, which Baumès and Viennirs held to contain the two viruses mixed. *It must be remembered that we have no reliable account whatever of what was the sort of vesicle or result on Chiabrera's arm, from*

[1] Lee gives the period of incubation at from three to seven weeks. Rollet gives a mean of twenty-six days, and out of a large number of cases there was only one case in which it was under fifteen days. In four cases in which the inoculation was by blood, the minimum was twenty-five days and the maximum thirty-five. (Rollet, Traité des Maladies Vénériennes.)

which the so-called vaccinations were done.[1] From such a result as Sperino's experiment affords (p. 314), a careless man might, a careful man would not, take what he called lymph; and I have very little faith in the proceedings of any one who, evidently, habitually used tenth-day cases. We might not really then (that is, supposing the incubation difficulty got over, which it must be, or else the Rivalta cases as connected with vaccination fall of themselves) have any difficulty in accounting for the propagation of syphilis: for hard and soft chancre would fall in the same category. But we should have more hesitation as to whether vaccinia also might be communicated at the same time; and, in fact, in what degree the Rivalta children who were syphilized were also vaccinated, it is impossible to say. I can quite conceive that if the vesicle on Chiabrera's or Manzone's arm was at all like that produced in Sperino's experiment, some spurious vaccine result might follow in some of those vaccinated from them. There is certainly no satisfactory evidence of any of the children ever having had regular vaccinia. When the arms were first seen (by Dr. Katt), or when they were seen by the Commission of Inquiry, they presented either so many syphilitic sores, or else cicatrices which, according to the description given, had no vaccine character about them; and the fact that the re-vaccination of five of the children was afterwards without effect (a re-vaccination which it is not stated was repeated) is far from being conclusive.[2]

[1] There is only the mother's account that it was regular; but I have already pointed out into what errors parents often fall on this subject (p. 118).

[2] It would be singular, no doubt, provided there had been *no* previous vaccine effect, but not the least singular if there had been a spurious effect.

None of the alleged cases, then, have established, in my opinion, that syphilis has ever been imparted in the due and proper performance of vaccination, *i.e.* with the unmixed lymph of a genuine vaccine vesicle. They are not even, in my opinion, at all conclusive as to this having been done by the inoculation, along with lymph, of a small quantity of syphilitic blood—although I hope that it is unnecessary for me to say, that this is not a matter in which the slightest possibility of risk should be allowed, and that a practitioner would be indeed highly culpable who should vaccinate with anything but pure and unmixed lymph, or who, in fact, should knowingly vaccinate from a syphilitic child at all. But whether from admixture of blood, or from admixture of the inoculable secretions or products of syphilis, as through foul lancets or in any other way, the real risks are, I believe, *entirely risks of carelessness*—risks which, with due regard to the rules which have been laid down for the proper performance of vaccination, could not occur.[1]

1 The performance of vaccination direct from animals, in whom the cow-pox has been artificially maintained, as already described (§ 12, a, p. 18), has been suggested as a way that would effectually obviate any possibility of invaccinating syphilis. And, following a plan which was previously in use at Naples, animal vaccinations, as they are called, have been practised to a limited extent of late in Paris and elsewhere. But the difficulties in applying such a plan to the vaccination of the general population are, I apprehend, quite insuperable: even on the very limited scale on which the practice has been attempted at the Académie (from seven to eight hundred vaccinations a year), the resources in animals did not allow of the vaccinations being done under the conditions believed to be most favourable for success in more than 60 per cent. of the cases; and the rest were done under circumstances of great disadvantage. But an objection, in my opinion, even to its limited application, is that it tends to weaken our defences against small-pox. Small-pox is yet so formidable an enemy that no risk of this must be run, out of fear of small, and almost, if not quite, hypothetical dangers.

(g) **The Practical and Common-Sense View of the Question.**—Suppose, however, that there existed risks of vaccino-syphilitic inoculation, greater than I can allow to have been shown, and that the occurrence is one that, under some unknown conditions, *might* take place in a properly-performed and careful vaccination; what, after all, looking at the matter in a plain, practical, common-sense way, do these risks amount to? Suppose we assume that in all the cases that have been advanced, except those in which on the very face of the story there was manifest mal-performance, the vaccination had been properly done, what proportion do these bear to the millions upon millions of vaccinations that have been performed? If men who have been all their lives professional vaccinators, as Marson, or Leese, or Tomkins; if men whose professional lives have

Our great defence against it consists in making vaccination *successful*, and *fully successful*: in taking care that when parents bring their children to be vaccinated, these shall be infected *at once* and infected *completely*: and this is just what animal vaccination does not do. (See *ante*, p. 95, note.) There is no one in England whose opinion on this subject will be received with so much respect as Mr. Ceely's, because there is no one who has nearly the knowledge that he possesses of the disease in the cow and of its transplantation to the human species. He looks upon this proceeding as not only open to the objections of impracticability, as applied to the general population, and of unsuccess: but he says also that, so far from being likely to produce fewer ailments and cutaneous eruptions in the predisposed, he knows from his experience that it would, as being more irritating, produce more. He regards it as uncalled for, either for regenerating lymph or for preventing syphilis. With regard to the latter, he says: "I cannot but think our continental brethren are very careless vaccinators, and that syphilis must be very much more prevalent among their infantile population than with us. It is remarkable that so many cases of vaccino-syphilitic inoculation are reported on the Continent while we hear of no such thing here. I cannot persuade myself that such inoculations are unavoidable." (See British Med. Journ. Jan. 7, 1865.)

been spent in the midst of syphilis, as Lee, or Acton, or Langston Parker, have met with no cases in which syphilis originated in this way, the conditions under which the occurrence can take place must be indeed of rare exceptionality. During the eight years in which there has been systematic inspection of public vaccination in England, some millions of vaccinations have been performed; but the Inspectors have no knowledge of any such accident having occurred in any one instance.

"Either," as Simon has well put it, "it is the case that—even with reprehensible carelessness as to the source of lymph, vaccination (so long as in any sense of the word it is vaccination) cannot be the means of communicating any second infection; or else it is the case that in the world of vaccinators, care is almost universally taken to exclude the possibility of danger."[1] The fifty-six thousand lives which at the least are now, on an average, saved annually from small-pox in England alone, are not gained without here and there a child getting erysipelas from its vaccination, and even in cases of excessive rarity dying of it; but what reasonable man ever hesitates on account of this risk—"risque," as Trousseau says, "bien plus grands que les chances à peu près nulles de la syphilis"—to have his child vaccinated? The danger, *if indeed there be any at all*, of communicating *through vaccine lymph, as in an ordinary well-performed vaccination*, any other infection than its own, must be so infinitesimally small, that for all practical purposes we may regard it as non-existent.

[1] Simon, Preface, &c. (*op. cit.*), p. lxxxi.

CHAPTER XV.

Of the Laws relative to Vaccination in England previous to "The Vaccination Act, 1867;" and of Public Vaccination.

115. Vaccination in England previous to the First Vaccination Law.—Very soon after the discovery of vaccination, most of the Governments of Europe made provision for affording its benefits to their respective populations. As early as 1803, an ordinance on the subject was promulgated in Sweden : ordinances were soon afterwards issued in Denmark, and in many of the German States. The first Austrian regulations date from 1808. When Jenner died (in 1823) there were very few European Governments, except Great Britain, in which there were not in force laws and regulations relative to vaccination. By the laws of many of these States, the practice was, directly or indirectly, compulsory.

The first law regarding vaccination in England was enacted in 1840 : and it is from that year that the present system of public vaccination dates. The National Vaccine Establishment, which had been founded by aid of a grant from Parliament in 1808, and has since been maintained by successive annual grants, was instituted for the purpose of keeping up and distributing

supplies of vaccine lymph. It had neither the powers nor the machinery necessary for carrying out any general system of vaccination. For obtaining the supply of lymph requisite to enable it to discharge its special functions, a certain number of stations were established in London, at which vaccination was gratuitously performed; and thus, in an indirect way and as subsidiary to the main object of its existence, the Establishment contributed (at that time not unimportantly) to the vaccination of the metropolitan population. But its operations, after all, reached but a small proportion, comparatively, even of the inhabitants of London,[1] and they did not extend to any of the rest of the kingdom. Such of the general public, therefore, as were unable to pay medical practitioners for the vaccination of themselves or their children, were obliged, if they were anxious to have vaccination performed, to have recourse to the benevolence, largely extended to them, of the medical profession, or to the facilities which were afforded in cities and towns by infirmaries and dispensaries, or to such arrangements as might be made by the various parishes with their respective medical officers.

Parochial arrangements concerned, of course, none but those who were in the class of "paupers," and the making such arrangements even for them was quite optional on parishes;[2] the state of the law, as declared

[1] In 1838 (when small-pox was severely epidemic) the Establishment vaccinated at its several stations 18,659 persons, or 6,241 more than had been vaccinated at them in any previous year. In 1839, the vaccinations were 13,144; in 1840, 15,588; in 1841, 15,361. The births in the metropolis at this period were about 55,000 annually.

[2] A medical practitioner, long established in a little market-town in Somersetshire, told me that a few years before the institution of public vaccination small-pox broke out and began to spread in the

in 1835, was, that it was no part of the duties of overseers to take measures for the vaccination of the pauper children of the parish, though small-pox were actually prevailing.[1]

The results of this state of things were what might have been anticipated. Vaccination was extensively neglected. Large parishes were to be found in which the children of the poor were almost without exception unprotected against small-pox. My own professional recollection carries me back to the year 1839, in which, in a large rural parish in Kent, I found scarcely a single child under five years old that had been vaccinated, and a great number above that age, as well as many adults, unvaccinated. There were places, indeed, in which the whole of the poor population under nine or ten years of age was entirely unprotected.[2] The neglect existing in the large towns of England and in the populous mining districts was startling. Whenever small-pox broke out, therefore, a frightful mortality ensued; and in 1837-8 the disease swept like a pestilence over England, destroying in the latter of these two years alone, upwards of 16,000 persons. The

town and parish. No provision had ever been made for the vaccination of the poor, and a large proportion of the labourers and other inhabitants were quite unprotected. He brought this under the notice of the vestry, and offered to vaccinate the whole parish for ten pounds. The proposition being received in a way which indicated doubts of his mental sanity, he reduced his proposal to five pounds. The vestry offered two pounds, which he declined. Either at this very meeting, or at a meeting held close thereupon, they voted from fifteen to twenty pounds for putting up a weathercock on the church steeple.

[1] The Vaccination Acts by Danby P. Fry, Esq. 2nd edit. p. 20, note.

[2] Report of the Vaccination Section of the Provincial Medical and Surgical Association, p. 92.

average annual small-pox mortality of the three years which preceded the first Vaccination Act was not less than 11,944.

116. Inquiry of the Provincial Medical Association.—Until the "General Register Office" was established, in 1837, no means existed of knowing accurately the mortality of any disease in England. But, without statistical evidence, the prevalence and fatality of small-pox were so notorious that the Provincial Medical and Surgical Association, at their annual meeting in 1838, had, in consequence, appointed a committee "to inquire into the present state of vaccination in England." While this committee were engaged in their labours, and at the moment these were reaching completion, the first Report of the Registrar-General (for the half year ending Dec. 31, 1837) reached them, showing that in that period nearly 6,000 persons had perished of small-pox, and that this was then the fifth most fatal disease in the kingdom. In the able and comprehensive Report which they presented,[1] they traced the continued prevalence of small-pox partly to the continuance of the practice of variolous inoculation, but chiefly to the neglect of vaccination. They showed that no proper provision for the vaccination of the poor existed, and they pointed out the necessity for a public system of vaccination. The Association, having adopted this Report, drew up a petition, which was presented to Parliament early in the next ensuing session, praying the Legislature to take steps (1) to restrict the practice of small-pox inoculation, and (2) to establish a system of public vaccination. They represented "that at this time

[1] *Op. cit.* This Report, in which the whole subject of vaccination, up to that date, was reviewed, will still be found full of interest and instruction, and well worthy of perusal.

there is no sufficient provision for the vaccination of the poor in this kingdom; that the practice, as offered to the poor at our public institutions in towns, as well as by private individuals, is by no means adequate to the wants of our greatly increasing population:" and they suggested that the State should remedy this great evil "by appointing regularly educated vaccinators, with suitable salaries, in districts sufficiently numerous to embrace the whole of the poor population of the country, and who shall offer gratuitous vaccination at stated periods to all within their bounds, keeping accurate registers of their proceedings and communicating regularly with the National Vaccine Establishment."[1] These suggestions, it will be observed, show that a medical organization and medical supervision of public vaccination were contemplated by the Association who had given so much attention to this subject:—a matter which was entirely lost sight of in the measure which the Legislature then adopted for the extension of vaccination, and the full importance of which was not recognised by the Government for nearly twenty years afterwards.

117. The Vaccination Act of 1840.—When this petition was presented to the House of Lords on the 10th of March, 1840, by the late Marquis of Lansdowne, Lord Ellenborough, who was not a member of the Government, at once suggested that a Bill should be introduced for securing the objects sought by the petitioners. And two days afterwards he laid the draft of a Vaccination Bill upon the table of the House. With the alterations which were made in it during its

[1] Trans. of Provincial Med. and Surg. Assoc., vol. viii. p. 83 (Proceedings of Anniversary Meeting, 1839).

progress through Parliament, this Bill became the first Vaccination Law.[1]

Its main provisions were that in every union, and in every parish which was not in union, there should be one or more qualified medical practitioners appointed for the gratuitous vaccination of all persons resident therein; that the remuneration of the practitioners so appointed should depend on the number of persons, not previously vaccinated, who should be successfully vaccinated by them; that the appointment of vaccinators should be vested in the Boards of Guardians, or in the Overseers, of the respective unions and parishes; and that a superintendence and direction of the whole machinery should be exercised by the Poor Law Commissioners. It was also provided that any attempt to inoculate, or otherwise produce, small-pox should be punishable by imprisonment. This Act was designedly not limited to paupers; it gave to "all persons" a right to claim vaccination at the public cost: but that no possible doubt as to this intention might remain, a further Act was passed in the following session, in which it was expressly declared that public vaccination was not of the nature of "parochial relief, alms, or charitable allowance," and did not therefore deprive the recipient of any "right or privilege," or subject him "to any disability or disqualification whatsoever." [2]

Seldom has the Legislature passed a measure of more obvious public benefit. Never has a small sum annually laid out been productive of so great and immediate a return. Large numbers of persons availed themselves every year of the opportunities put within their reach of protecting their children against small-pox; and the impression consequently produced on the mortality from

[1] 3 and 4 Vict., cap. 29. [2] 4 and 5 Vict., cap. 32.

that disease was so great, that the average deaths were soon reduced from 770 to 300 per million of population per annum (p. 252). In the thirteen years which intervened from the passing of this law, to the time when the Legislature took a further step, various severe epidemics of small-pox swept over the country, but not in the worst of those years did the small-pox deaths amount to nearly the half of what they had been in 1838. In the epidemic-year 1838, the deaths from small-pox were 1,101 per million of population; in 1852 (the most fatal small-pox year that has been known since vaccination laws have existed) they were 409 per million of population.

And these benefits would have been still greater, but for certain considerable drawbacks. It was an unfortunate circumstance that it should have been necessary, or should have been thought necessary, in instituting a public system of vaccination which was expressly designed to include the whole population, to place its administration, general and local, in the hands of those whose special function it was to relieve "the poor." Besides that all provision was thus omitted for that professional superintendence which the Provincial Association had pointed out as necessary, two results particularly followed, each of which has been, in its way, a serious hindrance to the good working of the system inaugurated by the Act of 1840. (1) Notwithstanding all the declarations of the Legislature, and the prominent way in which it was announced on such public notices as were ever sanctioned by the Poor Law Commissioners, or the Poor Law Board, that public vaccination was not medical relief, many of the public, who were little able to pay a proper fee for vaccination but yet far from being in the class of paupers, were for a

long time jealous of accepting anything from those who were the official distributors of the alms of the State. There was an *idea* or *feeling* of pauperism associated in their minds with everything that guardians and overseers had to do with. It happened also, unfortunately, that at the time the Act passed, the New Poor Law and the Poor Law Commissioners were extensively unpopular: and though the Commissioners did everything in their power to mark that distinction between public vaccination and Poor Law relief which the law had so clearly drawn, they were very sensible, as they stated with regret in one of their annual reports eight years after the system had been in operation, that people were deterred from seeking public vaccination because of its administration through their department. Some years later (in 1854) the President of the Board further expressed, in the House of Commons, his own "doubts whether it was the wise course to place vaccination in connexion with the Poor Laws in any way." The shyness, moreover, which people at first exhibited of public vaccination was far from being discouraged by many of the local Boards of Guardians, who saw in the proceeding little more than an additional burthen wantonly imposed upon "the rates." The names of those who had their children publicly vaccinated were freely canvassed, and some Boards went so far as to post on the church-doors the names of all who were vaccinated at the public cost, "to shame them." But as time has gone on the intentions of the Legislature have become better understood. Parents fully comprehend now that public vaccination is simply a public right. In most cases (as is shown sufficiently by the fact that at least two-thirds of the births are now *publicly* vaccinated) they readily accept it, and the objections which are still met with sometimes in

particular places, have reference rather to the defective local arrangements there subsisting, or to the individual vaccinators, than to the kind of local authority in which the administration is vested. Boards of Guardians, too, for the most part, no longer look on vaccination-payments with the jealousy they once did, but regard them very much in their true light of insurances against heavier expenses from small-pox. Though exceptions have occurred, there are very few Boards of Guardians now who do anything to discourage public vaccination. The great majority of them are, I believe, very anxious to have it well carried out; still there is, I am sorry to confess, a considerable minority who seem to have been hitherto quite indifferent and apathetic about it. (2) Another consequence of this fortuitous connexion of public vaccination with Poor Law administration—a consequence that has neither died out, nor has tended to die out—has been that the local arrangements for the medical relief of the sick poor have been made the basis of the local arrangements for public vaccination. These two things have nothing essentially in common. It may so happen, and is, indeed, actually the case as regards the rural and small-town unions of the kingdom, that the division of the union into districts, which is considered the most suitable for medical relief of the poor, is a very good division for public vaccination. But it may also happen, and is, indeed, the case in nearly all the large towns in England, and especially in London, that the Poor Law division is the most unsuitable possible for the proper performance of public vaccination—is, indeed, utterly at variance with all the principles on which vaccination arrangements should be based (§ 57). But in the one case, as in the other, local authorities have, for the most part, followed the course

of adopting the same division for both purposes; the real reason being that they were thus able, or flattered themselves that they were able, by making the public vaccination of a Poor Law district a "perquisite" of the District Medical Officer, to obtain his services at a low salary; and thus the public interests in the good performance of vaccination were sacrificed to a wholly extraneous consideration.[1] These were two great defects in the Act of 1840, and they were not touched by the next Act relative to vaccination, which was passed in 1853.

118. Inquiry of the Epidemiological Society.—Lord Ellenborough's Act had, as we have seen, wonderfully reduced the small-pox mortality of England, but, after all the reduction, there were still, on an average, above 5,000 deaths from this cause every year. When the Epidemiological Society of London was founded in 1850, for the study of epidemic diseases with a view to their mitigation or prevention, such a mortality as this from a disease looked upon as almost wholly preventible could not but attract their attention; and one of their first acts was to appoint a committee to investigate the causes of it, and suggest the remedies. In the course of the laborious and comprehensive investigation which this committee instituted, they corresponded with nearly 2,000 medical men engaged in the practice of vaccination in the United Kingdom and the British possessions, besides availing themselves of official information obtained from our own and foreign governments. And the unhesitating conclusion to which their inquiry led them was, that it was not to any diminution in the pro-

[1] A Regulation which will have the effect of altering the division, thus injudiciously adopted in most towns, has been recently issued by the Privy Council. (See Reg. II. of the Reg. Feb. 18, 1868, in App. II. B 2.)

phylactic power of vaccination, but to a still-continuing neglect of that precautionary measure, and to the imperfect way in which vaccination had in many instances been performed, that this serious mortality was due. In the Report which they subsequently presented to the Society they showed that, on the part even of those parents who were glad to avail themselves of public vaccination for their children, there existed an habitual procrastination, which left the children exposed to small-pox at the very period of life when they were most liable to its ravages: that while the fatal force of that disease is most felt under one year of age, the rule was not to vaccinate children till they were more than one year of age. And the remedies which the committee, having in the course of their inquiry received and weighed innumerable suggestions, submitted for consideration, were these: that it should be made compulsory by penalty on every parent to have his child vaccinated, health permitting, within three months of birth; that the birth-register should be the main basis for insuring this compulsion, a child whose birth was once inscribed therein being followed until the vaccination was also registered; that the system of public vaccination should be separated from the Poor Law system and be subjected to regular professional supervision; and that some means should be taken of checking the very low and inadequate rates of payment which Boards of Guardians were in the habit of giving to public vaccinators by fixing a statutable minimum.[1] It so happened that in the spring of 1853, while these recommendations of the committee, all of which were subsequently endorsed by the Society, were under consideration, Lord Lyttelton,

[1] The minimum adopted in the Act was below that which the Society urged, but represented a very considerable gain to the Public Vaccinators over their previous payments.

having observed, in the Union of which he was Chairman, the very imperfect working of the then Vaccination Law, introduced into the House of Lords a Bill to make vaccination compulsory. This Bill was not introduced either at the suggestion or with the knowledge of the Society, nor, in fact, in the shape in which it was first presented was it one of which they altogether approved. But, finding its principle to be entirely in accordance with the conclusions at which their committee had arrived, and which they themselves would soon have been pressing on the Legislature, as to the necessity for compulsory infantile vaccination, and as to the machinery by which it should be carried out, they at once communicated with its author. The progress of the Bill was in consequence suspended until the presentation of the Report on which the committee were engaged,[1] and the Bill was afterwards very materially altered in accordance with some of the suggestions which that Report contained. Other recommendations of the Society were not embodied in the Bill, and were not pressed by them at the moment, because they were advised that by so doing they might have risked the recognition by the Legislature of what they regarded as the all-important principle of compulsory vaccination. It was on this account especially that they postponed for a while urging the changes in the administration of public vaccination which they

[1] A copy of this Report "on the State of Small-pox in England and Wales and other countries, and on Compulsory Vaccination, with Tables and Appendices, presented to the President and Council of the Epidemiological Society by the Small-pox and Vaccination Committee, 26th day of March, 1853," was immediately forwarded by the Society to the Home Secretary, and ordered to be printed by the House of Commons, May 3, 1853, and by the House of Lords, June 27, 1853. It is the latter, or 8vo. edition, which is quoted throughout this book.

held to be of such essential consequence, and to which they soon after called the attention of the Government in a separate memorial.[1]

119. The Vaccination Extension Act of 1853.— Lord Lyttelton's Bill, with the amendments introduced in Parliament, received the royal assent on Aug. 20, 1853. By it compulsory vaccination was made the law of England. "It was indeed," says Simon, "a very important measure. Infantine vaccination was at length recognised at its full value. Henceforth it was to be counted among those conditions, necessary for the maintenance of life, which a parent should not be entitled to withhold (any more than food or clothing) from his offspring."[2] It was, moreover, the solemn decision of Parliament that personal predilections for small-pox should not be cultivated by individuals to the danger of their neighbours.

