HISTORY AND PRACTICE

OF

VACCINATION.

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TO THE RIGHT HON. THE PRESIDENT OF THE GENERAL BOARD OF HEALTH.

SIR,

YOU have desired me to lay before you, to the best of my judgment, such medical facts and considerations as will assist you in estimating the hygienic value of Vaccination, and the strength of any objections which have been alleged against its general adoption.

Accordingly, I have now the honour of bringing to your notice, as an Appendix to this Letter, a mass of material which will, I believe, justify conclusions on the very important subject to which they relate.

That appended material is as follows:— Enumeration of appended documents.

A. The evidence which, in 1802, was given by Dr. Jenner before a Committee of the House of Commons appointed to consider his claims to a public reward;

B. The Report subsequently made by the said Committee;

C. A Report which, in reference to certain assertions made in disparagement of Vaccination, was issued, in 1806, by the medical council of a "Royal Jennerian Society," then existing;

D. A Report on Vaccination which, in 1807, at His Majesty's command, was made by the Royal College of Physicians of London;

E. A paper extracted from the Transactions for 1852 of the Royal Medical and Chirurgical Society of London, and entitled "On the Protection against Small-pox afforded by Vaccination, illustrated by the Returns of the Army, Navy, and Royal Military Asylum," by T. Graham Balfour, M.D., Surgeon to the Royal Military Asylum, Chelsea;

F. A paper extracted from the Transactions for 1853 of the same Society, and entitled "An Analytical Examination of all the Cases admitted, during Sixteen Years, at the Small-pox and Vaccination Hospital, London, with a view to illustrate the Pathology of Small-pox, and the protective influence of Vaccination, in degrees varying according as the Vaccination has been perfectly or imperfectly performed," by J. F. Marson, Esq., Resident Surgeon to the Hospital;

G. The Petition of Mr. Marson to the House of Commons, in 1856.

H. A communication from Dr. Greenhow, Lecturer on Public Health at St. Thomas's Hospital, in reference to the present death-rates of London, at different ages and from different diseases, as compared with the corresponding death-rates at the end of the 17th and in the middle of the 18th century;

J. A long succession of Answers to certain Questions which, with a view to my present object, have been circulated among distinguished members of the medical profession, extensively in the United Kingdom, and partially in France and Germany;

K. Information communicated by the several Governments of France, Austria, Prussia, Sweden and Norway, Denmark, Portugal, Bavaria, Baden, and Wirtemberg, and by certain of our own Public Departments; stating, in reply to similar Questions, what has been the public experience of Vaccination in each country addressed.

As prefatory to these documents, I am instructed to submit to you my own reflexions on the subject; and in proceeding to this task, I believe I shall best fulfil your object by discussing, in turn, each of the following questions:—

Heads of proposed inquiry.

(I.) What kind of an evil was small-pox before vaccination arose to resist it?

(II.) What facts and arguments led to the first sanction of vaccination, and to what sort of inquiry were they subjected?

(III.) What further knowledge, at the end of half a century's experience, has been gathered on the protective powers of vaccination?

(IV.) What evils have been shewn to attend its practice, and to counterbalance its alleged advantages?

(V.) How far are there realized, in this country, those benefits which can reasonably be expected from the general use of vaccination?

I.—Small-pox before the Discovery of Vaccination.

You will not, I trust, think it irrelevant that I begin by referring to the history of small-pox. To the civilised classes of society, it has now almost ceased to be a fatal disease; and among them, accordingly, there is a temptation to forget how their fathers and grandfathers regarded it. Hence, in the middle of the 19th century, the very success of vaccination may have blinded people to its importance. It is so easy to be bold against an absent danger—to despise the antidote while one has no painful experience of the bane.

Dangers of natural small-pox.

Yet indeed, apart from historical records, our present daily experience of the nature of the disease might almost enable us to construct a description of the course which it has run. To know of it, that it is *fatal to a very large proportion of those whom it attacks;* that it is *eminently infectious from person to person;* and that it *seizes, with very few exceptions, on all who for the first time come within its range;*—this, if one reflects on it, is almost to have read the story of its ravages; and their details may be conjectured.

Among remote populations.

To remote or insular populations, having infrequent and difficult intercourse with the busier masses of mankind, such an infection would come seldom; but, having come, it would find, perhaps, the entire generation prone to receive it. There might have been no previous visitation within living memory. None of the population would have earned exemption by having suffered in a former epidemic. The disease, under such circumstances, must have ravaged more fiercely than the most ruthless of human wars: its effects on mankind must have been comparable to that obliteration of vegetable life which ensues when the army of locusts, descending on

pastures and vineyards, and sweeping onward with fatal procession, converts into the likeness of a desert what just before was all freshness and fertility.

In every country, probably, its first invasion has been of this kind; and its recurrences, when far apart, have been of equal malignity. Thus it was that in 1518, following European adventure to the Western world, it concurred with fire and sword and famine and bloodhounds to complete the depopulation of St. Domingo;* thus, that soon afterwards, in Mexico, it even surpassed the cruelties of conquest, suddenly smiting down 3½ millions of population and leaving none to bury them;† thus, that in Brazil, in the year 1563, it extirpated whole races of men; thus, that about the same period, in the single province of Quito (according to de la Condamine) it destroyed upwards of 100,000 Indians. And thus, too, it has been in later days that Siberia and Kamschatka‡ have been ravaged; thus, that again and again, till very recent times, the same dreadful pestilence has depopulated Greenland

* "Variolarum morbilli eis ignoti hactenus . . . qui tanquam morbosas "pecudes contagioso halitu eos invaserunt." (Pet. Mart. Angler. de Orbe Novo, decad. iv. c. 10.)—Not six and twenty years had passed since the island (then containing a million of Indians) had been discovered by Columbus, who received from the inhabitants an amount of kindness and hospitality which touched him to the heart, and whose language, in describing them, gives singular pathos to the thought of their then impending misery and extinction.—Comp. Helps's "Spanish Conquest in America," I. 124.

† "*No habia quien los enterrasse*" are words which Mr. Prescott quotes from Sahagun's History. Mr. Prescott ("Conquest of Mexico," v. 6) describes this terrible epidemic as "sweeping over the land like fire over the prairies, smiting "down prince and peasant, . . . leaving its path strewn with the dead bodies of "the natives, who (in the strong language of a contemporary) perished in heaps "like cattle stricken with the murrain." Dr. Stricker (Oppenheim's Zeitschr., vol. xxxiv.) gives information about several later epidemics in Mexico. He states that in 1779 its ravages were dreadful; that it then occasioned in the capital alone nearly 9,000 deaths out of nearly 39,000 attacks; and that in 1797 again it caused in the city 4,451 deaths out of 24,516 attacks. With these records he contrasts what has happened since the introduction of vaccination; that in 1829–30, when small-pox was most severely epidemic, vaccination was almost always protective; and that in 1830–1 there died in New Leon 1,740 persons, without a single vaccinated person contracting the infection.

‡ Pallas (Reisen, St. Petersb., 1770) makes mention more than once of the small-pox in Siberia; and in reference especially to the Ostjaks (Vol. iii. p. 50) describes it as the chief obstacle to an increase of their population. Captain Cook (Voyage to the Pacific Ocean, Lond. 1785, p. 365) speaks of the small-pox at its first appearance (1767) in Kamschatka as "marking its progress with ravages not less dreadful than the plague, and seeming to threaten "their entire extirpation."

and Iceland.* Before the terror of its presence, communities literally dissolved themselves;† and the well-known description of the plague at Athens does not convey more dreadful images of human suffering than may be gathered from the writings of those travellers‡ who, even to the latest times,

* A subjoined official communication from Denmark (App. p. 173) gives interesting particulars of various visitations which have befallen Iceland and Greenland. As late as 1734, Greenland suffered its first epidemic of small-pox, when nearly two-thirds of the inhabitants were swept away. In Iceland the disease had been known from much earlier times; but, in its eighteenth visitation (1707) it is said to have destroyed 18,000 persons out of a population of about 50,000. In Crantz's History of Greenland (London 1767, i. 335-7) may be read terrible details of the epidemic just adverted to: "Empty depopulated "houses and unburied corpses, some within and some without the houses," are described; and "in one island they found only one girl with the small-pox upon "her, and her three little brothers; the father, having first buried all the people "in the place, had laid himself and his smallest sick child in a grave raised "with stone, and ordered the girl to cover him." Sir George Mackenzie (Travels in Iceland, Edin. 1811, p. 409) referring to small-pox in Iceland, says, "its ravages have been such as to render this disease important even in the "political history of the island."