By the law, as laid down in that Act (16 and 17 Vict. cap. 100), it was required that every child, whose health permitted, should be vaccinated within three, or in case of orphanage within four months of birth, by the public vaccinator of the district, or by some other medical practitioner; that notice of this requirement, and information as to the local arrangements for public vaccination, should, whenever a birth was registered, be given by the registrar of births to the parents or guardians of the child; that every medical practitioner who, whether in public or in private practice, successfully

[1] On a State Provision for the Prevention of Small-pox and Extension of Vaccination. Ordered by the House of Commons to be printed, March 1, 1855. (See also a Paper on Public Vaccination in England and Wales, by Edw. C. Seaton, M.D., in Trans. Nat. Assoc. for the Promotion of Social Science, 1857.)

[2] Preface to Papers, &c. p. lxx.

vaccinated a child, should send to the local registrar of births a certificate that he had so done; and that the registrar should keep a minute of all the notices given, and an account of all certificates thus received. Parents or guardians who, without sufficient reason, after having duly received the registrar's notice of the requirement of vaccination, either omitted to have a child duly vaccinated, or, this being done, omitted to have it inspected as to the results of the vaccination, were liable to a penalty of 1*l.*; and all penalties were recoverable under Jervis's Act, and were to be paid towards the local poor-rate.

The impetus which the passing of this law gave to public vaccination was extraordinary. During the year immediately following its enactment the infantile public vaccinations (by which I mean the vaccinations under one year of age) were more than doubled; and there were publicly vaccinated, besides these children, nearly 300,000 others above one year old. So that the public vaccinations of 1854 were actually considerably (by more than 75,000) in excess of the year's births. These numbers were a sufficient proof in themselves of the general readiness of the people to obey the law; that whatever of apathy and indifference, and in some cases of more than mere apathy, had before kept parents back from having their children vaccinated, did not constitute an obstacle which the threat of a small fine was not enough to overcome. The large amount of public vaccination which was performed also in that year on children above one year of age was in two ways peculiarly significant: it illustrated the very great antecedent neglect, and it showed that this neglect had not really proceeded from any positive objection to vaccination in itself, for these children having been born before the passing

of the Act were not amenable to its compulsory provisions.

Such was the immediate result: but in a very short while it was found out that the specific provisions of the law very imperfectly carried out its objects. (1) The law made it no doubt clearly illegal for a parent to neglect the vaccination of his child, and every parent so neglecting was liable to penalty, and might be proceeded against by any one who thought it worth his while so to do; but there was no officer or authority whose business it was to set the law in motion. The Epidemiological Society had pointed out, while the Act was under consideration, that unless some provision of this kind were introduced, the law would be partially inoperative.[1] But this was not all. When such local authorities, or local officers, as were anxious to get rid of the abomination of small-pox from amongst them, began to take proceedings under the Act, they not only were met with considerable technical difficulties in being obliged to prove in each case that a notice to have the child vaccinated had been duly served, within seven days of the registration of its birth, by the registrar on the parent; but they also found that, even if they got a conviction, they might, unless the parent was able to pay the costs of the proceedings, have to meet these costs themselves, the Act having conferred no power of paying these costs out of the public moneys. A subsequent Act, passed in 1861, made provision for meeting the costs of all proceedings;[2] but the technical difficulties remained in force till the Vaccination Act, 1867, came into operation. Many local authorities and many local

[1] Report, &c. (*op. cit.*), p. 35.

[2] 24 and 25 Vict., cap. 59: "An Act to facilitate Proceedings before Justices under the Acts relating to Vaccination."

officers who had at first attempted with some zeal to carry out the compulsory provisions of the law, were checked by these difficulties. (2) The registration machinery, by which children were to be traced from the time of their inscription in the birth-register until medical evidence of their vaccination was obtained, was found not to accomplish its object, for two obvious reasons: (*a*) because, though the performers of vaccination were bound by the Act to certify to the respective birth-registrars their cases of successful vaccination, no penalty was attached to the neglect to do this; and (*b*) because, though the obvious intention of the Act was that a certificate of the vaccination of a child should go always to the registrar who had registered the birth, the words of the Act, by some oversight, required that it should go to the registrar within whose sub-district the vaccination had been performed (which was very frequently a different district). Hence it happened that only in a few places and under particular circumstances, where local zeal had overridden all technical difficulties, did the registers of vaccination afford the complete evidence which it had been intended they should afford of the vaccination or non-vaccination of the children born in the districts. There were, however, a large number of districts in which, from the regular entry of all public vaccinations, and from the partial entry of private vaccinations, and from arrangements which registrars had made among themselves for the interchange of certificates so as to carry out the intention rather than observe the mere words of the law, the books served still important practical purposes as the basis for further inquiries;[1] in other districts, less favourably circumstanced, they became useless.

[1] By reference to the Annual Reports of the Medical Officer of the Privy Council, iii.-vii. inclusive (Appendices on Local Inquiries as

Under these circumstances the number of public infantile vaccinations performed in 1854 fell off considerably the year following, and still further in 1856, and again in 1857, when it reached a point at about which, with certain fluctuations from year to year, it has remained.

Years.	Annual Public Vaccinations.		Annual Registered Births
	Under One Year of Age.	Over One Year of Age.	
Average of the 4 years 1848–52.	180,960	185,139	568,811
1854	408,824	290,111	623,699
1855	354,979	109,120	623,181
1856	350,847	84,165	640,840
1857	338,720	84,701	649,963
1858	341,790	126,218	654,914
1859	335,200	120,149	669,834
1860	354,401	140,541	689,060
1861	329,460	103,346	685,646
1862	339,930	102,465	702,181
1863	389,340	269,569	720,660
1864	367,826	169,386	739,236
1865	359,612	228,749	742,680
1866	341,780	118,309	743,859

to Vaccination), it will be seen what important use was often made of these books notwithstanding their imperfect state. But the greatest real gain which hitherto has resulted in England from the establishment of the Registration of successful vaccinations has been that the interest—small as it is—which Registrars of Births and Deaths have in obtaining certificates of successful vaccination has enlisted the services of that valuable and well-trained class of public officers in the extension of vaccination. In the local inquiries made under the

It may seem surprising that, with the considerable defects in its machinery which I have stated, the law should not wholly have broken down; and what might have been the case but for the interference of the Privy Council in 1859, and the system of inspection of vaccination commenced the year following, together with the hope constantly entertained that, while the principle of the Act and its fundamental machinery would be maintained, its technical defects would be remedied, it is impossible to say. But, as it is, the fourteen years' working of the Act of 1853 represents a vast amount of solid gain. The habitual performance of vaccination in the infantile period of life has been thoroughly established by it; there has been no going back in this respect to the state of things which had subsisted before 1853: and the greatly improved protection of the population against small-pox consequent on the action of the law in this and other respects is demonstrated by the saving of life which has been effected. On the average of the fourteen years

direction of the Privy Council there were scarcely any districts in which vaccination was well carried out, in which *the direct action of the Registrar* in producing that result was not clearly traceable. The opinion which Dr. Stevens, in one of his reports, expressed on the value of the services of these officers, was shared by all the other inspectors. "They are," he says, "the most valuable aids in the promotion of vaccination, and they can work in the cause with far greater freedom and with more propriety than can the public vaccinators. The people look upon the Registrars as the authorized instruments of the law; whereas they often openly accuse an importunate contractor of interested motives, of desiring to do as much vaccination as possible only to increase his emolument. There is no such feeling against the Registrar; therefore it is that vaccination flourishes in those districts in which the Registrar looks well after the people, and this he does when he gets paid for his work" [*i.e.* when the certificates are duly sent him, the Registrar's remuneration consisting of a certain payment on each certificate of successful vaccination]. (Sixth Annual Report of M. O. of Privy Council, p. 182.)

it appears that 100 lives have been annually saved out of every million of the population. The mere declaration of the will and intention of the Legislature has in itself no small power with the people of this country. But, besides this, there was really, notwithstanding its defects, a great deal of working power in the Act of 1853. In many districts, as I have had occasion before to state (Chap. XI. § 97, b), the law was found quite workable enough to enable the district-vaccination to be *completely and systematically* maintained; in very many it worked with tolerable regularity and efficiency:[1] and even where no *systematic* observance of its provisions was aimed at, local authorities and local officers were often able, at times when small-pox threatened, to effect immense good through its agency. The real state of things was in fact this: local authorities and local officers who had any anxiety or zeal for encouraging vaccination and extirpating small-pox were able to act, and to act effectively (though not without difficulties and discouragements), under it: those who were indisposed or indifferent in the matter, found in its imperfect provisions excuses, at all events plausible, and sometimes more than plausible, for letting things alone.

The necessity of amending the machinery of the law being soon obvious, the Epidemiological Society in 1855 addressed to the President of the then Board of Health the memorial to which reference has been already made, in which they urged this amendment, and the adoption of the administrative changes which they had always

[1] Producing results which, without a compulsory law, the utmost efforts of local officers had been unable to accomplish. See "Practical Remarks on State Vaccination"—an interesting pamphlet by Dr. Hughes, of Mold, Lond. 1855. See also the Reports of M. O. of Privy Council, iii.-vii. inclusive.

looked on as the necessary complement of a compulsory law. In 1856 the Medical Officer of the Board commenced an independent inquiry on the hygienic value of vaccination and the objections that had been urged to its general adoption; and, in 1857, the material he had collected was presented to Parliament, with a preface of his own, containing that comprehensive and masterly review of the subject which I have had such frequent occasion to quote.

120. Other Enactments relative to Vaccination.—It would be tedious to state all the circumstances that delayed full legislation on the subject of vaccination in England for ten years after the presentation of this report. In the meanwhile, however, the principle of compulsory vaccination had been affirmed by the Legislature on three distinct occasions: (1) in 1861, in a short Act, "to facilitate Proceedings before Justices under the Acts relating to Vaccination"[1] in England; (2) in 1863, in an "Act to further extend and make compulsory the Practice of Vaccination in Ireland;"[2] and (3) in the same year, in an "Act to extend and make compulsory the Practice of Vaccination in Scotland."[3] In the Acts for Scotland and Ireland, the birth-register was made the basis, as in England, of the steps for securing the vaccination of the child; but the Act for Scotland was drawn with particular care to avoid those errors of detail which had prevented the registration machinery in England from properly working. And the result, it may be observed, has been such as to show that the principle which the Epidemiological Society advocated was sound, and that the machinery, when properly adapted, answers its purpose. The Regis-

[1] 24 and 25 Vict., cap. 59. [2] 26 and 27 Vict., cap. 52.
[3] 26 and 27 Vict., cap. 108.

trar-General for Scotland has been able to report to Parliament that of 221,980 children born in that country between the day the Act came into operation (January 1, 1864) and the 31st of December, 1865,—the latest period to which his returns have been made up,—there were only 5,382 respecting whom the entries required by the Vaccination Act had not been made in his registers—a result which he justly regards as for all practical purposes complete.

121. Steps taken in regard to Vaccination under the Public Health Act, 1858. — Intermediately, also, under the requirements of the Public Health Act, 1858, some very important steps had been taken relative to Public Vaccination in England : (*a*) the National Vaccine Establishment and national lymph-supply were brought under the supervision of the Privy Council; (*b*) Regulations were issued to secure the due qualification of persons to be thereafter appointed public vaccinators, and the efficient performance of vaccination by all public vaccinators ; and (*c*) a systematic professional inspection of public vaccination was instituted.

(a) **As regards National Lymph Supply.**—At the time the Public Health Act was passed, by which this important matter was placed under the direction of the Privy Council, the National Vaccine Establishment was in a very critical position. The lymph which for fifty years it had been the means of distributing was derived, as I have already had occasion to state, from the children vaccinated at a certain number of stations (originally 9, and eventually 17) in the metropolis. The appointed vaccinator of each station was required to collect, from the subjects vaccinated by him and brought for inspection, as much lymph as he could properly take, and to forward it to the Central Office, whence it was

distributed gratuitously to all proper applicants. And as the vaccinations performed annually at these stations amounted, prior to the establishment of the parochial, or general public, system of vaccination, to about 15,000, the resources of the Establishment, in proportion to the then demands upon it, were ample. But when under the parochial system, a number of vaccinators—200 or more—were put down all over London, each being paid according to the number of children he vaccinated, an interest was created intercepting, if I may so say, the persons who otherwise would have been applicants at the Establishment Stations. The prestige which these stations, however, had acquired with the public was so great that the influence of the new system was at first comparatively little felt, but gradually a decline in the number of attendants was noticed, and this at last became very serious. The Establishment vaccinations, which in 1840 exceeded 15,000, had by 1850-2 fallen to 10,713 annually, on the average of the three years; had further fallen during the three years 1854-6 to an average of 8,207; and in 1857 amounted to only 6,445. And while, under the operation of the new system, the resources of the Establishment were thus gradually undermined, the demands made upon it for lymph were, by the operation of the same system (devised as it had been without any reference whatever to the cardinal point of lymph-supply), largely increased.[1] Bankruptcy of lymph was therefore impending on the Establishment: and a radical change in its practice became essential to enable it to continue its functions. The obvious course was to seek in the new system compensation (if it could be found) for what had, through it, been lost; to see whether some parochial stations

[1] The applications to the Establishment from *public* vaccinators alone amount to 1,500 a year.

could not be met with sufficiently frequented to be available for the purposes of the Establishment, and which could be incorporated with it. When this course was resolved upon, inquiries were instituted which brought out very strongly the effects of the minute division of work which had been made under the parochial system. In all London there were not found more than three stations of the new system which united with the one indispensable requisite of a thoroughly reliable and first-rate vaccinator the other indispensable condition of a sufficient annual number of vaccinations; and at not one of these three did the cases amount to the full annual number which, in the experience of the Establishment, entitles a station to be considered as of the first class.[1] In the provinces the same difficulties were met with. For purposes which will be explained in the next sub-section, it was deemed of particular importance, in this reconstruction of the Establishment, that there should be a station under its supervision in every large town in which there was a medical school. Manchester was found to be the only town able to supply, from the public system, a first-class station; to get such stations in Birmingham and Liverpool, it was necessary to travel beyond the public system, and to incorporate with the Establishment two important charitable institutions—the General Dispensary at Birmingham, and the Ladies' Charity at Liverpool—which, from their prestige, had survived the assaults of the parochial system. In some of the other towns in which there are Medical Schools, parochial stations were found sufficiently frequented to come within the requirements of the Establishment,[2] but there were others in which no such

[1] An average of 20 cases on each vaccinating day. See *ante.* § 57.

[2] An average of 10 cases on each vaccinating day.

station existed, and no appointment of any station in connexion with the Establishment was possible. Eventually there were incorporated with the Establishment parochial stations in London and in other of the large towns of England which have restored to it the resources it had lost. And the arrangements of the institution are now on a firmer basis than they have been at any time since the system of public vaccination was adopted; but the Establishment has not even yet that perfect stability and that abundance of resources that it should have, consistently with all the demands that may be made upon it. It has happened even within the last few years that, under sudden emergency, it has been obliged to restrict its supply of lymph to applicants below the amount which experience has shown it ought to be prepared to afford. It is to the operation of the New Vaccination Law that we must look for supplying the stations (see *ante*, § 57), which will both lessen the demands on the Establishment, on the one hand, and increase its resources, on the other.

(b) As regards Regulations for Public Vaccination. — The Regulations respecting vaccination which have been issued by the Lords of the Council, under the Public Health Act, 1858—regulations which remain in force under the new law, unless or until the Lords of the Council shall see fit to alter or repeal them —will be found in Appendix II. Regulations for securing the special qualification of persons to be appointed public vaccinators had been rendered necessary, because, as already explained (§ 71), professional licences and diplomas had been found to convey no guarantee of competency in vaccination. In proceeding to take action for the purpose of obtaining such guarantee, a preliminary difficulty occurred from there existing no

authorized places for the teaching of vaccination, or at which candidates for the office of public vaccinator could give practical evidence of their special qualification; but this difficulty having been surmounted by the selection of some of the stations of the National Vaccine Establishment in London, and by the appointment (as far as practicable) of stations in connexion with the Establishment in towns in which there were medical schools, Regulations were issued requiring that no one (who had not received his professional qualification prior to the date of their coming into effect) should be admitted as a public vaccinator, or as a public vaccinator's deputy, unless he produced a certificate of competency in the practice of vaccination from the appointed vaccinator of one or other of the stations selected. In the anticipation, however, that the respective licensing bodies of the medical profession would themselves soon require of candidates, for their licences or diplomas, some such guarantee of a competent knowledge of this essential branch of the profession, a proviso to meet this case was introduced into the regulations, so that, as soon as it became no longer necessary, the separate action of the Lords of the Council might be withdrawn. To the Regulations, in so far as they concern "the efficient performance of vaccination" by the public vaccinators, I shall have occasion to refer in the next chapter.

(c) **As regards the Inspection of Public Vaccination.**—The inspection of public vaccination which was begun in 1860, under the Public Health Act, for the purpose of seeing that the Laws and Regulations in force relating to vaccination were duly observed by those to whom they applied, afforded an opportunity of obtaining information more minute and circumstantial than could have been got in any other way as to what the real

working of the Acts then in force had been. The inspectors were required, in each union that they visited, to report on the amount of public vaccination, and the quality of the vaccination, in the respective districts, and on the working of the arrangements subsisting for public vaccination. The results of these inquiries, so far as they concern the amount and quality of public vaccination in England, I have already summarily stated (§ 73, b, and § 97, b), and, incidentally, I have had occasion to refer frequently to the kind of arrangements which existed; but it still remains to describe these concisely in detail.

The Acts of 1840 and 1853 were to be worked, under direction of the Poor Law Commissioners, and afterwards of the Poor Law Board, by the guardians of the respective unions and parishes of England, and by the overseers of those parishes in which the relief of the poor was not administered by guardians. And the arrangements made consisted of contracts entered into by these guardians or overseers with the medical officers of their several unions or parishes, and sometimes also with other medical practitioners, to the effect that the medical officers or practitioners so contracted with should severally attend at appointed times and places, either by themselves or legally qualified medical practitioners as their substitutes, and then and there duly vaccinate "all persons resident in such unions or parishes respectively." It was recommended by the Poor Law Commissioners in the first instance, that, as a general principle, guardians "should make the number of districts as small, and the number of vaccinators as great, as possible," and that the contractor, besides having a station (usually his surgery) for special weekly attendance at a fixed hour, and besides being ready with his services at any reasonable time, on personal

application at his residence, should be at liberty, if he thought fit, to vaccinate persons at their homes, and charge such vaccinations as though they had been performed at his station or residence. Although the Act of 1840 had not *required* any division of unions into vaccinating districts, practically the then existing division into Poor Law Medical Districts was made the basis of the vaccination arrangements ; with the proviso, however, that the action of the contractors was, under the statute, to be considered as not limited to these districts, but might be extended over the whole union. Thus, the *requirement* of the Act of 1853, that unions, &c. should, if necessary, be divided into vaccination-districts, had to a large extent been anticipated. Under that second Act, however, some considerable further division of unions did take place, and the number of stations and attendances was greatly multiplied. But it was still held that the action of the vaccinators appointed to the districts was not limited to those districts, though of course it could not extend beyond the particular union.

The provision for attendances at the stations was generally of the most diffuse kind. Contractors undertook to attend at their surgeries once a week, twice a week, thrice a week, daily—sometimes for two hours in the morning, sometimes morning and evening, occasionally from ten in the morning till four in the afternoon ; besides which, it was a very frequent stipulation that they would vaccinate "at all reasonable hours when at home and not professionally engaged." At other stations than their surgeries, they undertook to attend once, twice, or thrice a week, once a month, or once in two months, as the case might be.

The intention which underlay these arrangements for frequent attendances was most laudable. It was evi-

dently that of making vaccination as easily attainable to the public as possible. And if vaccination could be properly administered, as physic is poured out of a bottle, to any comer, at any time, there would have been nothing objectionable in them. But, in fact, they had been conceived without any reference to the essential nature of the thing that had to be done. "It had been seen that great facilities for vaccination might be given by a large number of stations, and by a large number of surgical attendances;—apparently it had not been seen, or at least had not been insisted on, that multiplication of attendances beyond a certain point defeats the object of attendance; and that public vaccination in a district may often be difficult or inefficient merely because the stations are too numerous, or the attendances at them too frequent."[1] Under such arrangements (if they could be made to work at all) vaccination must evidently be done in the great majority of cases with stored lymph, and with all the relative disadvantages which the use of stored lymph implies; and of such lymph unlimited quantities would be required. But, in point of fact, the arrangements did not work.[2] It was only in those places in which the nature of the work to be done had been understood, and the attendances limited accordingly, that any effective system, under the contracts, was found in action.