† It is said (Ring, Treatise on Cowpox, p. 994) that after such a dispersion the capital of Tibet once remained for three years without inhabitants. The same author (p. 604) describes that about the end of last century a tribe of Esquimaux on the Labrador coast was put to flight by the outbreaking of small-pox, and did not venture to return for three years; when their country had "become a desert without a living soul in it, but they found the skeletons of "500 persons who had fallen victims to that horrible disease." Incidents of this kind may be found abundantly mentioned by travellers to whom I have referred, and Dr. Mead (Works, p. 311) describes the Hottentots on a particular occasion as drawing lines of defence against any communication with the sick, and shooting all who attempted to pass.

‡ Striking accounts of its ravages among the North American Indians, in very recent times, may be gathered from Catlin's "Letters and Notes on the "Manners, Customs, and Condition of the North American Indians" (Lond. 1841) as especially at vol. i. pp. 6, 80, 99, 213; vol. ii. pp. 24–5, 43–4, 161, 238, 255; and App. A. At the first-mentioned of these passages, Mr. Catlin observes, "Thirty millions of white men are now scuffling for the goods and "luxuries of life over the bones and ashes of twelve millions of red men, six "millions of whom have fallen victims to the small pox, and the remainder to "the sword, the bayonet, or whiskey." And in another place (ii. 255) he adds, "I would venture the assertion, from books that I have searched and from other "evidence, that of the numerous tribes which have already disappeared, and of "those that have been traded with, quite to the Rocky Mountains, each one has "had this exotic disease in their turn, and in a few months have lost one half "or more of their numbers." Washington Irving's "Astoria" also makes mention of recent dreadful outbreaks, in which "almost entire tribes" have been destroyed; and I subjoin from a third source some details which both confirm and illustrate the above. *See Note* I., p. 304: Ravages of Smallpox among American Indians.

have witnessed the power of natural small-pox against remote unprotected populations.

In civilized countries.

While such was small-pox in the less travelled parts of the world, it seems certain that in civilized Europe, with its constant intercourse of towns and countries, the disease was at least as deadly. Its strength, indeed, was differently distributed. Not—as in Greenland—only twice or thrice in a century, but with one incessant process, that fatal sickle was ever in motion, and the increments of harvest were from day to day. Instead of coming after long absence on masses of population entirely unprotected against the infection, the disease recurred in each place so frequently that, for the most part, at any given moment, a more or less considerable majority of the inhabitants would have faced the danger before. They would have obtained against its attacks that protective exemption which was generally the good fortune of survivors. But it is a moderate computation, that for every five persons thus, at the price of much past suffering, almost secured against the disease, one at least must have died. The annual ravages of small-pox in Europe* alone, have been estimated at half a million of lives. M. De la Condamine†

* Dimsdale, who went to St. Petersburg to inoculate the Empress Catherine, talks (Tracts, St. Petersb. p. 119) loosely, and probably with exaggeration, of *two millions* as the annual mortality of the Russian empire from small-pox; and he mentions that on one occasion, going in search of virus to a village where small-pox had been prevailing, he found that of 37 patients all but 2 had died. Clarke (Travels) speaks of the small-pox mortality of China as "incalculable." Maitland, the first English inoculator, says of natural small-pox in the Levant that in some years it is "a kind of plague that sweeps away at least a third of "those who are seized with it." And Holwell (Account of Manner of Inoculating for the Small-pox in the East Indies, London, 1767, p. 4) gave the following description of its ravages in Bengal:—"Every seventh year, with scarcely any "exception, the small-pox rages epidemically in these provinces during the "months of March, April, and May, and sometimes until the annual returning "rains about the middle of June put a stop to its fury. On these periodical "returns (to four of which I have been a witness) the disease proves universally "of the most malignant confluent kind, from which few, either of the natives or "Europeans, escaped that took the distemper in the natural way, commonly "dying on the first, second, or third day of the eruption. . . . The usual "resource of the Europeans is to fly from the settlements and retire into the "country before the return of the small-pox season."

† Mémoire sur l'Inoculation de la Petite Vérole, 1754; or English edition (with additions from the author) by Dr. Maty, 1755. De la Condamine, estimated that small-pox "destroys, maims, or disfigures the fourth part of mankind."

reckoned that in France a tenth of the deaths were by small-pox; Rosen's estimate of Sweden was to the same effect. For our English experience, there exist only imperfect records; but it seems that, within the London Bills of Mortality, small-pox, when not at its worst, averaged a fourteenth* of the annual total of deaths; a fourteenth, too, at times when that total, as compared with the population, represented perhaps double our present death-rate.

Illustrated in royal families.

For a popular notion of the disease, it may be enough to cite what it did in royal families.† In the circle of William the Third, for instance: his father and mother died of it, and, not least, Mary, his wife; also his uncle, the Duke of Gloucester; also his cousins, the eldest son and the youngest daughter of James the Second; while he himself (like his friend Bentinck) had suffered from it most severely, barely surviving, with a constitution damaged for life.‡ Again, in the Court of Austria: "Joseph the First (says Vehse) was "carried off, when not more than thirty-three years of age, "by the small-pox; to which in the course of the eighteenth "century, besides him, two empresses, six archdukes and "archduchesses, an elector of Saxony, and the last Elector "of Bavaria, fell victims."§ To this list might have been

Williams (Elements of Medicine, I., p. 202) quotes the French Minister of the Interior as estimating (Report on Vacc. 1811) the former annual mortality by small-pox to have been 150,000 persons. Others (comp. Ring op. cit. 700) state it at a very much smaller though still enormous amount.

* See Dr. Jurin's "Letter containing a Comparison between the Mortality of the natural Small-pox and that given by Inoculation," Lond. 1723. His estimate is formed on the Bills of Mortality of the forty-two years 1667–86 and 1701–22; the intermediate years 1687–1700 being left out because in them measles and small-pox were not distinguished.

† Extensive fatality of any particular disease in single families can of course rarely be known, except where the house is of historical importance; but the same sort of thing must have been frequent in all classes of society. In one of Horace Walpole's letters (April 2, 1750) we read—"Lord Dalkeith is dead of the "small-pox in three days. It is so dreadfully fatal in his family, that, besides "several uncles and aunts, his eldest boy died of it last year; and his only "brother, who was ill but two days, putrefied so fast that his limbs fell off as "they lifted the body into the coffin."

‡ Burnet says of him:—"He was always asthmatical, and the dregs of the "small-pox falling on his lungs, he had a constant deep cough."

§ There were two words which Prince Kaunitz would not allow to be uttered in his presence: "Death" was one, "Small-pox" was the other.

added, no doubt, many other names; among them, for instance, a dauphin (1711) and a king (1774) of France, a queen (1741) of Sweden, and an emperor (1727) of Russia. It would be thought an awful epidemic now-a-days, that should strike like this in high places.

Mutilation and subsequent ill-health of many who were not killed.