[1] Fourth Annual Report of M. O. of Privy Council, p. 8.

[2] Vaccinators would not keep large stores of lymph on hand, many of them entertaining great and just objection to the frequent use of stored lymph. Accordingly parents would sometimes go again and again without being able to get their children vaccinated: nor, frequently, were the parents themselves at all satisfied to have the vaccination performed with stored lymph. I have on various occasions seen parents take their children away from an unfrequented station, without having the vaccination done, "because they would rather wait for a child," or "because they wouldn't have the bones put in."

The division of unions and parishes into vaccination districts was, I have said, almost invariably the same division as had been adopted for medical relief. In rural districts and in small towns, the inquiry did not show any objection to have attached, as a rule, to this division; it appeared, on the whole, to have worked as well as any other that could be devised. But in large towns the results had been disastrous. A compact town of, say, 40,000 or 50,000 people, which would have supplied just cases enough for one thoroughly good vaccinating station maintaining constantly a stock of fresh lymph (§ 57), happened to be divided for medical relief among three or four doctors: the vaccination cases had been divided accordingly, and every chance of a good station in the town thus thrown away. And whatever changes were made in the number of medical districts in a town, there must always, and without a suspicion that vaccination had any interests of its own to be considered, be a corresponding change in the number of vaccinators. Further, when, as in some towns, the guardians adopted the course of contracting with other medical men besides their district medical officers, the effect was necessarily the same as if they had multiplied the districts. So that whether one or other of these plans was in operation, but especially if the latter had been that adopted, there was in most of the large towns a number of public vaccinators many times as great as could be allowed consistently with due regard to maintaining the local fresh lymph-supply. In London, in which (excluding the remote suburbs, such as Hampstead, Eltham, &c.) sixty public vaccinating stations is the very largest number consistent with good provision for vaccination, there were more than four times that number. Liverpool had twice as many public vaccinators as it ought to have, and

Birmingham nearly the same. Bath or York had four times as many as should be, and Hull at least eight times. Manchester, in which public vaccination is much better provided for, is one of the few towns which has *not* adopted the Poor Law division for public vaccination.

Wherever, whether in town or country, the arrangements for attendance at a station had been made with any due regard to the number of children likely to be brought to the station—and there were many places where this was the case—no difficulty in maintaining the station was experienced. But where, as in the great majority of cases, there had been no such regard, —where, as in a very large proportion of cases, the nanual attendances contracted for exceeded, and sometimes were many times, the number of children born,—the inevitable result was that the contractor ceased to give attendances which he soon found to be fruitless. The contract engagements were treated as so much waste paper; and the vaccination of the district became carried on under no other law than the vaccinator's individual notions of fitness and personal convenience.

The arrangements which in this way some of the public vaccinators had adopted, in substitution for the original contract-plans, were as good as could be—were well devised and well carried out. But such was far from being the case in most districts, the vaccination being done often at long and irregular intervals, often not by the contractor himself, or by any legally appointed deputy, but by some unqualified assistant, or by some pupil or apprentice; done without the least care to assemble children, or to give them (even so far as he had it in his power) the vaccination from arm-to-arm. There were districts in populous towns in which the vaccinator, being quite unable himself, in consequence of

the subdivision of the town, to keep up a stock of lymph, was content to let vaccination remain in abeyance for months together; and there were rural districts which were left for years without any performance of vaccination at all.

When the competitive system was at work, and there were a number of vaccinators appointed to a district,—or when, though there had been only one vaccinator appointed to a district, the vaccinators of adjacent districts availed themselves of those provisions of the law, as expounded by the Poor Law Board, which enabled them to vaccinate at the public charge all over the Union, and to do it at people's dwellings,—a scramble among some of the contracting practitioners not unfrequently took place, each eager for eighteen-pence, and each content, so long as he got it, to let the mother dictate in what manner the vaccination should be performed.[1] But, apart from its obvious influence on the quality of the vaccination, the system worked badly as a means of getting even nominal vaccination done. For parents distrusted this great anxiety of vaccinators, or at all events felt that so long as they held back they were in the position of having a favour to confer; and so they often refused their permission.[2] And in many places the practitioners them-

[1] "I know that the regulations ought to be followed, and that it's wrong in me not to observe them; but what can I do so long as A. B. goes about and offers to vaccinate in a couple of places only?" said one vaccinator to me. "It's a case of conscience *versus* pocket," was the way of putting it of another, with whom conscience had prevailed. See Dr. Stevens's account of this system, as carried on in parts of South Staffordshire, &c., "The Black Country," where it was habitually in operation (Fourth Report of M. O. of Privy Council, p. 78), and its results in the kind of vaccination there practised—vaccination of a quality which, on a more recent visit, he reports as still "really infamous." (Eighth Report, p. 9.)

[2] In a large town in Kent I know of three practitioners calling on

selves got ashamed of the scramble, or got weary of a work which, being divided among so many, was so little profitable to any. Of course it was not in all places that multiple appointments worked thus.* Many practitioners merely contracted for the sake of retaining the vaccination of their own patients, of preventing their going to any other practitioner to be vaccinated; and they left it to the one amongst them who had the parochial appointment to look after all the poor. But his emoluments, when he had none to vaccinate but paupers, were so small, and his office of vaccinator worth so little, that he did not choose to take any trouble about it. From these circumstances, and because always the inevitable effect of dividing vaccination cases among too many operators is to induce a very unnecessary amount of vaccination with preserved lymph, it followed that, in the districts which had multiple appointments, vaccination was, as a rule, worse both in quantity and quality than in those which had one responsible vaccinator.

Under the Act of 1840, but still more after the extensive break-down of the contract-arrangements attempted under the Act of 1853, there was a considerable adoption of the practice of domiciliary vaccination at the public cost. "The people won't come to us, and therefore we must go to them," was an argument of much plausibility, and some validity, under a voluntary system; under a compulsory system, of course of no validity at all. But the disadvantages attending the practice, even under a voluntary system, were extremely great. Its effect on the success of vaccination, by impeding the arm-to-arm performance of that operation, is obvious. Besides this,

one morning on a poor woman to solicit the vaccination of her baby, and each having to walk away disappointed.

it was only in certain districts of very limited population, that, from the amount of labour it involved, it could be completely and systematically carried out; and the effect of attempting to carry it out partially was to undermine the stational vaccination. The two plans can never flourish side by side: if a parent knows that the only result of her staying at home will be that the vaccinator will come to her, she is not without a very good excuse for taking no trouble about it; hence it did not secure the vaccination of a district numerically nearly so well as a *good* stational plan, steadily adhered to. And it offered besides facilities for the employment of unqualified persons and for every kind of irregularity. The evils which had resulted from recourse to this system are abundantly illustrated in the reports of the Inspectors; all agreeing in substance with Dr. Sanderson, who stated that it "not only leads to the constant employment of preserved lymph, but is usually associated with general carelessness in the discharge of the contractor's obligations, as evidenced by long periods of neglect, the vaccination of persons far above the age that is most advantageous for the purpose, and the employment of unqualified assistants." In some scattered districts the system of domiciliary vaccination may be adopted as the least objectionable of various alternatives, but, except in these peculiar districts, the practice should be restricted to particular cases and particular circumstances, even in rural districts, but much more in towns.

To the results of these diffuse arrangements in some of our large towns, as contrasted with a system founded on due regard to lymph-supply, I have referred in a previous section (§ 61).[1] But the subject will be made more clear, and the necessity existing for an entire change of

[1] See also note, p. 133.

system as regards such towns rendered more obvious, by some examples.

In London, when first inspected in 1863, there were found to be 232 appointed public vaccinators who engaged to attend at 260 so-called stations. Of these 232 vaccinators, there was not one who had the number of annual cases requisite for a first-class station: there were only 19 whose annual vaccinations amounted to 500; 125 had less than 200 cases a year, many of them having only 30, 40, or 50 cases a year. In most of the Metropolitan unions there was the usual multiplication of attendances; and, in consequence of this, very few even of the vaccinators whose cases amounted to 500 a year had anything like an efficient station. In some of the unions there was a considerable amount of domiciliary vaccination. But if all the children publicly vaccinated had been vaccinated at the stations, the advertised attendances of the vaccinators were such that on an average each vaccinator would have had at each attendance only a fraction of a child to vaccinate. It is easy to see how difficult, and in most instances how impossible, it would be for a parent to obtain for his child, under such arrangements, that good arm-to-arm vaccination which, surely, in such a town as this, should be accessible to every one. But practically to test the matter, I attended at advertised times all the principal stations in twelve of the metropolitan unions—not by any means the most subdivided: 38 stations out of the 57 appointed in these unions. There were only four of these in which, on the occasion of my attendance, vaccination could have been done from the arm with any opportunity of selection, only nine of them at which it could have been done from the arm at all; at the remaining stations (29 out of 38) either vaccination

could only have been done with preserved lymph, or there was no vaccinator in attendance, or there was no lymph.

The state of things which existed in London in 1863 exists now. In the different unions of which the metropolis is composed, there is great diversity of arrangements: these in some, as in St. George's, Hanover Square, are as good as could be devised:[1] but in a large number of the unions, especially in the east and south of London (in parts of which small-pox may be said to be endemic), they are such as illustrate, in the highest degree, the disadvantages of the loose system, if it can be called system, which has been permitted. In the unions to which I refer, vaccination is professedly given by many of the contractors to all comers at all times, and people are also called on and vaccinated at their dwellings, the work being done to a large extent by unqualified persons. But so far is this course from getting the children generally vaccinated that there is an inconceivable amount of delay and neglect. Inevitably too, by the plan pursued, the vaccination is in great part, and in some districts in the majority of cases, done with stored lymph; and the cases are frequently charged as successful without any proper means being taken to ascertain that they are so.

1 The necessity of observing *union boundaries* in laying out vaccination arrangements is a considerable drawback to the public convenience in the metropolis, and some other large towns. The station of the excellent vaccinator of the In-Wards of St. George's, Hanover Square, for instance, is admirably placed for vaccinating part of Marylebone, and would gain greatly in efficiency by an increase in its numbers. This interference of union boundaries with the arrangements most suitable for London, was pointed out in the report of Dr. Buchanan and myself in 1863. This is a blot which is not hit by the Vaccination Act, 1867.

The working was just as unsatisfactory in many of the large provincial towns: the city of York, for instance, supplies annually sufficient cases for public vaccination to maintain one excellent station. But there were five appointed vaccinators, each with his appointed station, and one or two of them vaccinating also at dwellings. The consequence was that a very large proportion indeed of the vaccinations of the city were performed with dry lymph; and, in the practice of four out of the five contractors, public vaccination had been repeatedly suspended for weeks and even for months together. It was not only the quality, but also the amount of vaccination which was affected by this injurious division; in no important town were there evidences of greater neglect than in York.

Cardiff has also cases enough annually for one thoroughly good station. But there were four appointed public vaccinators; and the consequence was, that vaccination from the arm at all was the exception and not the rule, the four vaccinators stating the proportion of the vaccinations performed in this way, by each of them respectively, as being "not more than a third;" "probably one in four;" "about one in four;" and "a very small proportion." And in two of the four districts the performance of public vaccination had been at times suspended for several months consecutively. Infantile vaccination was in consequence greatly neglected.

The town of Hull, so far as it is within the "Hull Incorporation," and excluding that part of the town which is in the union of Sculcoates, is an illustration of the open system, all the practitioners in the Incorporation, who were willing to act, being contracted with. There were two nominal districts and eighteen

appointed vaccinators. The attendances of the vaccinators in proportion to the vaccinations to be performed were such that, on the average of three years, there had been for each prescribed attendance of a vaccinator the $\frac{1}{1}\frac{6}{8}\frac{2}{2}\frac{7}{5}$th part of a vaccination. In this large town there was not a single vaccinator who had been able to maintain, continuously, his arm-to-arm vaccination, and a large proportion of the vaccination of the town was carried on with dry, or otherwise preserved, lymph. The vaccination of the Hull Incorporation was deficient in amount, and *singularly bad in quality*. There was a quite unusual proportion of children with imperfect marks.

And these are but examples of what is to be found extensively throughout England.

The Vaccination Acts, then, notwithstanding the great amount of good they had done, had clearly fallen very short of what the Legislature had intended. Not only was the compulsion imperfect, and, as regards a great part of the kingdom, illusory, "but the condition which assuredly the Legislature intended to be a condition precedent to any enforceability of vaccination,—the condition that thoroughly good vaccination, provided at the public expense, under proper and well-notified arrangements, should everywhere, and gratis, be within reach of persons who may choose to avail themselves of it,"[1]—was very imperfectly realized.

[1] Fifth Annual Report of Medical Officer of Privy Council, p. 8.

CHAPTER XVI.

Of the Vaccination Act, 1867.

122. Scope of this Summary of the Act.—The Vaccination Act of 1867 was passed "to consolidate and amend the statutes relating to vaccination in England."[1] The Act itself may be consulted as to the powers which it confers on the Privy Council, the Poor Law Board, and the Registrar-General, in supervision of the local machinery provided for carrying it into effect.[2] I purpose in this chapter to give merely a plain and practical view of what I conceive to be the duties it imposes (*a*) on the parents or custodians of children, (*b*) on the local authorities charged with its

[1] The Bill, originally introduced into the House of Commons in the session of 1866, by the Rt. Hon. H. A. Bruce, Vice-President of the Committee of Council for Education, was in the course of that session considered and amended by a Select Committee of the House. But in consequence of the change of Administration towards the end of the session, no further progress was then made with it. The following session it was re-introduced, in the shape in which the Select Committee had left it, by the Rt. Hon. Lord Robert Montagu, and, with little or no substantial alteration, except the introduction of the important 27th clause, became law. The Royal Assent was given on the 12th of August, 1867.

[2] See Appendix II., in which it is reprinted, together with the Regulations in force relative to Public Vaccination, and other official documents.

administration, (*c*) on the appointed public vaccinators, and (*d*) on the registrars of births and deaths; and in so doing I shall also offer such suggestions as experience has taught me to think may be useful to those who are officially employed in the local administration of the Act. In attempting this, I must beg it to be distinctly understood that while I shall state, as carefully and correctly as I can, what I believe to be not only the intention, but the effect, of the statute, reference must be made to others on any points, if such should arise, of doubtful legal construction: these are matters on which it would be presumptuous in me to offer any opinion.

(A.) Of the Duties of Parents, etc. under the Act.

123. Obligation of Parents to have their Children vaccinated.—The Act imposes on the parents of all children born in England, or on other persons having the custody of such children, the obligation to have them duly vaccinated within certain periods which it fixes; and if such parents or custodians fail to fulfil this obligation, they incur a penalty of twenty shillings (Sect. 29):—

(*a*) *The parent* is bound to have this done *within three calendar months from the child's birth.* (Sect. 16.)

(*b*) If from the death, illness, absence, or other inability of the parent, the child is consigned to the care of *some other person*, this person must have it done *within three calendar months after receiving the custody of the child.* (Sect. 16.)

(*c*) But, in *either case*, if the district in which the parent or custodian resides be one of those districts in which public vaccination is appointed to take place at certain

periods of the year only (Sect. 12), the liability of the parent or custodian to penalty is suspended until after the occurrence of the first periodical vaccination ensuing on the child having attained the age at which its non-vaccination would have been otherwise illegal. Thus, suppose a child living in a rural district in which public vaccination is directed to be performed at two periods in the year only, say throughout the months of April and October, the parent of a child born in May, or the person who received the custody of a child in May, would not be liable to any penalty till the October vaccination was over:[1] so, as regards a child born in such a district, say in September, October, or November, not till the April vaccination was over, and so on. And this applies whether the vaccination is to be done by the public vaccinator or by a private practitioner. Parents, however, whose children are three months old or upwards when a periodical vaccination begins, or attain three months of age during its progress, must be very careful to get them vaccinated before the periodical vaccination is over, or they will be liable to the penalty.

The gist of the whole matter is this, that parents must have their children vaccinated *within three months of birth, or as soon afterwards as the public arrangements of the district in which they live will afford them an opportunity of obtaining gratuitous vaccination.* The registrar's notices should inform parents of the times when the public vaccination will be performed; and public notices will also no doubt be given by the local authorities.

(*d*) And, in every case, when the medical practitioner,

[1] For convenience, I shall not refer any more, separately, to the custodians of children. Whatever a parent is bound to do within three months of birth, a custodian must do within three months of receiving the child.

or public vaccinator, to whom the child may be taken for vaccination within the period prescribed by law, is of opinion that its state of health is such that the operation ought to be postponed, he may postpone it for any period he thinks fit not exceeding two months, and a certificate to this effect under his hand, according to the prescribed form in the schedule of the Act, or to the like effect, will save the parent from any liability to penalty for the period for which it is granted. (Sect. 18.) And successive certificates of further postponement may at the end of each period be given if necessary. (Sects. 18, 19.) These certificates, however, to be valid defences, must be given before, or at the time that, they become due: it will not do for parents to leave it till afterwards, and perhaps till proceedings have been commenced, to obtain them; parents desiring to plead the unfitness of their children on account of ill-health as an excuse for not having had them vaccinated, should be careful to provide themselves with the particular evidence of that unfitness which the law requires.

124. The Vaccination must be repeated till successful, unless the Child be found insusceptible.—If the vaccination be not successful, the parent is bound to have it done again and again till it takes effect (Sect. 17); but if, after three unsuccessful attempts, the public vaccinator or medical practitioner who has performed the vaccination shall find that the child is "insusceptible of successful vaccination," he shall give a certificate of insusceptibility to the parent, and this certificate will be as complete a defence to the parent against penalty as a certificate of successful vaccination. (Sects. 20, 34.) Parents, however, must be careful not to look upon this certificate as conveying any assurance that the child will not take small-pox, or that it may not at some

future time take vaccination. And every prudent parent will be careful to have further attempts made, at such times as the medical practitioner may advise, though no penalty will be incurred by the omission to do so. A parent also is not bound to have a child vaccinated which has already had small-pox, and a certificate of the child's having had that disease, granted by a public vaccinator or medical practitioner, will be a complete defence against any proceedings. (Sects. 20, 34.)

125. Right of Parents to Public Vaccination. Obligation to have the Vaccination inspected.—Every parent has a right to have his child vaccinated by the public vaccinator of the vaccination-district in which he resides without any charge; and the having the child thus vaccinated gratuitously is expressly declared not to be parochial relief, and not to deprive the parent of any right or privilege, or to subject him to any disability or disqualification. (Sect. 26.) Parents should always, on occasion of registering the child's birth, or within seven days after, receive from the Registrar of the registration-district in which they live, a notice requiring them to have the child vaccinated, together with information as to the times and places at which public vaccination may be had, and all the forms of certificate required under the Act (Sect. 15); but no parent can claim exemption from penalty on the ground that he has not received this notice and information. (Sect. 34.) Parents are under no obligation whatever to go to the public vaccinator, if they prefer to have the vaccination done at their own cost by any other practitioner. But those parents who choose to avail themselves of public vaccination should take notice that it is their business to go to the vaccinator, and not the vaccinator's business to come to them; and that if, after

vaccination has been performed by a public vaccinator, they neglect to take the child for inspection on the day-week following, and so on, till the vaccination is successful, or the child found insusceptible, they incur by such neglect a penalty of twenty shillings. (Sects. 17, 29.) When the vaccination has been done by a private practitioner the result must equally be inspected, in order that the necessary certificate of the successful performance may be obtained for registration.

126. Obligation of Parents who have their Children privately vaccinated to have such Vaccination registered.—When the vaccination has been performed by a public vaccinator, the parent has no responsibility whatsoever with regard to having the successful result registered; but he is entitled to have from the public vaccinator, free of charge, a certificate of the successful vaccination for his own keeping, if he request it. (Sects. 21, 22.) But when the vaccination has been successfully performed by a private practitioner, the parent must obtain from the practitioner, and the practitioner is bound under a penalty of twenty shillings to give, a certificate of the successful result; and this certificate the parent is bound, under a penalty of twenty shillings, to transmit within twenty-one days from the performance of the operation, to the Registrar of the district in which the birth of the child was registered; or if this be not known, or if the child's birth was not registered at all, then to the Registrar within whose district the vaccination was performed. (Sects. 23, 30.) This certificate may be delivered personally, or it may be sent (free) by post; but unless the certificate transmitted to the Registrar be the identical form which had been received from the Registrar at the registration of the birth, personal delivery, if practicable,

has advantages in the facilities it affords for identification of the child and for the correction of any error or omission in writing out the certificate.[1]

127. Liabilities in case of Neglect.—The liabilities incurred under 16 and 17 Vict., cap. 100, by parents whose children were born in England after August 1, 1853, and before the passing of this Act, remain in force; and such parents may still be proceeded against under the former statutes for neglect of vaccination. But there is also a way in which they may be proceeded against under the New Law (Sect. 31), if it be elected so to do. The action of this particular Section, moreover, under which Justices may make orders directing the vaccination of children, is not limited to children born in England, nor to children born before the passing of the present Act; but it applies generally to any child, "under the age of fourteen years," at any time in England. It meets, therefore, some cases which were not met under former Acts, nor are otherwise met under this Act; but it by no means takes away the option of proceeding in other ways in cases of neglect

1 On the forms of Vaccination Certificate which the Registrar supplies to each parent on the registration of a birth, he is directed by the Registrar-General to insert *a number* corresponding to the number of entry in the birth-register: and if parents are careful to retain *these particular papers*, and return *them* to the Registrar when the vaccination has been performed, no difficulty can arise about identification. But sometimes these papers are lost, and the public vaccinator or medical practitioner has to give his certificate on forms with which he is supplied for the purpose, but to which he cannot, of course, attach the registration number. Under these circumstances, the certificate must be very precisely filled up, or a difficulty may sometimes arise about identification. Personal registration of the certificate of course gets over all difficulties, and I found this mode much adopted by parents, at the suggestion of the Registrars, in the large towns of Scotland.

when such ways have been provided by the statutes. Thus all the penalties incurred under the present Act by parent, medical practitioner, or public vaccinator, respectively, whether for neglect to have a child vaccinated or the vaccination inspected, or to give a certificate when due, or to transmit a certificate to the Registrar, are recoverable by summary process (Sects. 29, 30, 33) without having recourse to this Section. It is only under this Section, however, that cumulative penalties can be enforced: a Justice of the Peace may, *as often as he sees fit*, make an order directing the vaccination of a child, and for a disregard of *every* such order a penalty is incurred.