Yet the ravages of small-pox are not half enumerated in the list of the myriads whom it killed. From the earliest to the latest medical records of the disease, there is constant mention of the tax which it levied upon survivors.* Among those who outlive it (says De la Condamine) many either totally or partly lose their sight or hearing; many are left consumptive, weakly, sickly, or maimed; many are disfigured for life by horrid scars, and become shocking objects to those who approach them. Another learned writer of the same period, after describing these frequent sequels of the disease, says that its very nature is one *quæ nullâ furcâ sese expelli patitur, sed usque recurrit.*† Sir Gilbert Blane‡ at a later period quoted a Report of the Hospital for the Indigent Blind, to the effect that two-thirds of those who applied there for relief had lost their sight by small-pox. Worst of all were these ill effects in persons already of feeble, especially of scrofulous constitutions. Nothing (says Dr. Gregory) developes that tendency more certainly than protracted small-pox.§

* De la Condamine, op. cit. p. 57. "As sequelæ of small-pox Dr. Willan "enumerates glandular swellings, ulcers (often gangrenous) about the thighs, "scrotum, and knees, puffy tumours of the soft parts, enlargement of the "bones, stiffness of the joints, ophthalmia, deafness, cough, dyspnœa, diarrhœa, "anasarca, hydrothorax."—Williams, loc. cit.

† Tralles, de Insitione Variolarum, 1765, p. 159, who begins his account by saying:—"Ab illo ævo quo innotuére variolæ ad hunc diem myriades exem-"plorum prostitêre, tristium vestigiorum que in corpore humano omnibusque "ejus partibus illæ post se reliquerunt."

‡ Medico-Chirurg. Transact., vol. x., p. 326. Similarly, Dr. Gregory writes that a large proportion of the blind have been found to owe their misfortune to the secondary fever of small-pox.

§ "Accordingly, in scrofulous constitutions we see secondary fever com-"plicated with strumous ophthalmia, characterized . . . . by obstinate resistance "to every kind of remedial treatment. Irritable ulcers form under the lower "eyelid, and around the knee, ankle, and elbow joints, and are found very "difficult to heal. Glandular enlargements of the neck take place which some-"times suppurate, but oftener continue indolent and of stony hardness. Children "frequently suffer from otitis." Gregory, op. cit. p. 741.—"On parle de quelques "individus scrofuleux dont l'état s'est amélioré sensiblement à la suite de la "variole; mais nous avons rarement eu l'occasion de vérifier ce fait à l'Hôpital "des Enfans. Une circonstance qui nous a, au contraire, frappée, c'est que les "affections scrofuleuses graves et la phthisie pulmonaire reçoivent ordinairement "de la variole une impression défavorable: presque toujours alors leur marche "est accélerée, et leur terminaison funeste suit de près."—Guersant et Blache, Dict. de Méd., art. *Variole.* See also to the same effect, Rayer, Maladies de la Peau, tome i., p. 522; and Lugol, sur les Causes des Maladies Scrofuleuses, p. 220. It deserves notice that Jenner, in his first publications, laid great stress on these, then notorious, after-effects of small-pox.

Habitual fears of the disease.

It is scarcely needful to say, of the disease I have described, that it was among all civilized nations a constant source of terror. Each time that the contagion was re-introduced to a place, all who had not been touched in previous visitations (including especially such children as had been born in the interval) might expect to become subjects of attack. Accident in individual cases might delay this dangerous moment, but for nearly all it was only delay.* Of persons not prematurely cut off by other diseases, in the long run very few escaped this infection.† Seventy years of age were no security; and for such as were disposed to triumph at the end of an epidemic which had spared them, there was often quoted the old saw, *Nemo ante obitum beatus.* Thus at every rumour of the disease, men might tremble for the valuable lives of others‡ or for their own; and that horror of the

* Mr. Cross, in his account of the variolous epidemic in Norwich (p. 15), says—"In several instances I have met with severe small-pox in adults who had "at various times, both in Norwich and in London, resisted the intimate and "continued exposure to the contagion of that disease, and who supposed, with "some appearance of reason, that they should for ever be free from it." And he subjoins the following anecdote, derived from one of the Suttons, who are mentioned in it:—"A man who believed himself to have had the small-pox lived "for *twelve years* as nurse in the establishment for the reception of inoculated "patients which the Suttons had near Norwich, continually waiting upon the "patients who were undergoing the disease; and at the end of that time he "caught the small-pox, of which he died."

† "All mankind, with few exceptions, are susceptible of the variolous poison "at some period of their lives . . . . . A few persons pass through a long life "apparently insensible to or insusceptible of the small-pox virus. It is a curious "and important circumstance, that, so far as is yet known, such constitutions "exhibit a like inaptitude to receive and nourish the vaccine disease."—Gregory, in Cyclop. Pract. Medicine, iii. 744.

‡ E. g. "The small-pox raged this winter (1694–5) about London, some "thousands dying of them, which gave us great apprehension with regard "to the Queen, *for she had never had them.* In conclusion she was taken "ill . . . . ."—Burnet's History.

living patient, which so loathsome an infliction occasioned, became, when death had ended his sufferings, a very panic towards his corpse.*

Commencement of 18th century.

Perhaps at no previous moment of English history had the horror of small-pox been greater or more fully justified than at the beginning of the last century.

Inoculation of small-pox.

And now for the first time there came to us a story that we could, so to speak, make terms with this loathsome and murderous enemy; that, by receiving it of our own accord, we could disarm it; that we could (as it was expressed) "buy "the small-pox" cheap; that the susceptibility to contract its fatal infection could be exhausted by artificial means, giving, indeed, the disease, but giving it so mildly, that life was almost unendangered in the process.

This, indeed, was substantially the fact; and 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; so that a person exposed to this artificial infection very generally contracts the disease in its mildest and most tractable form.†

Introduction of the practice in England.

This practice, subsequently known in England as inoculation for the small-pox, seems to have been followed for ages

* Witness Saint Simon's account of the Grand Dauphin's death:—"La "Vallière fut le seul des courtisans qui, ne l'ayant point abandonné pendant "sa vie, ne l'abandonna point après sa mort. Il eut peine à trouver quelqu'un "pour aller chercher des Capucins pour venir prier Dieu auprès du corps." Or Besenval's description how, on a different occasion, when Louis XV. had been huddled into his coffin, "quelques prêtres, dans la chapelle ardente, furent les "seules victimes condamnées à ne pas abandonner les restes d'un roi qui .... &c."

† Moore's Hist. of Small-pox, p. 218 et seq.; also communications by Timoni and Pylarini in the Philosoph. Transactions, Nos. 339 and 347; also Kennedy's Essay on External Remedies, 1715; and Maitland's Account of Inoculating the Small pox, 1722. In Kennedy's work, p. 157, mention is made of "some parts "of the Highlands of Scotland, where they infect their children by rubbing "them with a kindly pock, as they term it;" and the attractive estimate given of such inoculated small-pox is, that "it need be no more minded than as in "giving or taking the itch."

in the East. Not only, it is said, had the Chinese since the sixth century been accustomed to procure, by special means of their own, an artificial infection of the disease; but the Brahmins from remote antiquity had practised the very operation which was now to be discussed in England. The practice is stated also to have been in vogue in Persia, Armenia, and Georgia, and to have spread as a popular custom, not only about the shores of the Mediterranean, but even to those of the Baltic, to Scotland, and still less accountably to Wales. It was not thus, however, that the discovery first became notorious in England, but in the years 1714–1716 communications on the subject were published in London by members of the medical profession who had witnessed in Constantinople and Smyrna the great success of the practice; and in 1717 Lady Mary Wortley Montague's well-known letter (xxxi.) from Adrianople effectually awakened the public curiosity. Yet by her example, even more convincingly than by her pen, did Lady Mary introduce the knowledge of inoculation; for while still resident in Turkey she shewed her faith in it by submitting her son to the operation; and four years afterwards, having meanwhile returned to London, she had the first demonstration of the Eastern practice made here, almost publicly, on her daughter. The result being most satisfactory, others were soon encouraged to repeat the experiment; and in 1722 (after a preliminary experiment on seven condemned criminals) the critical course was taken of inoculating two children of the royal family.

From this time the inoculation of small-pox possessed a recognized though not an uncontested place in medical practice.

Objections raised against its use.

Not uncontested, for innumerable absurd objections were raised, which much interfered with its general adoption. It was said to be wicked and irreligious, and to savour strongly of magic, to promote vice and immorality, and to be an inspiration of the devil.* It was said to instil a vicious

* See Massey's Sermon against the dangerous and sinful Practice of Inoculation, Lond. 1722, where, *inter alia*, it is written—"Let the atheist and the "scoffer, the heathen and the unbeliever . . . inoculate and be inoculated." This author regards natural small-pox as an useful check on "the encrease of

humour without establishing an issue for its discharge; still worse, to be the means of introducing syphilitic and other infections into the body, and of exciting scrofula and consumption. Inoculating surgeons (it was urged) ought to be cut off, as poisoners, from the professional community.

Besides all this nonsense, there were objections, exaggerated but not unfounded, against a practice which sometimes occasioned death to the subject of the operation. It could not be denied that the worst possible forms of small-pox did sometimes, though rarely, ensue on this proceeding. Thus, in the first eight years there were inoculated in England only 845 persons, of whom seventeen had died; and in Boston, United States, there had been an equal amount of failure among the earlier experiments. It might not unreasonably be urged that this was a large risk to incur in the pursuit of a somewhat uncertain good; for, said the objectors, there is no absolute security given by it against subsequent attacks of small-pox.* But as improvements were progressively made in the methods of managing inoculated persons, the dangers from the operation greatly diminished; and Mr. Moore probably over-estimates the deaths which would follow the operation under the most favourable circumstances when he says, that "after the last improvement in treatment "had been established, probably not more than one in two hundred were lost."†

"vice and immorality," and thinks men have good reason to be grateful for it as among "the wholesome severities ordained for offenders." Among the numerous objections subsequently raised against inoculation in France, especially by Monsier Hecquet, it was urged that it came from Turkey, and had been well received in a Protestant country.

* It is remarkable that, at the moment of introducing inoculation to England, this objection was mentioned as one which had currency in the East. Kennedy (op. cit. p. 155) says—"The greatest objection commonly proposed is, whether "or not it hinders the patient from being infected a second time." He adds, that in such cases of re-infection the second attack is "rarely or never in the "same manner, or the same fulness of malignity . . . it generally proves to "be that commonly called the bastard or hog-pox, which is empty or skinny, "and very little matter or malignity contained in it."

† History of Small-pox, p. 302. De la Condamine says (p. 20) that "out of "6,398 persons inoculated in England, but 17 are suspected to have died of the "consequences of the operation, which is only one in 376." Dr. Maty, the learned friend and translator of Condamine, remarks on this passage: "I can't "help thinking M. la Condamine's proportion full large, and I am inclined, after "a mature examination of all the facts that are come to my knowledge, to reduce "it to that of one in a hundred." Among 5,964 individuals inoculated at the Small-pox Hospital in the years 1797–9, there were only nine deaths (Watson ii., 733). Gregory, loc. cit., p. 749, says: "the average number of deaths at the "Inoculation Hospital was only three in a thousand." The National Vaccine Board (see Reports 1825 and 1837) speaks decidedly of "one in 300" as the proportion of the inoculated that "will surely die" from the operation,

* "Argumenta quæ contra hanc variolas inserendi consuetudinem in principio "afferebantur, experientiam repellisse . . . . . eamque humano generi valde "salutarem esse se existimare."—Taylor, Orat. Harv., 1855.

The advantages of this alternative, as compared with that of encountering the risks of natural small-pox, were well set before the public by Dr. Jurin and Dr. Mead in England, by M. De la Condamine in France, and by others. The superstitions and prejudices respecting the practice were contended against by many able impartial persons. In 1746 an hospital was established for inoculating the poor, and for receiving them when affected with small-pox; and in 1754 the Royal College of Physicians of London pronounced its authoritative sanction of what was now no longer a speculative novelty.* Its advantages.

Many difficulties remained. "Inoculation," says Mr. Moore, "had become a very serious affair; for the preparatory "treatment lasted commonly a month, and medical attendance was requisite for five or six weeks longer; and, "though occasional disasters were palliated, they could not "be wholly concealed. Families in moderate circumstances "and timid mothers were not therefore very easily induced "to incur the expense and risk of such a process. Consequently, the practice of inoculation, though widely diffused, "was in a great measure confined to the opulent. .... It "appeared from a calculation made by Professor Monro in "1765, that between five and six thousand persons had been "inoculated in the whole of Scotland in thirty-one years,... "and the fatal cases amounted to one in seventy-eight. "Nothing, therefore, could be more vain than the expectations of those who imagined that such a system could be "universally adopted." Its disadvantages.

Yet, subsequently, as improvements were made, under which its adoption implied far less cost of time, convenience, money, and life; and as the public became aware of these

improvements, great impulse was given to the progress of inoculation; and this progress, as regards the masses of society, was made at least more rapid, if not more sure, by the competition of quacks, who promised for it a hundredfold what it could perform.

Its tendency to diffuse the infection of small-pox, and to cause an increased mortality.

But now at length it was that people began to see, in its full force, the one real and almost insuperable objection to variolous inoculation. For the inoculated themselves it was indeed an immense gain. By passing through the artificial disorder, they apparently became as safe against any recurrence of the infection as if they had suffered from it in the natural way; and they attained this result at a fiftieth part of the risk which would have attended the natural disease. They had no reason to complain.

But, meanwhile, what was the state of the remaining millions of the population of England? A principal point of improvement in the treatment of the inoculated was, wherever their strength allowed, to send them abroad into the open air; and as small-pox in its inoculated variety was not less infectious than in its natural form, the result may be imagined. Especially in the metropolis it could be observed; for here, under the influence of those doctrines which (so far as concerned the primary patients alone) made the chief improvements in treatment, inoculated persons were allowed to become incessant sources of general contagion. Even the Governors of the Small-pox Hospital (says Mr. Moore) broke through their original prudent regulations;* whoever applied at their gates were inoculated, and suffered to wander through the city of London covered with pustules and exhaling infectious vapour. The consequences of this system were, at the end of the century, admirably reviewed by Dr. Heberden, in a section of his well-known work;† and as this book is one of simple medical research, written with no controversial object, it will be well to consider his estimate of the case.

Dr. Heberden's estimate of this evil.

* The Small-pox Hospital (says Dr. Williams, p. 199) was much too small to effect its object, since it could only receive fifteen persons at a time.

† On the Increase and Decrease of different Diseases, and particularly of the Plague. By Wm. Heberden, junr. 1801.

"The inoculation of the small-pox having been first used
" in England since the beginning of the eighteenth century,
" and having been now for many years generally adopted
" by all the middle and higher orders of society, it becomes
" an interesting inquiry to observe, from a review of the last
" hundred years, what have been the effects of so great an
" innovation upon the mortality occasioned by that disease.
" But however beneficial inoculation prove to individuals, or
" indeed to the nation at large, the Bills of Mortality incon-
" testably shew, that in London more persons have died of
" the small-pox since the introduction of that practice. The
" poor, who have little care of preserving their lives beyond
" the getting their daily bread, make a very large part of
" mankind. Their prejudices are strong, and not easily
" overcome by reason. Hence, while the inoculation of the
" wealthy keeps up a perpetural source of infection, many
" others, who either cannot afford or do not choose to adopt
" the same method, are continually exposed to the distem-
" per. And the danger is still increased by the inconsiderate
" manner in which it has lately been the custom to send
" into the open air persons in every stage of the disease,
" without any regard to the safety of their neighbours. It
" is by these means that, while inoculation may justly be
" esteemed one of the greatest improvements ever introduced
" into the medical art, it occasions many to fall a sacrifice
" to what has obtained the distinction of the *natural* disease.
" This must always be an objection against making any
" great city the place for inoculation, until the practice is
" become universal amongst all ranks of people. Out of
" every thousand deaths in the Bills of Mortality, the num-
" ber attributed to the small-pox during the first thirty
" years of the eighteenth century, before inoculation could
" yet have had any effect upon them, amounted to seventy-
" four. During an equal number of years at the end of the
" century, they amounted to ninety-five. So that, as far
" as we are enabled to judge from hence, they would appear
" to have increased in a proportion of above five to four."