(B.) Of the Duties of Local Authorities under the Act.

128. Duties of Local Authorities.—The Guardians of the respective unions and parishes of England are the local authorities for administering this Act. And each Board of Guardians is required, within the area of its jurisdiction, to make provision for public vaccination, to enforce the observance of the law, and to perform certain special duties under the Act.

129. Provision for Public Vaccination.—The divisions of unions, &c. and all arrangements which subsisted when this Act came into operation, were to remain in force (unless inconsistent with the provisions of this Act) until they should be lawfully altered. Some of these arrangements, however, will be materially affected by the Regulations of the Privy Council, just issued; and both from the operation of these Regulations, and from the operation of that clause of the Act which increases the minimum payment to vaccinators, as well

as from other circumstances, there will, no doubt, be a very general revision on the part of local authorities of the plans for public vaccination heretofore adopted.

Guardians are required, in providing for public vaccination, (*a*) to divide their union into districts, *if necessary*, and appoint places for the performance of vaccination therein, subject to the approval of the Poor Law Board; (*b*) to appoint vaccinators to the respective districts (subject to the same approval) under a form of contract directed by the Board; (*c*) to notify these arrangements when made, and every change of arrangements which may from time to time be made; and (*d*) to see that the contract obligations of the public vaccinators, and certain of the duties of Registrars under this Act, are fulfilled.

(a) Division into Districts and Appointment of Stations. (1) **Districts.**—In dividing a union, if necessary, and in appointing stations, there are two things which a Board of Guardians should keep in view, (*a*) the providing, as far as possible, arm-to-arm vaccination and good lymph-supply, and (*b*) the public convenience as to distance. Heretofore, the latter of these considerations is the only one which, in the great majority of unions, has been in any way regarded. The other has been wholly overlooked: yet it is evidently the more important of the two. By any one who reflects it will be seen at once that it is much less hardship, and involves really much less loss of time, for a parent to have to take a child a mile or a couple of miles or more, for vaccination, and to be sure to get it, and to get good vaccination, when the journey's end is arrived at, than to have to make two or three, or perhaps half a dozen, journeys to a vaccinator within half, or a third, or a quarter of a mile, without getting the child vaccinated after all, or with the result of obtaining a vaccination which may be again and again

unsuccessful, or may take in an incomplete manner. The consideration of distance is one that should always have its due place, and on no account be overlooked: in rural districts, it is a very important consideration indeed: but it is not *the only* consideration to be attended to, nor must it be allowed a higher place than its due.

The principles on which division of unions should be made, with reference to lymph-supply, have been so fully stated in a former chapter (Chapter VII.), that it only remains here to offer a few suggestions with regard to their practical application.

And, first, as to large towns. Mr. Ceely is, I believe, of opinion that, to maintain a first-rate and wholly self-dependent public vaccinating station, there must be allowed the entire public vaccination of a population of about 50,000. And, as a general rule, I agree with him. Something depends, of course, on the *kind* of population, as affecting the proportion likely to seek *public* vaccination. The 40,000 inhabitants of Rochdale, for example, will give a great many more cases to the *public* vaccinator than the 40,000 of Cheltenham. The St. George's station at Manchester—quite one of the model stations of England—is sustained out of a population of about 48,000: it vaccinates on an average 1,400 cases a year. Certainly in no town of the first magnitude, such as Liverpool, Manchester, Birmingham, Bristol, &c. &c. should an average population of less than 40,000 be assigned to each vaccinating district and station:[1] and to the station or stations in *the central and most densely populated parts* of such towns a popu-

[1] Under the Regulations of the Privy Council, Feb. 18, 1868, "a vaccination district" in *a town* will not in future have more than one station: hence, *in speaking of districts exclusively urban*, the word "station" may be taken to mean also a complete vaccination district.

lation of 50,000 or 60,000 should be allowed (§ 57). Upon this calculation the union of Liverpool, for instance, would have its five or six, the unions of Manchester or Birmingham each its four, stations.[1] And though, if the arrangements heretofore usual were followed, there would be appointed to each such station a separate vaccinator, I think that in these cases, and in fact in all cases in which a Board of Guardians has under its jurisdiction a sufficiently large urban population, it would be well worth their consideration (indeed I would very earnestly press it upon them) whether it would not be a greatly preferable course to have the vaccination at all the stations done by one vaccinator, devoting himself exclusively to the work, and having no other professional engagements. By appointing the attendance at each station on different week-days, this could readily be done; and a great public gain would thus, I believe, be realized[2] (§ 72).

In smaller towns the same general principles will, of course, forbid the division of any which has less than 50,000 inhabitants, and each such town should have its one station. Such, in fact, will be the ultimate effect of the recent Regulation of the Privy Council, which requires that, as present contracts may lapse, *every* district within a town shall, except with special authorization to the con-

[1] The *Unions* of Liverpool, Birmingham, and Manchester (I use the word Union as leading to less confusion than the word Parish, which is their strict legal designation) had, at the last Census, populations of about 270,000, 212,000, and 185,000 respectively. They constitute but parts of the *towns* of the same name, the remainder of the town in each case being under the jurisdiction (*quoad* vaccination) of some other Board or Boards of Guardians. But the same general principles apply of course throughout the towns.

[2] The whole union would then be a vaccination district, and provided for by a single contract, and under special authorization from the Privy Council (Reg. I. 3, of the Reg. Feb. 18, 1868) the requisite number of stations could be appointed.

trary, have *at least* a population of 25,000, or whatever population, short of that number, is in the particular town under the control of one and the same Board of Guardians. The fixing, then, in this Regulation a population of 25,000 (when attainable) as the *minimum* for a town district, must not by any means be taken to imply that subdivision into districts of 25,000, if a larger population can be obtained for a district, is deemed desirable : on the contrary, when an urban union has, say, a population of 80,000, it will be much more in accordance with the spirit and meaning of the Regulation to have two stations (unless considerations of distance forbid) rather than three; or, in other words, to assign a population of 40,000 to each district instead of a population only a little exceeding 25,000.

The smaller a city or town, the less, of course, it admits of subdivision, until we come to those small towns which may fairly be considered parts of rural districts, and come under rural arrangements.

In rural districts considerations of distance acquire of course great relative importance ; and it is not by assigning minimum populations for such districts that provision will be best made in them for arm-to-arm vaccination, but by making the attendances for vaccination periodical (see § 59).

Whatever reconstruction of districts Guardians may resolve upon, they are required to submit the same to Poor Law Board for approval before it can take effect. And the Poor Law Board, on their part, where the division now existing, or any division hereafter made, does not properly provide for the vaccination of a union, may, under their order, require this division to be altered, and the Guardians are bound to alter it accordingly (Sect. 2, 3).

(2) **Stations.**—The next point after settling the division into districts is to consider the number of stations requisite. A district wholly or in part in a town can, under the Regulations in force, have only one urban station. But in rural districts, and in districts made up of a number of townships, several stations may be required. Local knowledge only can determine how many may be necessary, or where these should be placed. The only *general* considerations I have to press have reference to the selection, or not, of the vaccinator's surgery as one of them. Now, in small towns, and in villages in which the public vaccinators may reside and which may be the centres of rural districts, no arrangement can be more generally convenient than that which makes the vaccinator's surgery a public station. But in large towns it is essentially important—and it is a point my experience obliges me to urge very strongly—that the surgeries should *not* be appointed as the stations : and for the following reasons. In the first place, they very seldom indeed afford proper accommodation for the number of applicants for which provision ought to be made : even with the present district-division they generally do not do this ; *à fortiori* they will not do it when the districts are more populous. Secondly, it is a matter of mere accident if they are at all centrally and conveniently placed.[1] Thirdly, there is considerable jealousy on the part of private practitioners with regard to their patients going to another practitioner's house, which does not attach, or attaches much less, to

1 Nobody who has not had practically to deal with these matters could believe how absurdly at present the stations (being the surgeries) are in many instances placed. Vaccinators of very large and populous districts occupy probably houses face to face in the same street, each at the very end of his own district. This, or something like this, is not at all uncommon.

their going to a public institution. And, lastly, these stations or institutions should be intrusive upon public notice, each well marked by its board or plate, with full particulars upon it of the stational attendance; so that parents who may have immigrated into the district, or from any other cause may not have received information of the public arrangements from the district registrar, may at once know where and when they have a right to apply.

The accommodation required for the vaccinating station of a district in a large town is the use *for two or three hours once a week* of a commodious room, or preferably of two rooms (a vaccinating room and a waiting room), in a centrally situated and well-frequented locality, with provision for fire, attendance, &c. But as this accommodation is wanted only once a week, and for a very few hours at a time, the rent which a Board would have to pay for such a station is very trifling.

(3) **Attendances.**—The same considerations which forbid unnecessary multiplication of districts and stations (see Chap. VII. and App. II. B, 3) forbid also undue multiplication of attendances: and the Regulations require that, except at times when there is immediate danger of small-pox, the attendance at any station shall not be oftener than once a week. But when the population is not large enough for a weekly attendance throughout the year, the attendance at the station should be weekly *at certain periods of the year only*. The considerations respecting periodical vaccination have been sufficiently discussed (§ 59) to render it unnecessary here to re-enter on them. In most rural districts an attendance at each station for three or four successive weeks in the spring, and again in the autumn, will be ample: and in all such cases the proposal should be made to the Poor

Law Board to sanction (under Sect. 12) a periodical system.[1] In contracts with vaccinators for vaccinating a district entirely on the periodical plan, there should, I think, be two provisos: (1) that whenever the presence or proximity of small-pox may render it expedient that attendances for vaccination should be given in the intervals, the contractor would be prepared to give these attendances, on being required so to do by the local authority; and (2) that when, from special circumstances, parents required the performance of vaccination in an interval, the contractor would, on application at his residence, make provision for such performance as soon after as practicable.

(b) **Appointment of Public Vaccinators.** (1) **Selection of the Officer.**—For each district it is provided there should be a public vaccinator appointed: not necessarily a different vaccinator for each, for one vaccinator may hold three or four districts; but for every district *one* responsible officer. And by the recent Regulations of the Privy Council, there cannot, after June 30 next, be more than one official acting in this capacity in any one district, or in one and the same part of any union. The Qualifications of a public vaccinator are fixed by the Regulations of the Privy Council (Appendix II. B, 1); and no one not possessing these qualifications can either be appointed to that office or can legally act as a public vaccinator's deputy (Sect. 4). Where, as in rural districts, small towns, &c. the division for public vaccination may properly be the same as for medical relief, the appointment of the district medical officer to be the public vaccinator of his district generally works well. But where, as in large towns, other divisions

[1] See Appendix II. B, 4. Extracts from Letter from Medical Department of Privy Council, &c., II. *c.* 2 and 3, p. 457.

are indispensable, there can be no particular reason why a district medical officer should be selected rather than any other practitioner; and very generally there will be this great objection to the appointment of a district officer, that his other public duties occupy a great amount of time, and are indeed frequently overwhelming. The employment, in parts of London and in some of our large towns, of overworked district officers as public vaccinators has led in some instances to a farming out by them of public vaccination among a number of other practitioners, not themselves responsible to the local authority, and much more frequently to the delegation of the vaccinating duties to assistants, not legally qualified to act—irregularities for which the excuse alleged has been that the vaccinators themselves could not overtake the work:[1] so that, with few exceptions, the best parochial stations in London are now in the hands of practitioners who are not district medical officers. Still, while these reasons will militate *generally* against the selection of a district medical officer, they may of course be by no means always applicable; and I am far from wishing to lay down a rule that a district officer should, *ipso facto*, be excluded from the appointment.

(2) **Contracts. Considerations on the subject of Payments.**—In the contract which a Board of Guardians makes with an appointed public vaccinator,

[1] Some Boards of Guardians have winked at these things, or more than winked at them, because, as already explained, they thought that the *perquisite* of public vaccination induced these medical officers to accept a smaller salary. And thus, while the Legislature had considered it expedient, for the sake of getting a good class of vaccinators, to restrict Guardians to a minimum payment of 1*s.* 6*d.* per case, there was a sub-letting to other doctors by which the vaccination was done for 9*d.*, or a delegation to assistants, perhaps, at the rate of 3*d.*

the latter binds himself to the performance of certain duties which will be hereafter stated, and the former binds itself to the payment of certain fees, which, however, must not be less than the following sums fixed by the Statute (Sect. 6): viz. for primary vaccinations performed in accordance with the regulations of the Lords of the Council in force at the time and all other requirements of the Law, at a station within a mile from the vaccinator's residence, not less than eighteen-pence per case; at a station above a mile, but within two miles from the residence, not less than two shillings; and at a station above two miles off, not less than three shillings. For performance of vaccination at dwellings there is no minimum fixed; but payment for such performance, subject to the regulations of the Privy Council made in this behalf, may be provided for in contracts with the assent of the Poor Law Board.

For vaccinations performed under contract within the workhouses, a fee may now be paid which must not be less than eighteen-pence per case. Heretofore the Medical Officer of the workhouse has had to perform these vaccinations without fee. For such cases of successful re-vaccination as may have been performed by any contractor, in accordance with the Regulations of the Privy Council in force for the time being, a fee is payable of two-thirds the sum (whatever that may be) fixed in the contract for cases of primary vaccination.

With regard to the minimum payments fixed by law for stational vaccination, I venture to suggest that Boards of Guardians, if they be wise, will consider beforehand whether, by adopting the minimum scale, they will be paying a rate at which really good service can reasonably be expected. The observations which

on this subject I would particularly urge for their consideration are these: When the districts laid out are such (as should be the case in London and all towns of the first magnitude) that every district-station would have its eight, or twelve, or sixteen hundred applicants a year, these vaccinations, at the rate of 1*s.* 6*d.* per case, will give an annual remuneration per station of from 60*l.* to 120*l.* (besides the Government gratuity that may be earned)—a sum which it will not be contended is at all insufficient to secure the services of a practitioner of good standing and reputation. But where the population of districts is necessarily smaller, and such as may yield perhaps to the district-station not more than 600, 400, or 300 cases annually, the remuneration, if the minimum rate be maintained, is of course proportionally decreased, but the time the vaccinator has to devote to the work is not correspondingly diminished. Paradoxical as it may seem to any one not practically acquainted with the subject, it is easier, so far as the mere act of vaccination is concerned, to vaccinate properly a thousand children a year than it is to vaccinate properly a couple of hundred. The supply of lymph in the former case is constant, always ready from the arm, the operation done instantly, and the whole system almost self-acting: in the latter case, there needs abundance of contrivance and pains to keep the supply up at all, and often a waiting that consumes as much time as might have gone to the vaccination of two or three dozen children. Hence, in small and middle-sized towns, and in the suburbs of large towns, it will never be wise to adopt the minimum fee. Another consideration is that of distance. For this the law has to a certain extent provided, but it has left a great deal more to be settled locally. Although the minimum

rate of 3*s*. per case, at a station above two miles from a vaccinator's house, may fairly meet some circumstances, *e.g.* those of a large village only three or four miles off, where for each attendance there would be some six or eight vaccinations to perform, it will in no degree meet the case of a small village six or seven miles off, in which perhaps there may not be more than three or four children to be vaccinated. Guardians should have varying scales according to local circumstances: and it is only by those who have local knowledge that these variations of circumstances can be provided for. But the general considerations I have ventured to offer on the subject are, I know, really important, and I sincerely trust they may be well weighed.

(c) **Public Notifications.**—Public notification of the arrangements for public vaccination, and of every alteration of such arrangements, new appointments of vaccinators, &c. &c. is required by the Statute to be made by printed papers fixed in the districts. (Sect. 13.) The desirableness of publishing notice in the newspapers also should be considered. And particular care should be taken that immediate intimation of changes be made to *the registrar or registrars of the respective districts*, that their notices to parents may be altered without delay in conformity therewith.

(d) **Supervision.**—The local authority is bound to see that the obligations of contracts are fulfilled by the public vaccinators: *e.g.* that the attendances contracted for are duly given; that the vaccinator's register is duly kept; that the certificates have been duly sent to the Registrars, &c. The claim of vaccinators for payment under their contracts is for cases only in which the regulations in force, and all other requirements of the law, have been properly carried out by them. Thus no claim exists for

any case in which the vaccination has been performed by a person not legally qualified to perform it, nor for any case in which the results of the vaccination have not been duly inspected : two points on which a good deal of supervision appears to be called for. The Guardians are forbidden by the statute to make any payment whatever, and the Auditor is bound by the statute to disallow any such payment if made, unless the contract shall have been approved by the Poor Law Board, or whenever the Poor Law Board shall have determined the contract. (Sect. 10.) Guardians, also, before paying the fees of registrars under the Act, are required to see that the entries in the registers have been correctly made. (Sect. 25.)

130. Enforcement of the Law. Duties of a Vaccination Officer.—In order that the inquiries which the Act directs shall be made half-yearly respecting all cases in which parents have, *primâ facie*, not complied with the Law may be duly made, and that the Law may be properly enforced, it appears to me indispensable that Guardians should appoint some person or persons for the purpose. Failing such appointment, the duty would devolve on the union clerk ; but it would be impossible, I apprehend, for him to discharge it without assistance. Provision is made (Sect. 28) for the appointment and payment of whatever officers may be required for carrying the Act into effect. Local circumstances will best determine whom to appoint. In most rural, and in many urban unions, my experience leads me to believe that the Registrars will be found the most suitable persons to appoint, each to act in his own district, especially in those unions in which the Registrars are also relieving officers. But in unions of large urban populations it will be the best course, I apprehend, to

appoint a special officer to act for the whole union. Sanitary Inspectors would be sometimes very suitable persons to appoint to this office.

The duties of this officer, or of these officers, may be considered, (1) in relation to the inquiries to be instituted, and the action to be taken on information derived from the birth-register; and (2) in regard to the other duties necessary for carrying out the requirements of the Statutes.

(1) The Registrars of all sub-districts are required by the statute to present to the Board of Guardians half-yearly (in the first week of January and the first week of July) a list of all parents respecting the vaccination of whose children the proper certificate has not been received during the last preceding half-year (Sect. 27); and the statute is mandatory on the Guardians forthwith to inquire into the circumstances of the cases. The first duty, then, of an appointed vaccination officer would be to make inquiry on the lists so presented. It does not follow, in the first place, because a certificate has not been returned to the Registrar that there has been any default of anybody; the child may be dead, or the parent may hold a certificate of postponement, or of insusceptibility. This is the first thing to be inquired after. If neither of these be the case, the next inquiry would be whether the child had been vaccinated and no certificate thereof sent,—and if so, whether the default as to not sending the certificate was the default of a public vaccinator or of the parent,—or whether the child remained unvaccinated. What immediate steps should be taken in cases of default of one kind or the other thus found out—what *locus pœnitentiæ* may be allowed to the neglectful—will depend on the instructions each Board of Guardians may give to its officer. But it

would be an utter subversion of the declared object of the law to allow any person to escape unpunished who continued to neglect its requirements. The words of the Act are positive that Guardians *shall cause proceedings to be taken* against the persons in default. In the first instance, Guardians will, probably, be very much disposed to direct that warning be given to the parents that unless the vaccination be done, and the certificate duly registered, within a certain number of days, proceedings will ensue. But if there be any neglect of such warning, proceedings ought then by no means to be delayed: and in districts in which anything like *habitual* neglect exists, my experience satisfies me that public examples will be indispensable. That the law should be duly observed, it must be clearly seen that it is not to be trifled with.

But, although the law only *exacts* that these inquiries should be instituted and these proceedings taken at six-monthly intervals, I would venture to point out the enormous advantage which would ensue if they were made in each individual case, as soon as, or very shortly after, the default arises. The Registrars, when they are the appointed officers, know of course when each certificate becomes due to them. If the appointed officer be not the Registrar, he has still (Sect. 24) full access to the registers; and from the benefit his services will confer on the Registrars by procuring them their certificates he is sure to receive the cordial co-operation of those officers. At the beginning of each month, the defaults of the preceding month should be dealt with, a list being made of the cases for which certificates ought to have been received, but were not received, during the month preceding. Practically the shortest and best course of proceeding with these lists, after ascertaining

from the district vaccinator that none of his certificates were in arrear, would be, I believe, to send a written or printed notice, duly signed, of the non-receipt of the requisite certificate to each parent, specifying a time (say, a fortnight) within which it should be returned. The effect of this would be, in the great majority of cases, to bring in the certificate, or such an explanation as would at once show whether there had been default at all, and with whom it lay.[1] And when this was not the case, personal inquiry, at the expiration of the term, would of course follow, with such further proceedings as the officer's instructions from his Board would warrant.

[1] In Scotland, where the compulsory law has worked so marvellously well, this sending of a notice *immediately on default arising* is the course that the law requires to be taken. The Registrars are also required to send in six-monthly lists of the defaulters to the Parochial Boards, but even in such towns as Edinburgh and Glasgow these lists amount to a mere nothing, because *every month* the defaulters are warned by them, and compliance almost invariably follows such warning. Some such form of intimation as this would probably meet the case :—

To

I beg to intimate to you that a certificate has not been received of the successful vaccination of A. B., born on the of , 186 , and whose birth was registered in the registration sub-district of , which certificate should in due course have been received on or before the of . I request that such certificate may be transmitted to the Registrar of the sub-district within days from this date.

I would remind you that by terms of the Act every Parent neglecting to have his child vaccinated within three months of birth incurs a Penalty of Twenty Shillings; AND THAT A CERTIFICATE OF SUCCESSFUL VACCINATION MUST UNDER A LIKE PENALTY BE LODGED WITH THE REGISTRAR.

C. D.

Dated this day of , 186 .