Of the objections thus suggested to variolous inoculation— of the objections to it, at least, as a system for general

This objection almost insuperable.

adoption—I have ventured to say that they were almost insuperable. In theory, at first sight, it might seem otherwise. *If* all persons would but adopt that method, no one could suffer from another; the inoculated might then wander freely in fields and streets, or sit in theatres and omnibuses, finding no un-inoculated whom they could poison. But that *if* covers unattainable contingencies.

Putting aside for the moment all question of the strong and stupid prejudices against inoculation which still operated on multitudes of people; putting aside, also, the immoveable apathy and indifference of still larger numbers whom nothing will ever incite to precautions which look three days forward; putting aside, further, the reasonable fears entertained of an expedient under which two, or three, or four, or five, or ten in every thousand subjects were sure to die; and starting with an imaginary population neither prejudiced, nor apathetic, nor timorous, the inoculators themselves demurred against universal inoculation.* There were conditions of age and conditions of health, under which, even by them, it was thought unsafe to operate. Thus, even assuming an unanimous willingness of the world to adopt inoculation, there must inevitably remain against it this twofold objection:—first, that it would directly destroy a certain, though small, proportion of those submitted to its performance; and secondly, that to the very considerable number of persons, temporarily or permanently ineligible for the operation, it would occasion a greatly increased danger of contracting the natural disease.

State of the case sixty years ago.

And in practice (as may be inferred from Dr. Heberden's remarks) this objection was more fatal than in theory. Inoculation, despite its advantages to individual life, was becoming a serious evil to society. An admirable and till then unrivalled invention; it could only be worked at an intolerable cost of life.†

* See Dimsdale's Present Method of Inoculating for the Small-pox, 1779, pp. 9, 12, 13, 21; also De la Condamine, op. cit. pp. 17, 18, 45; also Mead, who implies the same sort of thing when he argues (op. cit. p. 344) that "the "venom is communicated to a young, healthy, and, for the age, strong body."

† From the commencement of inoculation this objection had been made to it on theoretical grounds, but had confused itself with the less reasonable arguments of that period. In France its validity had been recognised; and after a severe epidemic small-pox, which prevailed in Paris in 1763, and was ascribed to an increased infection from the practice of inoculation, this practice was prohibited in the capital, so that (says Mr. Moore) "those who wished to be inoculated "were under the necessity of retiring to the country, where they might reap the "advantage of this operation, without destroying their neighbours." See also De la Condamine, op. cit.

* Moore's History of Small-pox, p. 299.

Mr. Moore's estimate of the success of medicine against small-pox down to the end of the 18th century.

The historian of small-pox, looking back from this point of view on the labours which during twelve centuries had been made to mitigate its ravages, comes to a mournful conclusion on their value:—"The confession that must be made is "mortifying to a professional man, for, according to such "records as we possess, it appears that in spite of all medical "exertion, the mortality of small-pox had progressively "augmented. It has been made evident by calculations "from the Bills of Mortality of the City of London, "renowned for medical science, that at the beginning of "the eighteenth century about one fourteenth of the in-"habitants died of the small-pox, and during the last thirty "years of that century, when the practice in small-pox "was highly improved, the mortality by this disease had "augmented to one tenth....But this immense and in-"creasing consumption of human lives was not the sole "evil produced by this distemper; for a considerable por-"tion of the survivors were pitted and disfigured; some "lost one of their eyes, a few became totally blind, and "others had their constitution impaired, and predisposed "to a variety of complaints, which were productive of "future distress, and sometimes of death. These addi-"tional calamities cannot be reduced to calculation; but "as the mortality from small pox was continually on "the increase, these concomitant evils must have been so "likewise."*

Against the substantial justice of this painful criticism, so far as I am aware, no objection can be raised. Medicine baffled and helpless! For after times—for millions of our race—the continued raging of that pitiless plague. A drearier picture could scarcely have saddened mankind.

That this despair was not lasting is due to the genius of an English surgeon; and the close of the eighteenth century, which had much to darken it, will be remembered till the end of human history for the greatest physical good ever yet given by science to the world.

II.—The Early History of Vaccination.

Popular tradition on the efficacy of accidental cow-pox.

Among the dairy-folks of Gloucestershire there was a curious tradition, that a certain pustular eruption occasionally observed on the teats of cows, and supposed to be engendered in them by contagion from the grease of horses, might extend its infection to the human subject; and that persons who had suffered from this *Cow-Pox*, as it was called, were by it rendered insusceptible of small-pox.

Jenner.

Words to this effect were once spoken in the hearing of Edward Jenner, then a village doctor's apprentice in the neighbourhood of Bristol. They were never afterwards absent from his mind. Thirty years elapsed before their fruit was borne to the public; but incessantly he thought, and watched, and experimented on the subject; and the work in which at length he recorded the incomparable results of his labour may well have commanded the confidence of reflecting persons.

His first publication.

Little would ever be heard of objections to vaccination, if all who undertake the responsibility of its performance, and all who feel disposed to resist its adoption, would but thoroughly study that masterpiece of medical induction, and imitate the patience and caution and modesty with which Jenner laid the foundations of every statement he advanced.

The protective influence of cow-pox established;

In the first *Inquiry into the Causes and Effects of the Variolæ Vaccinæ* (1798) Jenner set on a scientific basis the popular belief to which I have referred. He cited in detail many instances of persons who, having at earlier periods of life accidentally contracted an infection from cows or horses, had afterwards shown themselves insusceptible of human small-pox;—instances, where the protective contagion had reached the hands of milkwomen, stable-boys, and the like;

where, for twenty, thirty, even fifty years afterwards, its consequences had survived; where the system, even at these distances of time, remained absolutely proof against all attempts to infect it with small-pox, either by inoculation or by the breathing of an infected atmosphere. He further showed by experiment (Case 19) that persons desirous of acquiring this protective influence needed not wait for some accidental infection; they could imitate the manœuvre of small-pox inoculation, and, on any occasion when the cattle of the neighbourhood might be suffering, could let the vaccine infection be surgically transferred to themselves from the cow.

and its inoculability from the cow.

Necessity for this demonstration.

If this had been the limit of Jenner's discovery he would, indeed, have made an interesting contribution to pathological science. For the popular belief which first excited his mind was by no means generally or firmly established, even in the counties where it originated. There were plenty of alleged instances, where cow-pox had failed to afford the imputed protection. The subject was obscured by many sources of fallacy; and nothing less than elaborate and skilful inquiry could have effected the important demonstration.

Partial anticipations of Jenner's practice.

Up to this limit, however, his merits—though very great and original—were not exclusive. No one else, indeed, had come to the subject with the insight of genius; no one else had surmised what immense human interests were involved in that gossip of cowhouses; no one else had seen through the fallacies which made it contradictory and incredible. Still the tradition which had so moved him was not special to his one neighbourhood.* Common (as afterwards appeared) to sundry cow-keeping districts, it had floated past many other ears than Jenner's, and as early as 1769 had been paragraphed in a Göttingen newspaper. In parts of Holstein,

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* [That it had prevailed also in our county of Buckingham is stated in an interesting little handbill which I have lately read, issued in 1806 by a then curate of Leckhampstead and Akeley, the Rev. J. T. A. Reed, who mentions that in 1800, when he sought to introduce Jenner's operation among the people of his neighbourhood, they were very generally ready to accept it, and, in doing so, commonly told him—"We all know nobody ever died of the cowpock, and we all know that nobody ever had the small-pox after it, but what an odd thing that anybody should think of inoculating with it."—J. S., 1887.]

too, the protective influence of cow-pox had been so thoroughly recognised that, on more than one occasion, its infection had been artificially conveyed to the human subject; and especially Plett, a village schoolmaster, near Kiel, had thus in 1791, inoculated from the cow three children who, three years afterwards, when small-pox prevailed severely in their family, were found to be proof against infection.*

Propagability of cow-pox from person to person.

But this was not the limit of Jenner's achievement. Happily for mankind, his thoughts had from the first stretched further forward in the subject; and it was his transcendent merit to show how that apparently local privilege of the Gloucestershire cowherds might be diffused for the blessing of nations. When (in March, 1780) he first disclosed to an intimate friend the magnitude of what was in his mind, and communicated the theory he had formed on the protective influence of vaccine lymph, he "declared his "full and perfect confidence that it might be continued in "perpetuity by inoculation from one human being to another "in the same way that the small-pox was." And now, in his first publication, he announced what, for practical purposes, may be regarded as the fulfilment of that prediction. In a succession of cases he had conducted the lymph to a fifth generation from its source; and the child vaccinated last in the series had been proved by the test of variolous inoculation, to be no less safe against small-pox than another to whom had been given a first infection from the cow.

Setting aside for the present the question whether this transmission of the vaccine influence from person to person can really and practically be "continued in perpetuity," it may be sufficient to observe, that (1) its transmissibility through at least many successive human bodies, and (2) the large multiplication of lymph which, by the production of new vesicles, occurs at each stage of such transmission, were established fully and solely by Jenner's researches. These

* I borrow this statement from an interesting Lecture by Prof. Hasse, entitled "*Die Menschenblattern und die Kuhpockenimpfung*," Leipzic, 1852: who refers for it to Choulant's *Life of Jenner*. In Mr. Cline's note-book referred to below (p. xiii., foot-note) I find an entry, apparently made in 1780, that "some "enquiries and experiments ought to be made relative to the cow-pox."

are the all-important conditions, under which alone the discovered virtues of cow-pox could be useful for public protection.

Sources of fallacy to be guarded against.

Jenner had now detailed twenty-three cases in which, by vaccination, accidental or experimental, the human system had been rendered, for periods ranging up to 53 years, insusceptible of small-pox inoculation. He had reasonably accounted to himself for the so called exceptions in the great pathological law which his cases illustrate; exceptions only in appearance; but which had precluded that law from early and general recognition. He had learned that not every eruption on the cow is the specific cow-pox; and that —even from cow-pox—not all inoculation is protective. The disease might be mistaken, or the lymph be spoilt. He had cautioned persons who would repeat his experiments against these sources of fallacy, "lest the want of discrimi-"nation should occasion an idea of security which might "prove delusive."

Barring such sources of fallacy, he asserted "that the "cow-pox protects the human constitution from the in-"fection of small-pox;" and that, by an appropriate procedure—henceforth to be named VACCINATION, this protective influence may be indefinitely communicated and multiplied among mankind.

VACCINATION.

Its first performance in London.*

These conclusions were at once accepted, as proven or probable, by persons of judgment and authority in the medical profession. Mr. Cline, then the great teacher of surgery at St. Thomas's Hospital, was, at Jenner's request, the first to verify them by experiment*; and early in 1799 Dr. Woodville, of the Small-pox Hospital, with the co-operation of Mr. Pearson, commenced a great series of public vaccinations in London.

* Both in Rose's Biographical Dictionary (art. Jenner) and in Gregory's Lectures on the Eruptive Fevers (p. 187) I read that the first verification of Jenner's discovery was made in *St. Thomas's Hospital*. As an alumnus of that school, I have wished to make sure of that statement; but neither in Mr. Cline's private case-book, in which his first vaccination is described, nor in Jenner's notice of the experiment (op. cit. p. 128), can I find any mention of the *place* where it was performed; and the name of the patient (Richard Weller) is not to be found in the hospital-register of the period.

Universal corroboration of Jenner's statements.

In these early days of the discovery, almost every case of vaccination was made a test of the alleged protection. Dr. Jenner, writing in 1801, says, "upwards of 6,000 persons "have now been inoculated with the virus of cow-pox, 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;" and Dr. Woodville (giving public evidence in 1802) said that, within two years (1799–1801) there were vaccinated at the Small-pox Hospital 7,500 persons, of whom about one half were subsequently inoculated with small-pox matter, and in none of them did small-pox produce any effect. Other observers, too, had contributed numerous instances of persons who, having accidentally contracted infection from the cow, were found, many years afterwards, capable of resisting all attempts to infect them by inoculation of small-pox.

Conclusiveness of these facts;

These facts told their own story, and they tell it still. They were in themselves sufficient argument; for Jenner's simple truthful style carried conviction. No one candidly studying them (in the first publication and in its supplements of the next two years) could, even at that time, reasonably doubt that, *subject to certain qualifications*, there was now given to society an almost absolute power to control the ravages of small-pox.

under certain qualifications.

Subject, I say, to certain qualifications; for it was not yet proved or tested that infants vaccinated by Jenner's process would permanently enjoy the same complete protection which he had shown to exist in persons who at riper age had contracted accidental cow-pox by their own manipulation of infected cattle; neither was it beyond question whether perhaps the vaccine influence might become progressively though slowly enfeebled by an indefinite length of human transmission. Time, and long time alone, would decide whether these would be over-fastidious doubts; but if, indeed, Jenner did undervalue their remote interest (almost invisible clouds, as they were, in the distance) it may, at least, be said that envy and malice have found no other weakness in his case.

Scientific meaning of cow-pox.

It was not till forty years afterwards that science supplied an authentic interpretation of Jenner's wonderful discovery. He, indeed, had suspected the solution, and had hinted his meaning when he called cow-pox by the name of *variolæ vaccinæ*:—for such, in fact, it is—*the small pox of the cow.* It had been an old medical observation that cattle often suffered in the same epidemic with men; certain of their diseases had already (especially by Dr. Layard, in the Philosophical Transactions for 1780) been compared to the human small-pox; and Jenner (says his biographer) "always "considered small-pox and cow-pox as modifications of the "same distemper, so that in employing vaccine lymph we "only make use of means to impregnate the constitution "with the disease in its mildest, instead of propagating it "in its virulent and contagious form, as is done when small-"pox is inoculated."* Researches subsequent to Jenner's, and extending to within the last twenty years, have settled this part of the question.† It has been made matter of almost familiar experiment that the infection of small-pox may, by inoculation, be communicated from man to the cow; that its result is an eruption of vesicles presenting the physical characters of cow-pox; that the lymph from these vesicles, if implanted in the skin of the human subject, produces the ordinary local phenomena of vaccination; that the person so vaccinated diffuses no atmospheric infection; that the lymph generated by him may be transferred, with reproductive powers, to other unprotected persons; and that, on the conclusion of this artificial disorder, neither renewed vaccination, nor inoculation with small-pox, nor the closest contact and cohabitation with small-pox patients, will occasion him to betray any remnant of susceptibility to infection.

Recent researches: their results, and authors.

The merit of first putting on record these important facts does not belong to England. As early as 1801, Dr. Gassner of Günzburg—after ten unsuccessful trials of small-pox inoculation on cows—had at last succeeded in infecting one;

* Much interesting historical information on these points is compiled by Dr. Baron in his fifth chapter, vol. i., p. 162.