Officer appointed by the Guardians of Union to enforce the provisions of the Vaccination Act, 1867.

In this way, few cases would remain to be reported half-yearly, by the Registrars, to the local authority. This would be the course in districts in which vaccination is appointed to be carried on continuously. In those districts in which vaccination is appointed to be carried on periodically, the most useful action of a vaccination-officer would consist in making a list *beforehand* of all who would be defaulters if the vaccination be not obtained during the forthcoming periodical attendance, and of *reminding* parents, so as to get compliance before the period had passed away.

(2) The duties of a vaccination officer, other than these inquiries founded on the birth-registers, would consist in personally finding out children whose births had not been registered; children unvaccinated who had been born in other districts; in fact, any unvaccinated children under fourteen years of age living in the district; and in taking all such means as are provided by this and preceding statutes for getting these children vaccinated. There is one species of parental neglect which, I venture to suggest, he should be instructed to deal with unsparingly in all instances,—the neglect of parents duly to bring their children for inspection after the vaccination had been performed. If cases be not brought back for inspection, not only is it impossible for a vaccinator to certify the success of the particular vaccination, but the whole machinery of public vaccination is thrown out of gear. No trifling excuses for such neglect as this should be allowed to prevail. Every public vaccinator should be directed to report these cases to the vaccination officer: and the vaccination officer should not fail, except for very sufficient excuse, to proceed against them.

The powers which this Act confers on local authorities

for enforcing effectual vaccination are so ample that I do not believe that there is any union in the kingdom, however circumstanced, that may not, by due exercise of them, keep itself safe from any serious outbreak of small-pox.

131. **Special Duties in Repression of Small-pox.**—The kind of action that Guardians should take when, from previous neglect of vaccination, small-pox spreads in a locality, has been fully explained in Chapter XIII. They are empowered by Sect. 28 of this Act to pay any expenses incurred by them in taking such measures. If there be any attempt to inoculate small-pox, proceedings should be taken under Sect. 32. When the Board of Guardians is the local authority under the Sanitary Act, it has powers, under that Act, for dealing with the cases of persons who, having small-pox, unlawfully expose themselves, or who expose their children, or others of whom they are in charge (while suffering under the disease), in public streets or in public conveyances; or who, without previous disinfection, expose or give away, &c. clothing, bedding, &c. infected with small-pox;[1] and for punishing persons who let houses, rooms, &c. in which the infection has been, without having them properly disinfected. When the local authority under the Sanitary Act is not the Board of Guardians, it is of the utmost consequence for giving effect to the measures recommended (Chapter XIII.) that the two authorities should act in concert. If, in case of an epidemic, a local authority neglects to take the requisite measures for arresting it, the Privy Council has power conferred on it (Sect. 4) to issue directions under the Diseases Prevention Act which the Guardians will have to carry out. Nothing, therefore, will now

[1] Sects. 25, 26, 38, 39.

be gained by ignoring the existence of small-pox, as has been too often done, "for fear of creating alarm," or "because it will injure the trade of the town,"—a plan under which a disease easily arrested at its outset is sure to get the mastery.

(C.) Of the Duties of Public Vaccinators.

132. General Observations on the Duties of Public Vaccinators.—A medical practitioner, on entering into a contract for the public vaccination of a district,[1] should take care to see that the contract binds him to nothing, on the one hand, that he cannot perform, and will not *bonâ fide* carry out (that he does not, for example, bind himself to any nominal or sham attendances), and that, on the other hand, the rate of payment he agrees to accept is such as will remunerate him for the services he undertakes to give. The law has wisely made the payment of a public vaccinator a matter of bargain between him and the local authority who employs him, subject to certain minima, below which the payment must not go. It has never, though it has often been mistakenly so stated, done such a foolish thing as to attempt to fix what the payments in any case

[1] In consequence of the stringent requirement of the law that no payments shall be made to a public vaccinator, where there is not a lawful contract in force, every public vaccinator who was in office when the law came into operation would do well to see that his contract is in due form. Existing contracts were not annulled by the new Act, but the attendances contracted for, and the vaccinator's proceedings under those contracts, are subject to all the regulations of the Privy Council which are not specially restricted to a future time or to future contracts. Where the attendances required under these contracts are onerous or impracticable, vaccinators should see to getting them changed and a new contract substituted as soon as possible.

should be. It has seen fit, it is true, to put a restraint upon guardians; it puts no restraint on vaccinators. I have already endeavoured to set out the considerations by which, in my opinion, local authorities, acting in the public interests, should be guided in this question of payments. Medical men, unless they wish the law to treat them as babies, must look out for themselves. And I am sure that all my professional brethren will agree with me that it would be utterly unworthy of any of us to undertake to perform duties at a certain rate of payment, and then to neglect or imperfectly perform those duties on the plea that the payment was not sufficient.

The first anxiety of a public vaccinator, in the execution of his duties, will doubtless be about the professional part of his work—to see that this is *well done*. The responsibility of procuring the vaccination of the children of his district rests not with him, but with the Board of Guardians; the responsibility of having the public vaccination *well done* is wholly his own. But, though it is quite true that a public vaccinator is not directly responsible for having the children of his district vaccinated, this does not in the least mean that he is not to take an interest in getting them done. On the contrary, without such interest, without even a zealous interest in the work, he can scarcely properly fulfil the objects of the contract. That vaccination should be well done there must not only be a sufficient supply of subjects, but *a regular succession of them*. No doubt the very largest stations are almost self-acting,[1] but even in the conduct of them

[1] Not but that the largest stations work all the better for special means employed. Some of the largest and best stations have a scout regularly attached to them, whose business it is to bring up a number of cases in weekly succession: this plan is one which works exceedingly well, and I would strongly recommend it to the vaccinators of large urban districts.

there is plenty of scope for a vaccinator materially to influence the amount and regularity of attendance by the kindly interest manifested in his work, his care and pains (qualities which the public are never slow to appreciate), and method, and system. But at all lesser stations the successful management of the district-vaccination will be found to depend very much indeed on the vaccinator's own exertions. My meaning is, that *for the mere* sake of swelling the *number* of his cases he must not resort to plans and contrivances which cannot act otherwise than detrimentally on the *quality* of his work; and that he must not suppose that it is a valid excuse, or would be accepted as a valid excuse, for his having done so, that if he had not taken this course the people would have gone unvaccinated altogether. If it may fairly be said (and it may) that former vaccination laws had not distinctly defined responsibilities, this cannot be said of the present law. It is the express duty of the Guardians, having made proper arrangements for public vaccination, and seen that these are observed by the contractor, to take care that vaccination is not neglected by the parents. And this being so, the Privy Council have thought it right now to restrict by positive Regulations practices which, under the excuses I have stated, have heretofore operated materially to deteriorate the quality and impede the success of vaccination (App. II. p. 450, Reg. 1). In reference to any information which the public vaccinator of a district, in order to regulate his succession of cases, may require to have with regard to the births in his district, it is specially provided (Sect. 24) that he shall have access to the Registrar's vaccination books.

133. **Government recognition of the zealous Discharge of them.**—It is with a view to the recog-

nition of this zeal and interest in his work—qualities which lie beyond the mere obligations of contracts—that the Legislature has provided that, on favourable reports made to the Lords of the Council by their Inspectors of Public Vaccination, as to the number and quality of the vaccinations performed in the several vaccination districts of England, certain gratuities or allowances may be awarded by their Lordships to any of these vaccinators, in addition to the payments received by them under their contracts. By the arrangements that have been made to carry out this provision, each vaccinating district will be inspected and reported on once in two years. At each inspection, the work of the district for the preceding two years will be inquired into: and every contractor who is then in office, and has been in office for a year previous to the inspection, and is the sole vaccinator of a district,[1] will be entitled to such award as their Lordships may think fit to make, if the Inspector's Report show him to have carried out his vaccination in conformity with the Law and the Regulations in force for Public Vaccination[2] (App. II.), and to have attained certain standards in the quality and amount of his vaccinations.

The quality must be such as a vaccinator, following the Instructions to Vaccinators which are part of the Regulations, would, if he have only done the work with due care, not have failed to produce. There must have

[1] Under the Regulations of the Privy Council (Feb. 18, 1868), every district will, after June 30 next, have one responsible Public Vaccinator only.

[2] Although there are parts of the Regulations (such, *e.g.*, as noting the source of lymph in registering the cases) which have not on the first biennial inspection now in progress been insisted on, public vaccinators will do wisely to adhere in future to the Regulations in all respects: the present instructions to the Inspectors are only provisional.

been the production, as a rule, of four or five separate *good-sized* vesicles, or of such a number of compound vesicles as would produce cicatrices covering at least the same area.[1] In regard to quantity there must have been such an amount and steadiness and regularity of *infantile* vaccination in the district, as testified to the vaccinator's pains and interest in his work ; it is by his amount of *infantile* vaccinations, by the vaccinations in babyhood, that a contractor's merits in this respect are gauged.

134. Contract and Statute Obligations.—The duties of a public vaccinator, as laid down by the law and by the contract,[2] consist (1) in attendances given, at the times and places expressed in the contract, for the vaccination, and inspection of vaccination, of all residents in his district who may apply for the purpose, and who have not before been successfully vaccinated ; and for the re-vaccination, and subsequent inspection, of such resident applicants as under the Regulations in force for the time being may lawfully be re-vaccinated at the public cost. He is not entitled to vaccinate at the public cost any persons resident *out of* his assigned district, except in the cases provided for in Sect. 11 of the Act. The attendance must be by himself or by another public vaccinator acting for him, or by a deputy

[1] Two grades of quality have during this first biennial inspection been recognised, the one of conspicuously first-rate work, receiving the full award, the other of good work receiving a less award : and a contractor who, following the instructions as to his mode of vaccinating, only so far succeeded as *habitually to produce* but three cicatrices, might come into the second grade, if these were of thoroughly good quality and full average size. How long it will be considered expedient to continue the awards to this quality of work, I cannot of course say.

I have not thought it necessary to print in the Appendix the form of contract prescribed by the Poor Law Board. All its substantial requirements are stated in the course of this chapter.

legally appointed (see App. II. B, 1), and the vaccination and all other proceedings must be in conformity with the Regulations in force for the time being. (2) In the keeping a Register of all vaccinations and re-vaccinations thus performed by him, or his legal deputy: which must be sent in for the examination of the Guardians once a month, or once a quarter, as may be agreed. (3) In transmitting (Sect. 21), in all cases of successful primary vaccination, a certificate of such vaccination WITHIN TWENTY-ONE DAYS OF ITS PERFORMANCE to the Registrar of the district in which the child was born (or if he be unable to ascertain this, to the Registrar of the district in which the operation was done); and in giving without charge, in all cases in which the parent or custodian of the child requests it, a duplicate of this certificate to such parent or custodian for his own keeping. (Sects. 21, 22.) And (4) In delivering to parents and custodians of children certificates of unfitness for vaccination, or of insusceptibility where the circumstances of the respective cases require it. With regard to these obligations, public vaccinators should particularly note that the law absolutely forbids (Sect. 4) that any person should act in the contractor's stead who is not legally qualified to be a contractor himself. It is desirable, also, that their attention should be directed to the register prescribed under the new form of contract,[1] and to the obligation contained in the contract, duly to make all the entries required therein. The Provincial Medical and Surgical Association, in their Report in 1839, laid great stress on the importance of accurate registers being kept. "Registers," they say, "accurately

[1] Whether there be new contracts or not, it is very desirable that the new form of Register should be adopted by Guardians in their respective unions at once.

constructed, would show every circumstance connected with perfect or imperfect vaccination, which could always be referred to on any future occasion when small-pox made its appearance in the neighbourhood." Heretofore, excepting in a few districts, registers, in the proper sense of the word, have not been kept at all. The books intended to be registers have been kept as mere accounts, or lists of the children vaccinated; entered sometimes, no doubt, on the days of vaccination, but more frequently entered from time to time, sometimes perhaps only once a quarter, and just before the book was to go in for examination and payment. Henceforth it is decided that these books should be kept *as Registers;* the names are to be entered on the vaccinating-day, with all particulars as to whence the lymph used was derived, &c. as specified in the respective columns; and as soon as the vaccinator or his legal deputy has inspected the cases, the results of such inspection are to be entered, as provided. If a case when inspected is unsuccessful, it should be recorded in the unsuccessful column; and when thereupon, or at a future time, it is vaccinated again, it must be re-entered as a fresh case. The vaccinator will see at once that, as the source of lymph has always to be recorded, and as on this second occasion it will be some other source than on the first, this re-entry of an unsuccessful case is indispensable. When registers are thus kept, the returns of successful and unsuccessful cases now made annually will have some real meaning, instead of being, as at present, simply delusive. Lastly, public vaccinators should observe that while the law requires (Sect. 7) the introduction into the contract of provisions for securing the due transmission of certificates to the Registrars, which will no doubt be a sufficient reminder to them of this duty, there is also a penalty attached by the

Statute to the non-delivery of a certificate of successful vaccination to a Registrar within twenty-one days of the performance of the vaccination (Sect. 30). It is obvious that such prompt transmission is very necessary to enable a Registrar, or a vaccination-officer, to take the requisite steps for looking after cases of default. It may be well to add that (under Sect. 22) a public vaccinator cannot charge as a public vaccination any case for which he is paid by any other person.

(D.) Of the Duties of Registrars under this Act.

135. Duties and powers of Registrars.—The duties consist (1) in delivering to parents at the time of registering a birth, or within seven days, a notice requiring the vaccination of the child in conformity with the Act, with forms of certificate attached, and with information as to the attendance for public vaccination; (2) in keeping a register (which, according to the instructions of the Registrar-General, is for the most part a transcript of the birth-register, with columns for minuting against the name of the child the delivery to the parent of the notice respecting vaccination), in which is to be entered against each name the certificate of successful vaccination, as and when it may be received, and in which also other certificates may be entered according to the instructions of the Registrar-General; (3) in preparing from this register, and delivering to the Board of Guardians, half-yearly, lists of defaulters; (4) in distributing among vaccinators such forms of certificate as the Registrar-General shall provide for their use.

The instructions which the Registrar-General has issued to the District Registrars, on these duties, are

so complete that it would be superfluous to do more than to refer to them. (Appendix II. C.) I will only venture, therefore, here, knowing the great interest a large number of this valuable class of officers have taken in the subject of vaccination, and their great anxiety to promote the objects of the Act, to call their attention to the large POWERS for enforcement of its provisions which the Legislature has conferred upon them. A Registrar may, without any appointment by the local authority, exercise of his own mere motion all the powers which the local authority, or its appointed officers, may exercise to enforce vaccination under the Act: but the portion of his powers which a Registrar is most likely to exercise of himself is that which will secure him the punctual delivery of the certificates of successful vaccination, upon the registration of which his remuneration depends. He may take proceedings at any time against any one who neglects duly to send him these certificates.

Two hints which I have derived from the practice of some of the Registrars I will venture to offer for the sake of the rest, because I believe that, if adopted, they will materially contribute to the receiving each certificate in such a state as will enable the child to be at once identified, and to the easy finding its name in the books. The one is, that the Registrars should, on the form of certificate of successful vaccination delivered to each parent, themselves fill in the name of the child and all particulars required that can be then properly entered; and the other is, that they should index their vaccination books.

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APPENDIX I.

A.

NOTE OF RECORDED DISCOVERIES OF COW-POX.

THE following is a list, as complete as circumstances have allowed me to make, of *recorded* discoveries of cow-pox in the cow :—

In ENGLAND, soon after Jenner's discovery had called attention to the disease, accounts were obtained of its being known to have occurred in at least eighteen counties, besides Gloucestershire, the county in which his own observations were made. (See Ring, Treatise on Cow-pox : and to the counties he names, Essex may be added, on the authority of a communication made to the Epidemiological Society by Dr. Rees Price, of Ilford.) It is impossible, however, to say whether the cases thus reported had been all of them cases of the *genuine* cow-pox. Jenner, in his first treatise (Inquiry into the Causes and Effects, &c.), besides referring to cases in which the disease had been accidentally transferred to various persons at different periods long past, mentions it as having been specially noted in the Gloucestershire dairies in 1770 (p. 9), in 1780 (p. 21), in 1782 (p. 23), in 1791 and 1794 (p. 22). Some of these are cited as cases in which the cow-pox had originated from a disease in the heels of horses. Jenner's first vaccination was performed in 1796, from a casual vesicle on the hands of a milker, but this source was not gone on with. In 1798, he met with the

disease again, and then raised his first stock of lymph. In January 1799, Woodville met with cow-pox in the London dairies, and raised a stock from it. (Baron's Life of Jenner, vol. i. p. 307.) In the spring of the same year cow-pox was seen at North Nibley, in Gloucestershire, and another stock obtained from it for Jenner's use (Ib. 323); and soon afterwards he also obtained a new supply from the dairies in Kentish Town (Ib. 325). We pass over a long interval, till 1836, when Mr. Leese, one of the vaccinators of the National Vaccine Establishment, obtained a stock from the cow, and propagated it. In 1838, the disease was met with, again in Gloucestershire, by Mr. Estlin; in 1838 or 1839, in Dorsetshire, by Mr. Fox, of Cerne Abbas; in 1839, also in Dorsetshire, by Mr. Sweeting, of Abbotsbury (Report of Vaccination Sect. of Prov. Assoc. in Trans. of the Assoc. vol. viii.); in 1838, 1840, and 1841, in the Vale of Aylesbury, by Mr. Ceely (Trans. Prov. Med. Assoc., vols. viii. and x.). From all these sources lymph was transferred to the human subject. In the Report of the Vaccination Section of the Association, above quoted, it is also stated that the cow-pox had been recently seen in Suffolk, in the neighbourhood of Stowmarket, "during the prevalence of small-pox in the neighbourhood." It is certainly very singular that it should have been seen by so many observers about the same time, and it deserves particular notice that this was at a period when one of the most formidable epidemics of small-pox that has occurred in the present century was sweeping over the land. No doubt the disease might have been found much more frequently if it had been only thought worth while to look for it; no doubt also, cases which *have* been found, and used for raising lymph, may often have passed unrecorded. Thus, when the Epidemiological Society made inquiries in 1851, several instances in which practitioners had met with cow-pox, and had vaccinated with the lymph obtained from it, were brought to light: as by Mr. Donald Dalrymple, of Norwich (on two occasions); by Mr. Beresford, of Narborough, in Leicestershire; by Mr. Gorham, of Aldeburgh; by Mr. Alison, of Great Retford; by Mr. Coles, of Leckhampton; by Mr.

Rudge, of Leominster, and one or two others. Mr. Sweeting (above referred to)informed the Society that he had met with the disease in *two* instances, and had disseminated lymph obtained by the vaccination of persons from each source. In all the foregoing cases the genuineness of the cow-pox had been established by successful vaccinations having been performed from them. But, besides these cases, several practitioners in various parts of the country had vaccinated unsuccessfully from what they believed to have been true cow-pox; and others reported having seen milkers suffering from a disease which, both from the description given and from their either resisting small-pox on exposure, or resisting ordinary vaccination, was no doubt genuine cow-pox. Some other occasions on which cow-pox has been met with in the Vale of Aylesbury, or in the dairies of Gloucestershire, are referred to in the text. It has been met with in Aylesbury Vale on one occasion within the last two years: and under circumstances that show how readily it may escape observation. A veterinary surgeon sent Mr. Ceely a crust removed from the udder of a cow (a quite isolated case), from which crust Mr. Ceely raised genuine vaccinia in the human subject. But for the intelligence of this veterinarian, no knowledge of this case would ever have come to light. No other case of the genuine pock had been met with in the Vale for many years: but of the white-pock (or spurious cow-pox) many cases had been seen. Most of the observers who had seen the casual disease in milkers, had seen it when too far advanced to take lymph from; but Mr. Tomkins, of the National Vaccine Establishment, as well as one other reporter, whose name I have mislaid, were able to obtain lymph, with which they successfully vaccinated. In IRELAND, cow-pox was early reported as having been known, and anti-variolous powers attributed to it. (Ring.)

In FRANCE, cow-pox is said to have been found in 1810 in the Department of La Meurthe; and in 1822, at Clairveaux. (Baron, *op. cit.*, vol. i. p. 552.) With these exceptions, there is no account of it as being met with in that kingdom

till the discovery of it at PASSY, in 1836; and, in the same year, at Amiens and RAMBOUILLET; in 1839, it was discovered at Rouen; in 1841, at Saint Illide, at SAINT SEINE, at PERYLHAC; in 1842, at Pagnac; in 1843, at Deux Jumeaux, the reporter of the case stating that during the thirty years he had been in practice, he had *several times* used lymph direct from the cow, and got stocks which he had kept up; on this occasion there is no account of any stock being established, but two milkers were infected from the cow, and could not be made, it is said, to take vaccinia afterwards (the case, though occurring in 1843, does not appear till the Report for 1851); in 1844, on A COW BELONGING TO M. MAJENDIE; in 1846, in three departments (but the accounts of these attacks are scanty and defective); in 1852 at RHEIMS, and also in the DEPARTMENT OF EURE-ET-LOIRE; in 1854, in the arrondissement of SANCERRE (but the details of this case also are meagre), and at BEZIERS; in 1863, at GUYONVILLE; in 1864, on farms in three villages near Nogent (but in two of these farms the first case was in a cow purchased only a few days before); milkers were infected on each of the farms, and from one of these milkers a lymph-stock was established; also in the same year, at PETIT QUEVILLY, near Rouen. (See Annual Reports of the Acad. Imp. de Méd. sur les Vaccinations pratiquées en France, 1841–1864.) Besides the foregoing occasions, cow-pox was met with also, in 1845, by Steinbrenner, at WASSELONNE, in the Department of Bas Rhin. In April 1866, cow-pox was also discovered at BEAUGENCY. In all the cases printed in small capitals, stocks appear to have been raised and to have passed more or less into use. There were, besides, many cases of cow-pox reported which turned out on inquiry to be spurious.