† *See Note* II., p. 305: Vaccinia as a modification of Small-pox.

and, with matter taken from the resulting vesicles of this animal, had inoculated four children; who thereupon had developed the ordinary phenomena of vaccination, furnishing vesicles from the lymph of which seventeen other children had been similarly infected. Dr. Gassner's discovery remained for forty years almost entirely unknown or unbelieved; but at length Dr. Thiele, of Kasan, repeated the experiment with equal success, and rendered it still more complete by supplying a necessary test of the nature of the process. He shewed, namely, that the lymph engendered in these experiments possessed, not only the local infectiousness, but likewise the protective powers of cow-pox; that persons recently inoculated with it might with impunity be let sleep in one bed with small-pox patients, or be inoculated with small-pox virus; that, in short, it was true, protective, vaccination which they had undergone. The result of these investigations was not published before the beginning of 1839;* at which time other experiments of the same kind, independent and equally conclusive, were being conducted in this country by Mr. Ceely, of Aylesbury; of whom I am glad to repeat the praise awarded him by the high authority of Dr. Robert Williams, that he "has done "more to advance the natural history of vaccination than "any other individual since the days of Jenner." Soon afterwards—and also by independent experiments—Mr. Badcock, a long established druggist of Brighton, arrived at the same conclusion as to the origin of cow-pox: and from 1840 to the present time he has constantly been applying his knowledge to its important practical purpose; having within this period again and again derived fresh stocks of vaccine lymph from cows artificially infected by him; having vaccinated with such lymph more than 14,000 persons; and having furnished supplies of it to more than 400 medical practitioners.

Theoretical interest of these observations.

These researches are mentioned out of their chronological order, because they set in so very clear a light the meaning of Jenner's practice. A host of theoretical objections to

* *See Note* II., p. 305 : Vaccinia as a modification of Small-pox.

vaccination might have been met, or indeed anticipated, if it could have been affirmed sixty years ago as it can be affirmed now:—"This new process of preventing small-pox is really "only carrying people through small-pox in a modified form. "The vaccinated are safe against small-pox, because they in "fact have had it. Their safety is of the same sort as if they "had been inoculated under the old process, or had been "infected by the natural disease. The trifling disorder which "they suffer—these few tender vesicles on the arm, this "slight feverishness that they shew—is small-pox of the "most mitigated kind; small-pox so modified by the inter-"mediate animal organization through which it has passed, "that, when thus re-introduced to the human body, it excites "but insignificant disturbance, and no general exhalation of "infective material."

The subject of vaccination first brought before Parliament.

Returning now to the early history of vaccination, we find that early in 1802 the subject was formally brought under cognizance of the Legislature. By this date Dr. Jenner's "correspondence had become so extensive as to occupy "almost all his time, and to make him a most laborious "servant of the public for their great and exclusive benefit, "whilst there was nothing of advantage left to himself but "the consciousness that he was so employed; and, under "these circumstances, it was thought that the magnitude of "his discovery and the very disinterested manner in which "he was sacrificing his time and his property in diffusing its "blessings, were fit subjects for the consideration of the "British Parliament."* On presentation of a petition to this effect, Mr. Addington, then Prime Minister, informed the House of Commons that he had taken the King's pleasure thereon, who strongly recommended it to the consideration of Parliament.

First Parliamentary Committee.

The Committee to which the petition was referred, "after "examining a number of witnesses of the highest character "and most extensive experience in the profession," reported in full corroboration of all that Jenner had alleged.

* Baron's Life of Jenner, p. 480.

Subjoined to this Letter is the evidence (App. A.) which Jenner gave before that Committee, and likewise (App. B.) the Committee's Report.*

Its Report.

Admiral Berkeley, the chairman of the Committee, in the speech with which he introduced the Report, made a statement which greatly added to its significance. "In the investigation of a matter so important to mankind in general, "it was not thought right by the Committee to confine their "examination to the petitioner's evidence alone, as is usually "the case, but to sift out any case which could make against "it. This conduct, which certainly may appear to bear hard "on the petitioner, has proved a matter of fresh triumph to "him; for although we descended to sift out information "from every anonymous letter—though we raked the very "kennels for information against this practice—all that we "were enabled to get is pointed out at full length in the "Report; and such were the explanations on those very "cases—such were the testimonies against that evidence—"that if Dr. Jenner's discovery could receive additional lustre "from this sort of inquiry, it certainly has done so. Upon "the beneficial effects of this discovery I hardly wish to "trouble the Committee (of Supply) as I am certain, if the "Report, which contains the scientific opinion of the first "medical men in this country, does not satisfy the House, "the united opinion of all the world, the homage of Europe, "which has been paid to the discoverer of this blessing, will "have its due weight on the minds of his countrymen."

First Jennerian Institution.

The verdict was not without its effect. At the close of this year steps were taken, with unprecedented strength of public support, to found by voluntary contributions a society "for the extermination of small-pox;" and on the 3rd of February, 1803, the great discoverer took his seat for the first time as President of the Royal Jennerian Institution. This society, "fostered by the most exalted patronage, and

* The Evidence at large, as laid before the House of Commons, respecting Dr. Jenner's Discovery of Vaccine Inoculation, together with the Debate which followed, and some Observations on the contravening Evidence, &c.; by the Rev. G. C. Jenner, 1805.

"adorned by all the learning and talent of the medical pro-"fession of the metropolis," took a very important part in diffusing the first advantages of vaccination. "Thirteen "stations were opened in different parts of the metropolis. "In eighteen months they were enabled to announce that "12,288 inoculations had taken place, and during the same "space of time 19,352 charges of vaccine virus were supplied "from the central house to most parts of the British empire, "and to foreign countries..... This society was also in "correspondence with other institutions, and its medical "council investigated with care and fidelity such cases of "small-pox as were alleged to have occurred after vacci-"nation."

Early prejudices against vaccination; compared with former prejudices against inoculation of small-pox.

It would have been claiming too much from reason, to expect that this progress could be made without opposition. Eighty years earlier the use of variolous inoculation—a thing of immemorial practice in eastern countries—could not be imported here by those who had witnessed its operation on thousands, without its introduction exciting theoretical (as well as rightly founded practical) objections. How much less, then, could Jenner find an easy reception for his method! It appealed to no national experience. It based itself only on some rustic traditions, and on his few thoughtful observations.

Prognostics.

Great allowance must indeed be made for those who then hesitated to accept this wonderful novelty. The very magnitude of the promised boon almost justified mistrust. And—to persons ignorant of the Gloucestershire experience—that good should accrue from such a source was a strange supposition. Fears were more suggested than hopes.* What could be expected from "a bestial humour" but new and dreadful diseases? Who could see the limit of its "consequences," physical or moral? What security was there against "horns" growing on the vaccinated? What "ideas might arise in the

* See especially "Treatise on Lues Bovilla, or Cow-pox" (3 editions) "Commentaries on Lues Bovilla, or Cow-pox" (3 editions) and "Cow-pox "Epistle to Rowland Hill" (7 editions) all by B. Moseley, M.D., Member of the Royal College of Physicians of London, and of the University of Leyden; likewise other works mentioned below.

" course of time from a brutal fever having excited its incon-
" gruous impressions" on the brain? Who knew but that
" the human character might undergo strange mutations from
" quadrupedan sympathy, and some modern Pasiphae rival
" the fables of old?"

and denunciations,

While these physiological conjectures were gravely pressed upon the public, religion and morality were not less misargued to the same effect.* Leviticus was quoted, with dark insinuations against "contaminating the form of the Creator " with the brute creation." Small-pox being a "merciful " provision on the part of Providence to lessen the burthen " of a poor man's family," was it not "impious and profane " to wrest out of the hands of the Almighty these divine " dispensations?" What could ensue, on so daring a measure of attempted prevention, but some unimagined punishment?

Reply to these various scruples (where they were sincere) was no difficult matter. Those who feared mysterious bodily changes were answered from the collection of observed facts and experiments; were assured that, in Berkeley, neither horns had grown nor Minotaurs been begotten. To the others—superstitious mistrusters of good—it seemed enough to say that, in this beneficent economy of the world, antidotes are ever scattered side by side with poisons; that not exclusively the latter are of divine gift; that man's duty concurs with his instinct and privilege, to struggle against physical as against moral evil.

and inventions.