In ITALY, cow-pox was early discovered, viz. in 1800, in the PLAINS OF LOMBARDY, by Sacco; and again, in 1808-9, by the SAME INDEFATIGABLE VACCINATOR, and by other medical men: in 1830 also, according to accounts, it was seen in Piedmont. In 1812, it was discovered at Naples,

by Miglietta (Steinbrenner, *op. cit.*, p. 581), and I believe that it has been met with since on two or three occasions, either there or in some part of the former kingdom of that name. In 1832, and again in 1834, it was found at Rome, on cows of Swiss breed, by Dr. Maceroni, and on the latter occasion a lymph-stock was established.

In GERMANY, the same sort of inquiries as were set afoot in England after the promulgation of Jenner's discovery, showed that cow-pox had been recognised in various places, especially in Mecklenburg, Holstein, Brandenburg, Silesia, in the country about Giessen, and Erlangen; as also in Switzerland. (Bouchholz, Vollständige Abhandlung über die Kuhpocken.) There is to be found, indeed, in a Göttingen newspaper of as old a date as 1769, "The Allgemeinen Unterhaltungen," a notice of this disease being often seen about Göttingen, of milkers being affected by it, and protected thereby against small-pox. (Hering, Ueber Kuhpocken, &c. p. 24.) A probable instance of cow-pox occurred in Wirtemberg in 1802. (Ibid. p. 34.) In 1812, the disease was seen in BERLIN AND ITS ENVIRONS, by Bremer; near LUNEBURG, by Fischer, and in Greifswalde by Mende; in 1816, at Seggerde, in Brunswick, by Giesker, an undoubtedly genuine outbreak, though no stock appears to have been raised from it: the cow-pox existed at the same time in various other parts of Brunswick. In the eleven years preceding 1824, Luders saw five epizöotics of the disease in Holstein (Steinbrenner, Traité sur la Vaccination, p. 583); and in 1824, 1826, 1829, 1830, and 1832, Ritter made successful vaccinations from cows which he found suffering from it in various parts of Schleswig-Holstein. Ritter says that in some parts of Schleswig-Holstein the disease is very common: he had himself seen it on many previous occasions, but not in the stage admitting lymph to be taken, nor till the pustules on the milkers' hands had become sores. (Hering, *op. cit.*, p. 29.) Probable examples of the disease were those met with in 1829 by Riss, at Neu Breisach (Ibid. p. 30), and by Albers, near Stralsund, in 1834 (Steinbrenner, *op. cit.*, p.

585). The history of the discoveries of cow-pox in Wirtemberg is interesting as showing how much these discoveries depend on the zeal with which the disease is looked for. Inasmuch as the tendency of all herd-keepers and their servants is to keep secret the existence of any disease among their cattle, the Government bethought them of offering premiums for the discovery of natural cow-pox in the cow, and in 1825 it was determined that a prize should be given for each case of cow-pox reported, which should be found in such a state that the character of the disease could be well ascertained, and the case used for vaccinating from. The ordinance as at first issued was subsequently modified, but all that concerns us is the general result, that cases were met with *every year*, and that in eleven years (1827-37) the genuine cow-pox was found (in a state that successful vaccination could be performed from it) in sixty-nine different places, the cows affected by it amounting to 84: besides which there were reports from 152 places, regarding 208 cows, in which the disease *probably* was cow-pox, though vaccinations were either not performed at all from them, or were unsuccessful. There were also forty-nine reported cases which turned out to be manifestly spurious. To those who think it a matter of any real moment to find out the natural disease, these facts are very suggestive.

In HOLLAND, according to Numann, cow-pox has been seen in 1805, in 1811, and in 1824. (Hering, *op. cit.*, p. 28.)

In DENMARK, a probable case was seen by Neergaard at Fünen, in 1801. (Ibid. p. 25.)

In RUSSIA, in 1838, an epizöotic of cow-pox is said to have occurred among the cows in a village in the neighbourhood of St. Petersburg.

In NORTH AMERICA, cow-pox is said to have been met with by Dr. Buett, of Massachusetts; and by Drs. North and

Trowbridge, of Connecticut—both in 1801. (Baron's Life of Jenner, vol. i. p. 470; also letter from Dr. Brigham to Mr. Estlin, London Medical Gazette, vol. xxiii.)

In SOUTH AMERICA it was found existing in three places (viz. in the Valley of Atlixco, in the neighbourhood of Valladolid de Mechoacan, and in the district of Calabozo, in the province of Caracca), by the expedition sent out by the Spanish Government for the purpose of conveying the cow-pox from Europe to its possessions beyond the seas. (Baron's Life of Jenner, vol. ii. p. 80.) Humboldt is said also to have found it in Peru. And according to Professor Pœppig, in his "Voyage to Chili and Peru," it has been seen among the cows in Chili. (Steinbrenner, *op. cit.*, p. 585.)

In ASIA it appears to have been met with in the East Indies by Macpherson, in 1832; and by Messrs. Farnell and Brown, in Assam, in 1833.

This list has been put together with somewhat more haste than I desired, and I shall feel much obliged to any readers who will give me additional references.

B.

TABLE showing the Ages at which the Deaths from Small-pox occurred in England during the Ten Years 1856-65.

AGE.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	Total for the Ten Years.
Under 1 year	544	972	1,525	990	649	330	392	1,430	1,882	1,509	10,223
Between 1 and 2 years	236	483	751	447	323	153	179	571	846	619	4,608
Between 2 and 3 years	174	343	557	352	237	98	143	533	643	483	3,563
Between 3 and 4 years	177	267	435	264	201	73	126	407	533	384	2,867
Between 4 and 5 years	168	270	317	194	134	69	91	326	390	267	2,226
Total under 5 years	1,299	2,335	3,585	2,247	1,544	723	931	3,267	4,294	3,262	23,487
Between 5 and 10 years	272	638	1,113	478	307	140	173	622	800	647	5,190
Between 10 and 15 years	88	120	248	169	113	60	71	221	280	262	1,632
Between 15 and 20 years	298	363	677	190	147	72	70	299	360	336	5,079
Between 20 and 25 years				250	280	89	122	462	547	517	
Between 25 and 35 years	161	260	490	263	236	100	128	532	703	636	3,409
Above 35 years	159	220	347	251	222	136	133	561	700	751	3,480
At all ages	2,277	3,936	6,460	3,848	2,749	1,320	1,628	5,964	7,684	6,411	42,277

TABLE showing the Ages at which the Deaths from Small-pox occurred in Scotland during the Ten Years 1855–1864.

AGE.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	Total for the Ten Years.*
Under 3 months.....	101	89	66	31	31	90	60	30	137	139	774
Between 3 and 6 months.....	88	80	54	38	39	112	50	20	111	106	698
Between 6 and 12 months	242	226	144	44	92	220	118	71	188	168	1,513
Total under 1 year	431	395	264	113	162	422	228	121	436	413	2,985
Between 1 and 2 years.....	237	246	191	64	120	217	126	72	265	227	1,765
Between 2 and 3 years.....	158	156	94	36	92	156	80	59	153	148	1,132
Between 3 and 4 years.....	92	118	61	26	58	129	58	31	122	103	798
Between 4 and 5 years.....	65	67	47	10	41	67	43	22	60	92	514
Total under 5 years	983	982	657	249	473	991	535	305	1,036	983	7,194
Between 5 and 10 years.....	104	114	58	25	61	149	63	38	183	181	976
Between 10 and 15 years.....	35	25	16	7	17	41	23	9	49	50	272
Between 15 and 20 years.....	33	34	13	8	19	40	25	15	57	68	312
Between 20 and 25 years.....	52	45	36	13	33	71	28	17	88	136	519
Between 25 and 35 years.....	51	41	35	20	45	102	43	22	108	145	612
Above 35 years	50	63	30	10	34	98	48	20	124	177	654
At all ages	1,309	1,306	845	332	682	1,495	766	426	1,646	1,741	10,548

* In this column cases are included in which the Age at Death was not specified. There were only nine such cases in the Ten Years.

D.

TABLE showing the Annual Mortality from Small-pox in England, with the Proportion of Deaths to Population and to Total Mortality, from 1838 to 1865 inclusive.

Year.	Population.	Deaths from all causes.	Deaths from Small-pox.	Deaths from Small-pox per million of Population.	Deaths from Small-pox per 1,000 deaths from all causes.	Place occupied by Small-pox in the order of mortality of the causes of death in England.
1838	15,312,256	342,529	16,268	1,101	47.96	5th
1839	15,515,296	338,979	9,131	604	26.93	10th
1840	15,721,029	359,561	10,434	679	29.00	9th
1841	15,929,492	343,847	6,368	408	18.51	14th
1842*	16,123,793	349,519	2,715	172	7.76	25th
1847*	17,131,512	420,304	4,227	246	10.05	22d
1848	17,340,492	398,531	6,903	398	17.32	16th
1849	17,552,020	440,839	4,644	264	10.53	20th
1850	17,766,129	368,995	4,665	263	12.90	19th
1851	17,982,849	395,396	6,997	396	18.00	15th
1852	18,205,627	407,135	7,320	409	18.28	17th
1853	18,403,313	421,097	3,151	174	7.60	26th
1854	18,618,760	437,905	2,808	153	6.49	29th
1855	18,786,914	425,703	2,525	136	6.01	34th
1856	19,045,187	390,506	2,277	121	5.90	35th
1857	19,304,897	419,815	3,936	206	9.48	24th
1858	19,523,103	449,656	6,460	335	14.54	18th
1859	19,746,000	440,781	3,848	197	8.84	26th
1860	19,902,713	422,721	2,749	140	6.59	35th
1861	20,119,314	435,114	1,320	66	3.06	46th
1862	20,336,467	436,566	1,628	81	3.77	39th
1863	20,554,137	473,837	5,964	293	12.70	21st
1864	20,772,308	495,531	7,684	373	15.64	18th
1865	20,990,946	490,909	6,411	309	13.20	21st

* From 1843–46 inclusive the causes of death were not analysed by the Registrar-General.

E.

SMALL-POX MORTALITY IN THE METROPOLIS.

(*a*) TABLE showing the Average Annual Deaths from all causes and from Small-pox in the Metropolis for Decennial Periods from 1751—1860.

Periods.	Average Annual Deaths.		Small-pox Deaths per 1,000 deaths from all causes.
	All causes.	Small-pox.	
1751–60	20,872	2,061	100
1761–70	23,202	2,445	108
1771–80	22,404	2,204	98
1781–90	19,516	1,705	87
1791–1800	20,213	1,780	88
1801–10	19,582	1,253	64
1811–20	18,604	793	42
1821–30	21,645	699	32
1831–40	24,585	573	23
1841–50	52,217	841	16
1851–60	61,047	715	11

The mortality given in this Table up to 1840 is the mortality of London "within the Bills of Mortality." From 1840 it is the mortality of the Metropolis within the (greatly enlarged) limits adopted by the Registrar-General, the population of which was in 1841, 1,948,369; in 1851, 2,373,799; in 1861, 2,803,989; and is now estimated at considerably above three millions. The materials of the Table up to 1840 are taken from a Table on page 41 of the Report of the Small-pox and Vaccination Committee of the Epidemiological Society.

[T.O.

E. (*continued.*)

(*b*) TABLE showing the Annual Deaths from Small-pox in the Metropolis (within the limits adopted by the Registrar-General) from 1838 to 1866 inclusive, arranged in three periods.

1. Before the Enactment of any Vaccination Laws.		2. Vaccination provided gratuitously, but not obligatory.		3. Vaccination to a certain extent obligatory.	
Year.	Number of Deaths.	Year.	Number of Deaths.	Year.	Number of Deaths.
1838	3,817	1841	1,053	1854	694
1839	634	1842	360	1855	1,039
1840	1,235	1843	438	1856	531
		1844	1,804	1857	156
		1845	909	1858	242
		1846	257	1859	1,158
		1847	955	1860	898
		1848	1,620	1861	217
		1849	521	1862	366
		1850	499	1863	1,996
		1851	1,062	1864	547
		1852	1,159	1865	640
		1853	211	1866	1,388
Average Annual Deaths	**1,859**		**834**		**759**

The diminution has taken place in a constantly and rapidly increasing population. In the years 1840–41 the Annual Deaths from Small-pox in the Metropolis were 616 out of every million persons living at all ages: from 1841–50 they were, on the mean population, 389 per million: from 1851–60, 272 per million.

F.

TABLE showing the Distribution and Mortality from Small-pox in the British Army from 1859 to 1865 inclusive.

Year.	United Kingdom.			Mediterranean.			British America.			West Indies (Whites).			West Indies (Blacks).		
	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.
1859	71,715	175	7	11,733	15	1	6,013	2	—	1,839	1	—	2,711	3	—
1860	85,443	140	9	16,265	5	1	5,280	2	—	1,849	3	—	2,497	59	2
1861	88,955	51	4	16,374	24	3	6,564	12	1	1,895	—	—	2,358	13	—
1862	78,173	64	4	16,044	8	2	16,395	3	—	1,924	—	—	2,734	9	—
1863	75,945	123	6	15,604	—	—	15,350	20	—	1,860	—	—	2,183	1	—
1864	73,252	111	10	12,917	—	—	14,114	50	2	1,703	2	—	2,001	18	3
1865	72,999	90	6	10,708	12	—	12,202	20	1	1,715	—	—	2,003	2	1

[T.O.

F. (*continued.*)

TABLE showing the Distribution and Mortality from Small-pox in the British Army from 1859 to 1865 inclusive.

Year.	West Africa (Blacks).			St. Helena, Cape, Mauritius, Ceylon (Whites).			Ceylon (Blacks).			Australia, New Zealand.			China (Whites).			China (Blacks).		
	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.
1859	949	21	—	6,954	12	1	1,564	—	—	2,839	—	—	1,550	—	—	2,009	—	—
1860	1,042	20	1	7,737	1	1	1,533	—	—	2,794	—	—	7,774	21	3	5,094	4	—
1861	1,106	14	—	8,106	—	—	1,448	—	—	5,797	—	—	6,135	15	2	3,128	2	—
1862	944	—	—	8,139	—	—	1,468	—	—	6,482	—	—	3,511	69	11	1,725	3	1
1863	1,323	10	—	7,783	1	—	1,438	22	1	6,567	—	—	2,464	5	—	1,562	1	—
1864	1,638	3	1	7,310	—	—	1,417	2	—	9,835	—	—	2,629	25	5	1,553	1	—
1865	1,476	—	—	7,196	—	—	1,419	1	—	9,914	—	—	2,553	25	4	354	1	1

F. (*continued.*)

TABLE showing the Distribution and Mortality from Small-pox in the British Army from 1859 to 1865 inclusive.

Year.	Bengal.			Madras.			Bombay.			On Board Ship going to Foreign Service.			On Board Ship returning from Foreign Service.			On Board Ship going from one Service to another.		
	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.
1860	42,371	135	16	10,696	3	—	11,388	20	3									
1861	37,483	203	30	10,739	4	1	8,860	19	4	2,055	—	—	2,352	2	—	571	1	—
1862	39,312	14	2	12,531	13	1	11,870	12	2	1,461	—	—	1,030	—	—	84	—	—
1863	42,575	44	10	12,621	3	—	12,329	8	2	2,520	24	—	719	—	—	664	—	—
1864	39,936	86	13	12,993	8	2	12,173	42	4	2,791	—	—	1,369	1	—	724	—	—
1865	37,361	109	14	13,059	2	—	11,899	21	2	1,863	—	—	2,533	—	—	813	—	—

G.

TABLE showing the Distribution and Mortality of Small-pox in the British Navy from 1856 to 1864 inclusive.

Year.	Total Force.					Home.			Mediterranean.			North America and West Indies.			S.E. Coast of America.		
	Strength.	Cases.	Deaths.	Cases per 1000, Mean Force.	Deaths per 1000, Mean Force.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.
1856	51,730	39	3	—	—	12,445	12	1	11,090	16	—	7,845	—	—	1,200	2	—
1857	42,470	19	—	0.5	—	10,400	10	—	7,120	—	—	3,640	—	—	1,500	—	—
1858	43,120	83	10	1.9	0.2	12,600	47	5	5,390	—	—	2,600	—	—	1,270	—	—
1859	52,825	128	11	2.4	0.2	19,300	51	4	11,100	4	—	2,780	—	—	1,000	1	—
1860	64,025	327	25	5.2	0.4	23,500	84	12	14,210	153	8	2,250	—	—	1,250	36	—
1861	62,485	315	24	5.0	0.3	22,900	35	1	16,600	105	9	4,750	8	—	1,120	1	—
1862	58,870	103	18	1.7	0 3	20,760	8	1	9,950	34	4	10,135	—	—	1,420	1	—
1863	54,090	121	15	2.2	0.2	21,570	39	2	8,470	2	—	7,050	—	—	1,370	38	1
1864	53,000	462	33	8.8	0.6	19,630	199	9	7,920	9	—	6,040	56	4	1,370	3	—

G. (*continued.*)

TABLE showing the Distribution and Mortality of Small-pox in the British Navy.

Year.	Pacific.			West Coast of Africa.			Cape of Good Hope.			East Indies and China.			Australia.			Irregular.		
	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.	Strength.	Cases.	Deaths.
1856	2,680	—	—	1,630	—	—	890	—	—	3,410	1	—	540	—	—	10,000	8	2
1857	2,170	—	—	1,620	—	—	1,060	—	—	7,080	6	—	390	—	—	7,490	3	—
1858	2,310	—	—	1,870	—	—	1,140	—	—	11,300	31	5	380	—	—	4,260	5	—
1859	2,650	—	—	1,590	1	1	1,160	—	—	6,600	56	3	585	—	—	6,060	15	3
1860	3,490	—	—	1,845	1	—	1,570	—	—	8,540	32	4	940	—	—	6,430	21	1
1861	2,650	—	—	2,050	—	—	1,880	3	—	5,860	144	13	945	—	—	3,730	19	1
1862	2,760	2	—	2,190	—	—	1,180	—	—	3,570	58	13	945	—	—	5,960	—	—
1863	3,220	—	—	1,930	2	2	1,350	—	—	4,740	38	10	580	—	—	3,810	2	—
1864	2,420	—	—	1,610	2	—	2,620*	3	1	5,390†	150	16	1,160	—	—	4,840	40	3

* Cape of Good Hope *and* East Indies.

† China only.

APPENDIX II.

A.

THE VACCINATION ACT, 1867.

30 & 31 Vict. Cap. lxxxiv.—*An Act to consolidate and amend the Laws relating to Vaccination.* [12th August, 1867.

WHEREAS, &c. :

1. From and after the Day when this Act shall come into operation as herein-after provided, the Statute of the Third and Fourth Years of the Reign of Her Majesty, Chapter Twenty-nine, that of the Fourth and Fifth Years of the same Reign, Chapter Thirty-two, that of the Sixteenth and Seventeenth Years of the same Reign, Chapter One hundred, the Seventh Section of the Statute of the Twenty-first and Twenty-second Years of the same Reign, Chapter Twenty-five, the Second Section of the Statute of the Twenty-first and Twenty-second Years of the same Reign, Chapter Ninety-seven, and the Statute of the Twenty-fourth and Twenty-fifth Years of the same Reign, Chapter Fifty-nine, shall be repealed,—

Except in regard to the Divisions and Districts of Unions and Parishes previously made, and to all Contracts under the said Statutes then in force, and to all Acts and Proceedings duly commenced under the same, and not then completed, and except in regard to all Liabilities and Responsibilities incurred under the same, all which shall remain in as full Force as if the same Statutes had not been repealed, unless they be in any respect inconsistent with the Provisions herein contained.

2. The Guardians of every Union or Parish where the same shall not have been divided into Districts for the Purpose of Vaccination shall, unless such Union or Parish respectively shall be of so limited an Area as not to require Subdivision, in which Case the same shall be treated as a Vaccination District within the Meaning hereof, forthwith divide the Union or Parish for which they act into Districts for the Performance of Vaccination; and when the Poor Law Board shall by their Order require any Districts for the Time being to be consolidated or otherwise altered, the Guardians shall proceed to consolidate or alter the same, and they shall in every such Case of Division, Consolidation, or Alteration report their Proposal to the Poor Law Board for their Approval, which Board shall approve or disapprove of the same as they see fit; and the Guardians of every Union or Parish may, with like Approval, from Time to Time as they shall find it requisite, alter the Districts heretofore formed or hereafter to be formed for the Purpose of Vaccination.

3. If the said Board disapprove of the Proposal the Guardians shall forthwith proceed to prepare another, and submit the same to the said Board for Approval, and so on from Time to Time as shall be requisite until their Proposal shall be approved, and when the said Board shall have approved of the same the Guardians shall enter into a Contract with some duly registered Medical Practitioner for the Performance of Vaccination of all Persons resident within each District; and every such Medical Practitioner shall be termed the Public Vaccinator of the District; and as and when the Contracts now existing shall determine the Guardians shall enter into others, with such Modifications as the Circumstances shall render necessary, subject to the like Approval of the Poor Law Board as aforesaid.

4. No Person shall be appointed a Public Vaccinator, or act as a Deputy for a Public Vaccinator, who shall not possess the Qualification heretofore prescribed by the Lords of Her Majesty's Council, or such as shall be from Time to Time hereafter prescribed by them, except when such Lords

shall upon sufficient Cause sanction any Departure from their Directions; and all such Regulations as the said Lords have heretofore made or shall hereafter make, which they are hereby authorized to make, to secure the efficient Performance of Vaccination or the Provision and Supply of Vaccine Lymph by the Public Vaccinator, and all such Directions or Regulations as the said Lords acting under any Act for the Prevention of Diseases may issue in relation to Smallpox, shall be duly observed by the several Persons to whom they apply; and the said Lords may from Time to Time cause such Inquiries to be made relating to the Observance of such Regulations and to the Execution of this Act as to them shall seem fit, and shall direct how any Money hereafter to be provided by Parliament for or towards defraying the Expenses of the National Vaccine Establishment, or otherwise providing for the Supply of Vaccine Lymph, shall be applied.

5. On Reports made to the Lords of Her Majesty's Council with regard to the Number and Quality of the Vaccinations performed in the several Vaccination Districts of *England*, or any of them, the said Lords may from Time to Time, out of Moneys provided by Parliament, and under Regulations to be approved by the Lords Commissioners of Her Majesty's Treasury, authorize to be paid to any Public Vaccinators, in addition to the Payments received by them from Guardians or Overseers, further Payments not exceeding in any Case the Rate of One Shilling for each Child whom the Vaccinator has successfully vaccinated during the Time to which the Award of the said Lords of the Council relates.

6. Every such Contract for Vaccination shall provide for Payment in respect only of the successful Vaccination of Persons, and so that the Rate of Payment for primary Vaccinations shall be not less than the following; that is to say, for every such Vaccination done at an appointed Station situated at or within One Mile from the Residence of the Vaccinator, or in the Workhouse of the Union or Parish, not less than One Shilling and Sixpence; and for every

such Vaccination done at any Station over One Mile and under Two Miles distant from his Residence, not less than Two Shillings ; and for every such Vaccination done at any Station over Two Miles distant from his Residence, not less than Three Shillings ; such Distance being measured according to the nearest public Carriage Road ; but in respect of successful Vaccinations performed elsewhere than at a Station or in the Workhouse as aforesaid, the payment shall be according to the Terms specified in the Contract as approved of by the Poor Law Board.

7. The Guardians shall, with the Consent of the Poor Law Board, make Stipulations and Conditions in their Contracts to secure the due Vaccination of Persons, the Observance of the Provisions of this Act with regard to the Transmission of the Certificate of successful Vaccination, and the Fulfilment of all other Provisions of this Act on the Part of the Public Vaccinator, and shall provide all Stations at which the Vaccination shall be appointed to be performed other than the Surgery or Residence of the Public Vaccinator.

8. The Provisions of the Contracts entered into before this Act comes into operation shall not after the Thirty-first Day of *December* next apply to the Cases of Persons who having been previously successfully vaccinated shall be re-vaccinated, but if the Lords of Her Majesty's Council shall have issued or shall hereafter issue Regulations in respect of the Re-vaccination of Persons who may apply to be re-vaccinated, which such Lords are hereby authorized to do, the Guardians shall pay in respect of every Case of successful Re-vaccination performed in conformity with such Regulations under such Contracts or under new Contracts entered into after the Date hereof a Sum amounting to Two Thirds of the Fee payable upon each Case of successful primary Vaccination.

9. No Contract for Vaccination entered into under the Provisions of this Act shall be valid until the same shall have been approved of by the Poor Law Board, and such Board may, at their Discretion, upon the Application of the Lords of Her Majesty's Council or otherwise, at any

Time after the same shall have been approved of by them, determine it either forthwith or at a future Day.

10. No Payment in respect of Vaccination shall be made out of the Common Fund of any Union, or out of the Poor Rate of any Parish, or out of any other public or parochial Fund, where the Poor Law Board shall not have approved of a Contract for the Performance thereof, or after they shall have determined any such Contract; and every Payment made contrary hereto shall be disallowed by the Auditor in the Accounts of every Board of Guardians, or of the Overseers, or of any Officer who shall have made the same.

11. Where a District shall have been or shall be assigned to a Vaccinator, he shall not be entitled to be paid a Fee in respect of the Vaccination or Re-vaccination of any Child or other Person resident out of his District, except in case of a Vacancy in the Office of Vaccinator in any adjoining District, or of the Default of the Vaccinator therein, of which Default Notice shall have been given to him in Writing by the Guardians, or when a Relieving Officer of his Union or Parish shall in Writing refer any Child to him for Vaccination.

12. The Guardians may with the Consent of the Poor Law Board provide in Districts where the Population is scanty or much scattered, or where some peculiar Circumstances may render it expedient for them to do so, for the Attendance of the Public Vaccinator at the appointed Places after Intervals exceeding Three Months; and if by reason of such Intervals the Vaccination of any Child cannot be performed within the respective Periods herein prescribed, no Parent or other Person who would otherwise be liable shall be liable to any Penalty in respect of a Neglect to procure the Vaccination during any such Period; but every such Parent or other Person shall be bound to procure such Vaccination to be performed at the Time and Place so appointed before the Commencement of the next Interval, unless it be otherwise performed by a Medical Practitioner as herein provided, or unless the Child shall be certified to be then in an unfit State for or insusceptible of Vaccination.

13. When the Guardians make any Alteration in a Vaccination District, or otherwise in the local Arrangements for Vaccination, they shall give public Notice of such Alteration by printed Papers to be affixed in the Districts affected by such Alteration for One Month prior to the Alteration taking effect.

14. The Registrar General for *England* and *Wales* shall, when he shall deem it necessary, from Time to Time as Occasion shall require, after the passing of this Act, frame and provide appropriate Books, Forms, and Regulations for the Use and Guidance of the Registrars in the Exercise of their Duties therein prescribed, and also such Forms as shall be required for the Use of the Public Vaccinators and the Signature of the Medical Practitioners under the Provisions of this Act, and shall transmit the same to all Registrars of Births and Deaths, who shall retain such as relate to themselves, and distribute among the Vaccinators within their respective Districts such as relate to them without any Fee or Reward.

15. The Registrar of Births shall, on or within Seven Days after the Registration with him of the Birth of any Child not already vaccinated, give a Notice, according to the Form in the Schedule hereto annexed marked A., or to the like Effect, to the Parent, or, in the even of the Death, Illness, Absence, or Inability of the Parent, to the Person having the Custody of such Child, if known to him, requiring such Child to be duly vaccinated according to the Provisions of this Act, and specifying the Days, Hours, and Places where the Public Vaccinator of the Vaccination District wherein such Child resides, or the Vaccinator of any Station duly authorized by the Lords of Her Majesty's Council, will attend for the Purpose of performing the Operation, to which Notice Forms according to those in the said Schedule marked B., C., and D., and also the Address of the Registrar giving the Notice, shall be attached in such Form as the Registrar General shall deem most convenient.

16. The Parent of every Child born in *England* shall within Three Months after the Birth of such Child, or where

by reason of the Death, Illness, Absence, or Inability of the Parent, or other Cause, any other Person shall have the Custody of such Child, such Person shall, within Three Months after receiving the Custody of such Child, take it or cause it to be taken to the Public Vaccinator of the Vaccination District in which it shall be then resident, according to the Provisions of this or any other Act, to be vaccinated, or shall within such Period as aforesaid cause it to be vaccinated by some Medical Practitioner; and the Public Vaccinator to whom such Child shall be so brought is hereby required, with all reasonable Despatch, subject to the Conditions herein-after mentioned, to vaccinate such Child.

17. Upon the same Day in the following Week when the Operation shall have been performed by the Public Vaccinator such Parent or other Person, as the Case may be, shall again take the Child or cause it to be taken to him or to his Deputy that he may inspect it, and ascertain the Result of the Operation, and, if he see fit, take from such Child Lymph for the Performance of other Vaccinations; and in the event of the Vaccination being unsuccessful such Parent or other Person shall, if the Vaccinator so direct, cause the Child to be forthwith again vaccinated and inspected as on the previous Occasion.

18. If any Public Vaccinator or Medical Practitioner shall be of opinion that the Child is not in a fit and proper State to be successfully vaccinated he shall forthwith deliver to the Parent or other Person having the Custody of such Child a Certificate under his Hand according to the Form in the Schedule hereto annexed marked B., or to the like Effect, that the Child is then in a State unfit for successful Vaccination, which Certificate shall remain in force for Two Months, and shall be renewable for successive Periods of Two Months until a Public Vaccinator or Medical Practitioner shall deem the Child to be in a fit State for successful Vaccination, when the Child shall, with all reasonable Despatch, be vaccinated, and the Certificate of successful Vaccination duly given if warranted by the Result.

19. At or before the End of each successive Period the Parent or such Person as aforesaid shall take or cause the Child to be taken to some Public Vaccinator or Medical Practitioner, who shall then examine the Child, and give the Certificate according to the said Form B., so long as he deems requisite under the Circumstances of the Case.

20. If any such Public Vaccinator or Medical Practitioner shall find that a Child whom he has Three Times unsuccessfully vaccinated is insusceptible of successful Vaccination, or that a Child brought to him for Vaccination has already had the Smallpox, he shall deliver to the Parent or other Person as aforesaid a Certificate under his Hand according to the Form in the Schedule hereunto annexed marked C., or to the like Effect, and the Parent or such Person as aforesaid shall thenceforth not be required to cause the Child to be vaccinated.

21. Every Public Vaccinator who shall have performed the Operation of Vaccination upon any Child, and have ascertained that the same has been successful, shall, within Twenty-one Days after the Performance of the Operation, transmit by Post or otherwise a Certificate according to Form D. in the said Schedule, or to the like Effect, certifying that the said Child has been successfully vaccinated, to the Registrar of Births and Deaths in the District within which the Birth was registered, but if such District be not known to him, or if the Birth of the Child shall not have been registered, to the Registrar within whose District the Operation shall have been performed, and upon Request shall deliver a Duplicate thereof to the Parent or other Person as aforesaid.

22. No Fee or Remuneration shall be charged by the Public Vaccinator to the Parent or other Person for any such Certificate or Duplicate Certificate as aforesaid, nor for any Vaccination done under his Contract, nor shall he be entitled to Payment under his Contract for any Vaccination in respect of which he shall have been paid by the Parent or other Person for whom or on whom it is performed ; and if he should have received Payment under his Contract he

shall not be entitled to recover Payment for the Vaccination from any other Person.

23. Where the Vaccination shall be successfully performed by a Medical Practitioner not being a Public Vaccinator, the Parent or other Person as aforesaid causing the Child to be vaccinated shall submit a Certificate according to the said Form marked D. to such Medical Practitioner, to be filled up and signed by him, and shall within Twenty-one Days after the Performance of the Operation transmit the same so signed, by Post or otherwise, to the Registrar of the District where the Birth of such Child was registered, or if such Child shall not have been registered, or the District of the Registration shall not be known to such Parent or other Person, to the Registrar of the District in which the Operation shall have been performed.

24. Every Registrar shall keep a Book in which he shall enter Minutes of the Notices of Vaccination given by him as herein required, and also register the Certificates transmitted to him as herein provided, and shall at all reasonable Times allow Searches to be made therein, and upon demand give a Copy under his Hand or under that of his Deputy of any Entry in the same, on Payment of a Fee of Sixpence for each Search and Threepence for each Copy; and every Registrar shall receive a Fee of One Penny in respect of every Child whose Birth he shall have registered, and in respect of whom he shall give the Notice as aforesaid, and another Fee of Threepence in respect of every such Child whose Certificate he shall have registered as herein provided, and he shall receive a Fee of One Penny in respect of each Child whose Certificate he shall have registered without having registered the Birth: Provided that no Fee shall be charged for any Search made by a Public Vaccinator, or any Officer of the Guardians, authorized by them to make such Search, or any Inspector appointed by the Poor Law Board or the Lords of Her Majesty's Council.

25. The Registrar shall make out an Account of the Fees to which he shall be entitled under this Act at the usual Quarter Days of the Year, and submit the same to the

Guardians of the Union or Parish for which he acts, and they shall, after examining the same and comparing with the Register of successful Vaccinations kept by him and finding the Account to be correct, forthwith pay the Amount of the same out of the Funds in their Possession.

26. It is hereby declared, That the Vaccination, or the Surgical or Medical Assistance incident to the Vaccination, of any Person in a Union or Parish, heretofore or hereafter performed or rendered by a Public Vaccinator, shall not be considered to be Parochial Relief, Alms, or charitable Allowance to such Person or his Parent, and no such Person or his Parent shall by reason thereof be deprived of any Right or Privilege, or be subject to any Disability or Disqualification.

27. The Registrar of each District shall, within One Week after the First Day of *January* and the First Day of *July* in each Year, make a List of all Cases in which Certificates of Vaccination have not been duly received by him during the last preceding Half Year, and shall submit the same to the next Meeting of the Guardians of the Union or Parish wherein he acts, and the said Guardians shall forthwith make Inquiry into the Circumstances of the Cases contained in the List, and if they find that the Provisions of the Act have been neglected shall cause Proceedings to be taken against the Persons in default.

28. The Guardians of any Union or Parish may pay out of their Funds all reasonable Expenses incurred by them in causing Notices to be printed and circulated as to the Provisions of this Act, and in and about Inquiries and Reports as to the State of Smallpox or Vaccination in their Union or Parish, and in taking Measures to prevent the Spread of Smallpox and to promote Vaccination upon any actual or expected Outbreak of that Disease therein, and may pay any Officer appointed by them to prosecute Persons charged with Offences against this Act, or otherwise to enforce its Provisions.

29. Every Parent or Person having the Custody of a Child who shall neglect to take such Child or to cause it to be taken

to be vaccinated, or after Vaccination to be inspected, according to the Provisions of this Act, and shall not render a reasonable Excuse for his Neglect, shall be guilty of an Offence, and be liable to be proceeded against summarily, and upon Conviction to pay a Penalty not exceeding Twenty Shillings.

30. Every Public Vaccinator, Parent or Person, as the Case shall require, who shall neglect to transmit any Certificate required of him by the Provisions of this Act completely filled up and legibly written to the Registrar within the Time herein specified, and every Public Vaccinator who shall refuse to deliver the Duplicate to the Parent or other Person, on Request, and every Medical Practitioner who shall refuse to fill up and sign the Certificate of successful Vaccination when submitted to him as aforesaid, shall be liable to pay upon a summary Conviction a Penalty not exceeding Twenty Shillings; and every Person who shall wilfully sign a false Certificate or Duplicate under this Act shall be guilty of a Misdemeanor, and punishable accordingly.

31. If any Registrar, or any Officer appointed by the Guardians to enforce the Provisions of this Act, shall give Information in Writing to a Justice of the Peace that he has Reason to believe that any Child under the Age of Fourteen Years, being within the Union or Parish for which the Informant acts, has not been successfully vaccinated, and that he has given Notice to the Parent or Person having the Custody of such Child to procure its being vaccinated, and that this Notice has been disregarded, the Justice may summon such Parent or Person to appear with the Child before him at a certain Time and Place, and upon the Appearance, if the Justice shall find, after such Examination as he shall deem necessary, that the Child has not been vaccinated, nor has already had the Smallpox, he may, if he see fit, make an Order under his Hand and Seal directing such Child to be vaccinated within a certain Time; and if at the Expiration of such Time the Child shall not have been so vaccinated, or shall not be shown to be then unfit to be vaccinated, or to be insusceptible of Vaccination, the Person upon whom

such Order shall have been made shall be proceeded against summarily, and, unless he can show some reasonable Ground for his Omission to carry the Order into effect, shall be liable to a Penalty not exceeding Twenty Shillings :

Provided that if the Justice shall be of opinion that the Person is improperly brought before him, and shall refuse to make any Order for the Vaccination of the Child, he may Order the Informant to pay to such Person such Sum of Money as he shall consider to be a fair Compensation for his Expenses and Loss of Time in attending before the Justice.

32. Any Person who shall after the passing of this Act produce or attempt to produce in any Person by Inoculation with Variolous Matter, or by wilful Exposure to Variolous Matter, or to any Matter, Article, or Thing impregnated with Variolous Matter, or wilfully by any other Means whatsoever produce, the Disease of Smallpox in any Person, shall be guilty of an Offence, and shall be liable to be proceeded against summarily, and upon Conviction to be imprisoned for any Term not exceeding One Month.

33. The Statute of the Eleventh and Twelfth *Victoria*, Chapter Forty-three, except Section Eleven, shall apply to all Proceedings to be taken under this Act ; and the Justices for the County, City, Borough, or other Place where the Offence shall have been committed shall have Jurisdiction to hear and determine the Complaint, and where a Union or Parish shall be comprised in several Jurisdictions, the Complaint as to any Matter arising in such Union or Parish may be heard and determined in any One of such Jurisdictions ; and all Prosecutions undertaken by the Guardians or their Officers or any Registrar under this Act shall be deemed to be within the Operation of the Seventh and Eighth *Victoria*, Chapter One hundred and one, Section Fifty-nine, and the Union Chargeability Act of 1865, Section Nine.

34. In any Prosecution for Neglect to procure the Vaccination of a Child, it shall not be necessary in support thereof to prove that the Defendant had received Notice from the Registrar or any other Officer of the Requirements of the Law in this respect ; but if the Defendant produce any such

Certificate as herein-before described, or the Register of Vaccinations kept by the Registrar as herein-before provided, in which the Certificate of successful Vaccination of such Child shall be duly entered, the same shall be a sufficient Defence for him, except in regard to the Certificate marked B., when the Time specified therein for the Postponement of the Vaccination shall have expired before the Time when the Information shall have been laid.

35. The word "Parent" shall include the Father and Mother of a legitimate Child and the Mother of an illegitimate Child; "Medical Practitioner" shall mean a registered Medical Practitioner; and the several Words herein contained shall be construed, except where any Inconsistency would ensue from such Construction, in the same Manner as in the several Acts for the Amendment of the Law for the Relief of the Poor.

36. The Seventh Section of the Public Health Act, 1858, shall apply to all the Proceedings and Acts of the Lords of Her Majesty's Council herein authorized.

37. This Act shall come into operation on the First Day of *January* next, and may be cited as "The Vaccination Act of 1867."

[Schedules A. B. C. D. of the Forms of Notice and Certificates given by Registrars to Parents, being forms in daily use, it is not thought necessary to print them.]

B.

REGULATIONS AND OTHER OFFICIAL DOCUMENTS ISSUED BY THE PRIVY COUNCIL.

(1.) Regulations relative to Public Vaccination issued on the 1st day of December, 1859.

Whereas by the Public Health Act, 1858, and by an Act since passed to perpetuate the same, it is enacted that the Privy Council may from time to time issue such regulations as they think fit, for securing the due qualification of persons to be thereafter contracted with by Guardians and Overseers of Unions and Parishes in England for the Vaccination of persons resident in such Unions and Parishes, and for securing the efficient performance of Vaccination by the persons already or thereafter to be contracted with as aforesaid:—

Now, therefore, it is hereby ordered, by the Lords and others of Her Majesty's Most Honourable Privy Council (of whom the Vice-President of the Committee of the said Privy Council on Education is one) that on and after the first day of January, 1860, the following Regulations shall be in force, viz.:—

1. Except where the Privy Council, for reasons brought to their notice, see fit in particular cases otherwise to allow, no person shall in future be admitted as a Contractor for Vaccination, unless he possess the same qualifications as are required by the Orders of the Poor Law Commissioners as qualifications for a District Medical Officer, and produce a special Certificate, given, under such conditions as the Privy

Council from time to time fix, by some public Vaccinator whom the Privy Council authorize to act for the purpose, and by whom he has been duly instructed or examined in the practice of Vaccination, and all that relates thereto[1] :—

But the production of this special Certificate on occasion of the contract being made may be dispensed with, if the Certificate, or some other which the Privy Council judge to be of like effect, have been among the certificates or testimonials necessary for obtaining any diploma, licence, or degree, which the candidate possesses ;—

And also, in respect of persons legally admitted to practise before this Regulation comes into effect, the special Certificate may be dispensed with [on condition that the Contract, during one year from its making, continue subject to the approval of the Poor Law Board][2];—

And all persons now contracted with shall be deemed to be qualified to be again contracted with.

2. Under the same conditions as are appointed for the admission of a Contractor, any person qualified to be a Contractor may, on the Contractor's application, be admitted by the Guardians or Overseers to act as his occasional deputy ;—

But, if this admission be not part of the original Contract, it must be notified by indorsement upon the Contract ; and at least 15 days before it is intended to take effect a copy of the proposed indorsement, together with all requisite evidence of the qualification of the person whom it is proposed to admit, must be transmitted to the Poor Law Board.

3. All Vaccinations and Inspections under Contract shall be performed by the Contractor in person, or by some other Contractor of the same Union or Parish acting for him, or by a deputy, duly admitted as above ;—

[1] Lists of the persons authorized to give these certificates are published annually in the "Medical Directory," and sent at the beginning of each Medical Session to every Medical School. They can be obtained always by letter addressed to the Medical Department of the Privy Council.

[2] The part of this clause in brackets has never been acted on. The certificate has been unconditionally dispensed with in all cases of persons who obtained their legal qualifications to practise before the Regulation came into effect.

But at any station where the Contractor is authorized (as above) to grant certificates, pupils and other candidates, aged not less than 18 years, may, in his presence and under his direction, take part in vaccinating.

All Vaccinations and Inspections under Contract shall be performed in accordance with the annexed "Instructions for Vaccinators under Contract."

4. Until some new form of Vaccination-Register be duly prescribed,[1] the person who performs any Vaccination under Contract shall, on the day when he performs it, legibly write in his Register (as now provided) the letter R (for Re-vaccination) against the name of every person, adult or adolescent, who, having in early life been successfully vaccinated, is re-vaccinated ; and shall also enter in some column, or in the margin of the Register, the source whence the lymph used in the Vaccination was obtained ;—

Thus : the name, or number (if any) in the Register, of the subject from whom the lymph was taken ; or "N. V. E.," if the lymph was sent by the National Vaccine Establishment; or the name or description of any other source ;—

And where the Vaccination or the Inspection is done by a person acting as Deputy for the Contractor, the Deputy shall write the initials of his name in the Register side by side with the entry of the case; viz. in the left margin of the page, if it be a Vaccination which he performs, or in the right margin of the page, if it be an Inspection which he performs.

5. Guardians and Overseers, in their respective Unions and Parishes, shall forthwith take measures to bring the performance of public Vaccination into conformity with these Regulations.

Instructions for Vaccinators under Contract.

(1.) Except there be immediate danger of small-pox, vaccinate only subjects who are in good health. Satisfy yourself that there is not any eruption behind the ears, or elsewhere

[1] Such form of Register is now prescribed, and contains columns for all the entries here directed to be made.

on the skin ; nor any febrile state ; nor any irritation of the bowels. Under no circumstances vaccinate a subject to whom, from the state or prospects of his health, vaccination is likely to prove injurious. Do not re-vaccinate persons who in infancy have been efficiently vaccinated, unless they be more than 15 years of age, or, if during any immediate danger of small-pox, more than 12 years of age.

(2.) In all ordinary vaccinations, vaccinate by four or five separate punctures, so as to produce four or five separate good-sized vesicles ; or, if you vaccinate otherwise than by separate punctures, take care to produce local effects equal to those just mentioned.

(3.) Direct care to be taken for keeping the vesicles uninjured during their progress, and for avoiding afterwards the premature removal of the crusts.

(4.) Register the results of vaccination only after having yourself inspected the cases. Register as "successful" no case of primary vaccination, unless the course of the vesicle have been strictly regular according to the subjoined description, A. ; and register as "successful" no case of re-vaccination, unless either the regular vaccine vesicle have ensued, or the results have been normally modified according to the subjoined description, B. Or if in either case you register as "successful" any result which does not agree with the subjoined descriptions, write also the word "irregular" in the column of the register where you record the result.

(5.) Endeavour to maintain in your district such a succession of cases as will enable you uniformly to vaccinate with liquid lymph directly from arm to arm ; and do not, under ordinary circumstances, adopt any other method of vaccinating. To provide against emergencies, always have in reserve some stored lymph ;—either *dry*, as on thickly-charged ivory points, constantly well-protected from damp ; or *liquid*, according to the method of Dr. Husband, of Edinburgh, in fine, short, uniformly capillary (not bulb) tubes, hermetically sealed at both extremities. Lymph, successfully preserved by either of these methods, may be used without definite restriction as to time ; but with all stored lymph caution is

necessary, lest in time it have become inert, or otherwise unfit for use. If, in order to vaccinate with recent liquid lymph, you convey it from case to case in a vial or in other like manner, without its being hermetically sealed, do not let more than 18 hours, and in very hot weather not more than 12 hours, intervene before it is used.

(6.) Consider yourself strictly responsible for the quality of whatever lymph you use or furnish for vaccination. Take lymph only from subjects who are in good health; especially satisfying yourself that they are free from eruption on the skin. Take it only from well-characterised, uninjured vesicles. Do not take it from cases of re-vaccination. Take it (as may be done in all regular cases on the day week after vaccination) at a time when the vesicles are plump, either just before the formation of the areola, or, at the latest, not more than 24 hours after the areola has begun to form.

(7.) In vaccinating from arm to arm, and still more in proceeding to store lymph, avoid draining any vesicle which you puncture. From such a vesicle as vaccination by puncture commonly produces do not, under ordinary circumstances, take more lymph than will suffice for the immediate vaccination of five subjects, or for the charging of seven ivory points, or for the filling of three capillary tubes; and from larger or smaller vesicles take only in like proportion to their size.

(8.) Scrupulously observe in your inspections every sign which tests the efficiency and purity of your lymph. Note any case wherein the vaccine vesicle is unduly hastened or otherwise irregular in its development, or wherein any undue local irritation arises: and if similar results ensue in other cases vaccinated with the same lymph, desist at once from employing it.

(9.) If from any cause your supply of lymph ceases, or becomes unsuitable for further use, take immediate measures for obtaining a new supply.

(10.) Keep in good condition the lancets or other instruments which you use for vaccinating, and do not use them for other surgical operations.

N.B.—Supplies of lymph, guaranteed by the National Vaccine Board, are furnished on application to all medical practitioners. Letters of application for this lymph should be addressed "To the Registrar of the National Vaccine Establishment, Privy Council Office, London, S.W."

Signs of successful Vaccination and of successful Re-Vaccination.

(Gregory, revised by Ceely and Marson.)

(A.) "When vaccination has been successfully performed on a healthy infant, the puncture may be felt elevated on the second or third day, and soon afterwards, if examined with a magnifying glass, appears surrounded by a slight redness. On the fifth or sixth day a distinct vesicle is formed, having an elevated edge and depressed centre. On the eighth day it appears distended with a clear lymph. The vesicle on this, its day of greatest perfection, is circular and pearl-coloured; its margin is turgid, firm, shining, and wheel-shaped. Late on the seventh, or early on the eighth, day an inflamed ring or areola begins to form around the base of the vesicle, and, with it, continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. When at its height, on the ninth or tenth day, there is often considerable hardness and swelling of the subjacent cellular membrane. On the tenth or eleventh day the areola begins to subside, leaving, as it fades, two or three concentric circles of redness. The vesicle now begins to dry in the centre, and acquires there a brownish colour. The lymph which remains becomes opaque, and gradually concretes; so that about the fourteenth or fifteenth day the vesicle is converted into a hard round scab of a reddish brown colour. This scab contracts, dries, blackens, and, about the twenty-first day, falls off. It leaves a cicatrix which commonly is permanent in after life, circular, somewhat depressed, dotted or indented with minute pits, and, in some instances, radiated. The above described local changes,

while in active progress, are attended by feverishness : first, from the fifth to the seventh day, so slightly that often the fact passes unobserved; and again more considerably during those days when the areola is about at its height; the infant now being restless and hot, with more or less disturbance of stomach and bowels. About the same time, especially if the weather be hot, children of full habit not unfrequently show on the extremities, and less copiously on the trunk, a lichenous, roseolar, or vesicular eruption, which commonly continues for about a week. When vaccination is performed on such adults or adolescents as have not previously been vaccinated, and likewise when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the preceding description, are somewhat retarded in their course; and the areola is apt to be much more diffuse. There is also more feverishness; but eruption is less frequently seen."

(B.) "When persons who have once been efficiently vaccinated are, some years afterwards, re-vaccinated with effective lymph, there sometimes result vesicles which, as regards their course and that of the attendant areolæ, cannot be distinguished from the perfect results of primary vaccination. But far more usually the results are more or less modified by the influence of such previous vaccination. Often no true vesicles form, but merely papular elevations surrounded by areolæ ; and these results, having attained their maximum on or before the fifth day, afterwards quickly decline. Or if vesicles form, their shape is apt to vary from that of the regular vesicle, and their course to be more rapid; so that their maturity is reached on or before the sixth day, their areolæ decline on or before the eighth day, and their scabbing begins correspondingly early. In either case the areolæ tend to diffuse themselves more widely and less regularly, and with more affection of the cellular membrane, than in primary vaccination; and the local changes are accompanied by much itching, often by some irritation of the axillary glands, and in some cases on the fourth or fifth day by considerable febrile disturbance."

(2.) Regulations relative to Public Vaccination, issued Feb. 18, 1868.

I.—*Places and Times for Vaccination under Contract.*

1. Except where the Privy Council, for reasons brought to its notice, sees fit in regard of any particular District to sanction a system of domiciliary Vaccination, every Vaccination-District shall have in it at least one public Station appointed for the performance of the Vaccinations under Contract; and where any such Station has been provided for a District, no person resident within two miles thereof, and not being an inmate of the workhouse, shall be vaccinated under Contract elsewhere than at such Station, unless the Vaccinator in the particular case be of opinion (which, if so, he is hereby required to note in his Register) that, for some special reason, the person whom he purposes to vaccinate cannot properly be vaccinated at the Station.

2. Except under special authorization from the Privy Council as aforesaid, or in so far as may be expedient at times when there is immediate danger of Small-pox, Vaccination under Contract shall not be appointed to be performed at any station oftener than once a week.

3. And in any future contract concerning a Vaccination-District which is partly or wholly within a town, there shall not, except under special authorization as aforesaid, be appointed within the town more than a single Station for the performance of the Vaccinations of the District.

II.—*Vaccination Districts in Towns.*

No part of the Metropolis, or of any city, or municipal borough, or town corporate, or other town, shall, in respect of any future Contract, form by itself, or with any rural place, a separate District for Vaccination, except with the approval of the Privy Council, unless it contain an estimated population of at least 25,000 persons, or else be as much of the Metropolis, city, borough, or town, as is for purposes of Vaccination under the control of one Board of Guardians.

III.—*Office of Public Vaccinator.*

After the expiration of the month of June next, no two or more persons shall be allowed to act severally as Vaccinators under Contract in any one and the same part or district of any union or parish.

IV.—*Re-Vaccination.*

The performance of Re-Vaccination by the Public Vaccinator on persons applying to him for that purpose shall be limited in each case by the following conditions :—(1) That, so far as the Public Vaccinator can ascertain, the applicant has attained the age of 15 years, or, if during any immediate danger of Small-pox, the age of 12 years, and has not before been successfully re-vaccinated ; and (2) that, in the Public Vaccinator's judgment, the proposed Re-Vaccination is not for any sufficient medical reason undesirable ; and (3) that the Public Vaccinator can afford Vaccine Lymph for the purpose without in any degree postponing the claims which are made on him for the performance of Primary Vaccination in his District.

(3.) MEMORANDUM ON THE SUB-DIVISION OF PUBLIC VACCINATION, AS AFFECTING THE SUPPLY OF LYMPH, ISSUED IN 1859.

There is reason to believe that the performance of Public Vaccination in England is disadvantageously affected by its present extreme sub-division.

For the satisfactory working of a public vaccinating-station, it is requisite that systematically on each vaccinating day two groups of cases should assemble there ;—on the one hand infants, who, having been vaccinated on the day-week preceding, are now (as the law requires) brought back for inspection, and are ready to furnish the Vaccinator with lymph for his present proceedings ;—on the other hand infants brought for vaccination, who, if now vaccinated, will on the day-week following be brought back for inspection,

and then in their turn contribute lymph for the benefit of further applicants. By the coming together of these two groups of cases, the Vaccinator is enabled to vaccinate from arm to arm ; a mode of proceeding which (as a rule) is of great importance to his success.

It is also requisite that each group of cases should not be too restricted in number. The careful Vaccinator does not indifferently vaccinate from the arms of all infants brought back on the eighth day, but exercises selection among them ; and facility for this selection cannot be afforded him, unless there be on each vaccinating day an average return of several vaccinated cases. If his share of the local vaccination be either too small or too much sub-divided among different stations and different days, the cases returning to him for eighth-day inspection will on many vaccinating days be too few for his purpose. On all such occasions, he must either omit to vaccinate those who apply to him, or (unless he have recourse to less eligible sources) must vaccinate them with preserved lymph, and incur the much greater chances of failure which belong to the usual modes of thus vaccinating.

Ill-frequented vaccinating-stations (stations, that is to say, where the total number of vaccinations, as compared with the number of vaccinating-days, is too small for the local lymph-supply to be continuously and properly maintained) are now a very prominent feature in our system of public vaccination. And this state of things is one of serious consequence ; not only as implying that at present a large proportion of the vaccinations in England are performed under disadvantageous circumstances ; but also because, if it continue, the general lymph-supply of England can scarcely fail to become insufficient or deteriorated.

The excessive sub-division which leads to this result arises in various ways. Sometimes, no doubt, the quantity of vaccination to be performed within one jurisdiction has been divided among too many performers. But still oftener it is the case, that individual Vaccinators have distributed their respective shares of the public duty among too many

stations, or too many vaccinating-days ; and in some cases the Vaccinator develops the inconvenience to its greatest extent by almost or entirely disusing the appointed station, and habitually performing his vaccinations under contract at the several private dwellings of his patients ;—a mode of proceeding, which in thinly-populated rural districts may be convenient and even necessary, but which in town-districts can never be necessary, and scarcely ever can fail to be disadvantageous.

It cannot be questioned but that Local Authorities, in adopting the arrangements here animadverted on, have been actuated by the very laudable intention of giving the utmost possible facility to persons desirous of being vaccinated. To any one who has not studied the subject, it naturally appears that the greatest facilities for vaccination must be given by the largest number of stations, and the largest number of surgical attendances there ; whereas in fact (from circumstances which have been here explained) any multiplication of attendances beyond a certain point can only give spurious facilities for its purpose ; and public vaccination in a district may often be difficult or inefficient, merely because the stations are too numerous or the attendances at them too frequent.

The inconveniences adverted to are not altogether removable. In rural districts, from obvious and unavoidable causes, it never can be as easy as in populous towns to maintain effective vaccination at one common centre ; and in many of such districts the Medical Officer exercises a wise discretion in vaccinating, as opportunities offer, at the scattered dwellings of his patients. Again, in instances where small-pox breaks out among a population which presents considerable illegal arrears of vaccination, the emergency, while it lasts, requires exceptional arrangements.

Exception being made of these, and perhaps other special cases, it seems certain that the Public Vaccination of England would be greatly improved by judicious consolidation of its present too diffuse arrangements. And to effect this object, it seems desirable that Guardians and Overseers,

where there is no special reason to the contrary, should regulate the details of their respective contracts in uniformity with the following General Rules :—

1. That, except at times when there is immediate danger of small-pox, vaccination be not appointed to be performed at any station oftener than once a week ;
2. That, except at times when there is immediate danger of small-pox, or for special reason in individual cases, vaccination in town-districts (unless it be of private patients) be performed only at the public station ;
3. That, as opportunity offers, especially in Urban Unions and Parishes, all unnecessary sub-division of public vaccination among many districts or stations be discontinued ; and that in populous towns, unless under special circumstances, sub-division be not made beyond the point where each vaccinating-station will have annually at least 500 applicants for vaccination.

(4.) EXTRACTS FROM A LETTER FROM THE LORDS OF THE COUNCIL, ADDRESSED TO THE POOR LAW BOARD, DATED DECEMBER 7TH, 1867, ON THE VACCINATION ACT 1867, AND COMMUNICATED BY THE POOR LAW BOARD TO THE RESPECTIVE BOARDS OF GUARDIANS IN THEIR CIRCULAR LETTER ON THE ACT, DEC. 31, 1867.

I. It seems in their Lordships' opinion important, first of all, to impress very distinctly upon the Guardians that now, under Section 27 of the Act, they are bound to ascertain at stated intervals whether the Act has or has not been complied with by the parents, &c. of children whose births have been registered within the Union, and, in cases of neglect, to take such steps as shall ensure compliance.

For this purpose, as will be seen, lists of persons presumed to be in default are to be delivered half-yearly to the Guardians by the Registrars of the respective districts in the first week of January and first week of July in each year. The first of these lists will be due in July next ; and Guardians

ought to consider in the meanwhile how the requirements of the Act as to dealing with such lists may best be carried out. It appears to their Lordships that in any district it will be difficult, and in any populous district impossible, for Guardians to give full effect to the intention of the Legislature, unless they appoint a paid officer or officers to make the requisite inquiries, and to take such further proceedings as the statute requires. The services of such an officer are desirable, moreover, and in fact almost indispensable, for giving proper effect to Section 31. For in most districts there will be found, in larger or smaller numbers, unvaccinated children whose births have escaped registration, unvaccinated children who have come in from other districts, and (for some time to come) unvaccinated children born before this Act comes into operation ; and the duties of a Vaccination Officer will apply to all these cases. He ought to find them out, to give notice to the parent, &c. requiring the vaccination to be done within a certain period, and to take such further course as may be required to give effect to the Section.

My Lords further think that if the Act is to succeed fully according to its intention, every officer appointed as above should be instructed to keep himself constantly informed of the progress of vaccination in his district as compared with the local birth registers. If this were systematically done, and if the practice were adopted of sending a notice of default to every parent as soon as the default arose, few cases would remain to be reported half-yearly to the Local Authority. It is evident that a Registrar of Births has, from the nature of that appointment, peculiar facilities for acting as Vaccination Officer to the Guardians. But, of course, in certain cases there may be reasons why this appointment should not be made. And for cases where the Vaccination Officer of the Guardians is not the Registrar of Births, it is to be remembered that under Section 24 of the Act the Vaccination Officer, as such, has access to the Registrar's Vaccination Book.

The instructions of the Vaccination Officer should have

special reference to any proceedings that may be necessary for carrying into effect Clause 17 [regarding Inspection of results in each case of Vaccination].

II.—Next, as regards the Local Arrangements for Vaccination :—

(*a.*) By Sections 2 and 3 the Guardians of any Union may be required to revise the present divisions of their respective Unions, and to consolidate or otherwise alter existing districts. The class of Unions that will be chiefly affected by these sections are Urban Unions, at present so sub-divided as injuriously to affect the performance of public vaccination ; and my Lords presume that local arrangements will have now to be brought into conformity with the principles laid down in the memorandum issued by the Council Office On Sub-division of Vaccination :"—

1. That, except at times when there is immediate danger of small-pox, Vaccination be not appointed to be performed at any station oftener than once a week ;
2. That, except at times when there is immediate danger of small-pox, or for special reason in individual cases, Vaccination in town districts (unless it be of private patients) be performed only at the public station ;
3. That, as opportunity offers, especially in Urban Unions and Parishes, all unnecessary sub-division of public Vaccination among many districts or stations be discontinued ; and that in populous towns, unless under special circumstances, sub-division be not made beyond the point where each Vaccinating station will have annually at least 500 applicants for Vaccination.

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(*b.*) The intention of the Act (Sections 3 and 11) is to have for each Vaccinating district one responsible Public Vaccinator. This arrangement is at present the usual one ; and in cases where it does not yet prevail, the Guardians ought at once to consider the expediency of determining the present

contracts, and of making new contracts to the effect intended by the present law.

* * * * * * *

(*c.*) The duties which devolve upon Public Vaccinators under the contracts will no doubt be defined by the contracts; but here again, with particular reference to the attendances specified in the schedules, my Lords hope that the Guardians will not be permitted to overlook the rules essential for the proper performance of vaccination.

1. Vaccination should not be appointed to be performed at any station oftener than once a week.

* * * * * * *

2. Where, as in rural and wide-spread districts, provision has to be made for attendance at more than one station in a district, it is only at the principal station that a weekly attendance should be given, and the attendances at the other or subsidiary stations should be for a certain number of consecutive weeks at two or three stated seasons of the year; and
3. Where the population of the district is so sparse that there is not a resident Public Vaccinator, the Poor Law Board will, my Lords presume, sanction an arrangement (under Clause 12) for attendances at fixed periods of the year only. An essential condition of success of a Vaccination station is that the attendances shall be in fair proportion to the number of children likely to be brought annually to the station for Vaccination.

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In addition to the reasons advanced there is another why the schedules should be revised. The new law is very stringent in requiring the attendance of parents; and it is of the utmost importance that the attendances of the Vaccinators, in conformity with the announcements made to parents, should be punctually given. To effect this, my Lords are of opinion that the attendances to be fixed in contracts should be such as Vaccinators can reasonably be expected to adhere to.

C.

EXTRACTS FROM THE CIRCULAR LETTER OF THE REGISTRAR-GENERAL TO THE RESPECTIVE DISTRICT-REGISTRARS (1ST NOVEMBER, 1867), ON THE VACCINATION ACT 1867.

THE Registrar-General, after giving a short abstract of the Act, so far as it relates to the duties of Registrars, thus proceeds :—

The following explanatory remarks are intended for your further information and guidance in carrying into effect the provisions of some of the Sections above quoted.

1. The times and places for Public Vaccination which you will be required to insert on each Notice of Vaccination (Sched. A), are the times and places appointed for the *Vaccination District* in which the child resides, and these places may or may not be within your Sub-District. If you are not already in possession of the requisite information respecting them, you should obtain such information before January 1st, 1868, from the Board of Guardians. Any *changes* of arrangement made subsequently to that date by the Guardians are required to be publicly notified.

2. Your registration of Successful Vaccinations will be of the CHILDREN BORN IN YOUR SUB-DISTRICT ONLY, except in the particular cases in which the parent or person responsible for sending you the Certificate does not know where the birth was registered ; or when the birth has not been registered at all. It may sometimes happen, however, that through carelessness or inadvertence a Certificate will be brought or sent to you which ought to have been delivered to some other Registrar. Whenever this is the case, you

should forward the Certificate, or direct the parent or other person to forward it, to the Registrar to whom it ought in the first instance to have been sent.

3. In presenting your quarterly accounts for payment, you will have to produce your Register of Successful Vaccinations with the Certificates to show that the entries have been correctly made. And the Registrar-General will direct his Inspectors from time to time to examine these books, to see that they are properly and correctly kept.

4. The lists which you will have to submit half-yearly to the Board of Guardians will have regard to children the Certificates of whose Successful Vaccination have not been *duly* received by you during the preceding half-year, and will be made from your "Register of Successful Vaccinations." As three months from birth are allowed for the vaccination of a child, and three weeks more for the transmission of the Certificate, the Registrar-General is of opinion that no child under four months old should be included in the half-yearly list. Therefore, your first list, presentable in the first week of July 1868, should contain the names of those children only who were born in the preceding January and February whose Certificates of Successful Vaccination had not been forwarded to you; the list presented in January 1869, of the children born March to August 1868, inclusive; and so on. In districts which may hereafter come under Clause 12, even a longer period from birth may elapse before the Certificate becomes due: the essential point is to include in each list those names only respecting which the Certificate ought, at the time of making out the list, to have come into your possession. Any of these children whose deaths you may have registered before the period for sending in the lists would of course be omitted, the word "dead" being put against their names in the columns appointed for the entry of Successful Vaccinations in your Vaccination Register.

5. By Sect. 33 you are empowered to take summary proceedings against Public Vaccinators, Parents, or others who neglect to transmit to you the Certificates which the Act requires; but as this neglect will often arise from mere

inadvertence, you will probably, as a general rule, deem it right, before instituting proceedings, to intimate, verbally or otherwise, to the defaulter the neglect that has taken place, and to proceed in those cases only in which the intimation is disregarded.

* * * * * * *

The Registrar-General has directed me to take this opportunity to impress upon you the necessity of your *never* failing, after registering a birth, to deliver to the parent, &c., the Vaccination Notice with the forms B, C, and D annexed —*taking care to insert your Name and Address in the Notice* (*Sched. A*) *and on the endorsement or postal direction of the Certificate of Successful Vaccination* (*Form D*)—and to remind you, that on ascertaining that the parent or other person is unable to read, it will be incumbent upon you, before delivering the Notice, to make such parent, &c., *verbally* acquainted with the requirements of the Vaccination Law, and the penalty which is attached to their non-fulfilment.

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