Up to a certain point, the weaker side in a controversy is apt to grow noisier with defeat. In proportion as Jenner's merit became recognised by Parliament and the public, those who had committed themselves to opposition became more and more vehement against his matchless discovery. All that

* "Cow-pox Inoculation no Security against the Small-pox Infection," by W. Rowley, M.D., Member of the University of Oxford, and of the Roy. Coll. Physicians; "Serious Reasons for uniformly objecting to the Practice of " Vaccination," by John Birch, Surgeon to St. Thomas's Hospital. Over Mr. Birch's remains, within one of the City churches (Rood Lane), a monument erected by his sister commemorates, that "the Practice of Cow-poxing, which first became general in his day, Undaunted by the overwhelming influence of power and prejudice, And the voice of Nations, He uniformly and until Death (1815) perseveringly opposed."

had been predicted was now, they said, in fulfilment. The nation, unconsciously, was dying of vaccination. Terrible portents were described.* A child at Peckham had its former natural disposition absolutely changed to the brutal, so that it ran upon all fours like a beast, bellowing like a cow, and butting with its head like a bull! Sarah Burley's face was distorted, and began to resemble that of an ox! Master Joules, similarly degenerating, became the ox-faced boy—a proverb and a frontispiece! A lady's daughter coughed like a cow, and had grown hairy all over her body! William Ince, too, had grown patches of hair not resembling his own, but of the same colour, length, and quality as that of a cow! Many had suffered like him! Some also squinted as only oxen can squint! Others had lost their nails and the ends of their fingers! Eruptions, ulcers, mange, abscesses, scabs and blotches, glandular tumours and diseased joints and decaying bones, fevers and blindness, and gangrene and convulsions, were multiplying among the victims of Jenner! Deaths, as every one could see, were plentiful. And on what but vaccination could they depend? It was the old story again:—

Post ignem æthereâ domo
Subductum, macies et nova febrium
Terris incubuit cohors;
Semotique prius tarda necessitas
Lethi corripuit gradum.

Such was the experience of the opposition. Divested of its more ludicrous imaginations, and some allowance being made for an occasional unskilfulness of those who pretended to vaccinate, all resolves itself into the one not uncommon error, of confounding what is fact with what is opinion or inference.

Facts.

* "Dissertation on the Failure and Mischief of Cow-pox," and "Cow-pox " exploded," both by G. Lipscomb, Surgeon; "Observations on the Pernicious " Consequences of Cow-pox Inoculation" (3 editions) by R. Squirrell, M.D. The last-named author certainly did his utmost to produce the results which he predicted. Not content with being struck "with such horror and aversion that " he could not as a man of honour or feeling submit to or coincide with " vaccination," he recommended those who had already undergone the operation immediately to submit themselves to a course of treatment to "eradicate every " particle of the cow-pox virus out of the blood." His treatment was mercury. The consequences may be imagined. See also (contra) "Letters to Dr. Rowley " on his late Pamphlet" (with a frontispiece) by Aculeus; "The Vaccine " Contest," by William Blair; and "Treatise on Cow-pox," by John Ring.

A child coughed: to the ears of the vaccinophobist, the sound was as of a cow; to his intellect, it was the effect of vaccination. A child was ugly or squinting, or it had those skin eruptions which have always been frequent incidents of infancy: at once, to the alarmist, there was *vultus taurinus* or *tinea bovilla*. In a word, the oldest and most familiar diseases were thus re-named, in conformity with a belief that vaccination was causing them; while, in reality, there was no more reason in this belief, than if vaccination had been charged with occasioning infants to cut their teeth, or with leading boys to prefer cricket to Cornelius Nepos.

Last appeals.

As the chances of the opposition became less hopeful, so did their language grow worse and their arguments more wild.* Placards and caricatures were resorted to. Tender points were aimed at. Were persons about to marry—might not vaccination injure their fortune in life? Might there not be a disclosure of shocking facts? And was nothing due to patriotism? Evil and Buonaparte (1807) and Vaccination are allowed to triumph for a time, perhaps as the scourge and punishment of our sins:—but shall we submit because they have for awhile been prosperous? No! Britons never, never, &c.

* Rowley, op. cit.; also F. Smyth Stuart's "Letter on the Subject of Coercive "Vaccination," and "£30,000 for the Cow-pox." To this author's fancy vaccination was "a mighty and horrible monster with the horns of a bull, the "hind hoofs of a horse, the jaws of the kraken, the teeth and claws of a tyger, the "tail of a cow, all the evils of Pandora's box in his belly; plague, pestilence, "leprosy, purple blotches, fœtid ulcers, and filthy running sores covering his "body, and an atmosphere of accumulated disease, pain and death around him "which had made its appearance in the world and was devouring mankind—"especially poor helpless infants, not by scores only or hundreds or thousands, "but by hundreds of thousands." The author assists his description by an engraved caricature:—Dr. Jenner and other ministers of vaccination (distinguished from ordinary practitioners of medicine by the addition of cowtails and horns) are discharging large hampers of children into the mouth of the monster; while another (apparently Dr. Thornton) officiates behind with a spade, and shovels into a nightman's cart the undigested remains of this diet. From the distance are advancing to the rescue Drs. Moseley, Squirrel, and Rowley, with Messrs. Birch and Lipscombe, "the men, the heroes," to whom also an obelisk is erected in the right background. Perhaps it may have been in this unattractive guise that vaccination was first introduced to Philadelphia, where (see Baron's Life of Jenner, vol. i. p. 442) "the leading physician pronounces it too beastly "and indelicate for polished society."

Present interest in this obsolete literature.

You will find it difficult to believe that the very oldest of this nonsense, which I have transcribed, was written in England within sixty years of the present time. By us, for half a century, it has been forgotten; or only recalled as an echo by occasional last words from the continent, where, far off, there is seen sometimes a feeble wave still rippling from that old flood of ours. It is wearisome work to read stuff so stupid or so dishonest. But I have ventured to trouble you with it, as with some other parts of this narrative, in order that it may plainly be seen how little of suddenness or surprise there was in the first social successes of vaccination; how everything possible and impossible was affirmed against it; how all weaknesses and prejudices were appealed to; how every inch of progress was contested; and how little it can be said that Jenner stole a march on the public mind. Further—because there is nothing new under the sun, and the wheel of time brings back the follies of the past oftener than its wisdom, it may become necessary, in case these doctrines should emerge again from obscurity, to refer to their right authors the praises of original invention, and to remember that fifty years ago such objections were examined and refuted and condemned.

Public doubts.

For, when those outcries were raised, the public naturally hesitated, and asked for explanation. Moseley and Squirrell and Rowley and Birch and Lipscombe and even Stuart were, no less than Jenner, members of the medical profession. To the uninitiated, it was Doctor against Doctor.

Under these circumstances two inquiries were successively instituted.

Report of Royal Jennerian Institution.

First in 1805, "the medical council of the (then) Royal "Jennerian Institution, having been informed that various "cases had occurred which excited prejudices against vaccine "inoculation, and tended to check the progress of that im-"portant discovery in the kingdom, appointed a committee "of twenty-five of their members to inquire into the nature "and truth of such cases." The Report in which the council recorded the result of this inquiry, contains much which is as applicable to the present occasion as to the circumstances of that time. I therefore subjoin it (App. C.) for your con-

sideration; begging merely to observe, that among the members of this council and committee were not only surgeons and physicians of the largest practice and highest character in London, but especially some whom the profession of that day would have selected as the most competent persons in England to pronounce on the questions at issue. You will observe that minute inquiry was made, not only into allegations then current against the protective powers of vaccination, but also into "opinions and assertions which "charged the cow-pox with rendering patients liable to "particular diseases;" and that the council, after having detailed the results of this inquiry, "cannot conclude their "report upon a subject so highly important and interesting "to all classes of the community, without making this solemn "Declaration:—

"That in their opinion, founded on their own individual "experience, and the information which they have been "able to collect from others, mankind have already derived "great and incalculable benefit from the discovery of vac-"cination: and it is their full belief, that the sanguine "expectations of advantage, and security, which have been "formed from the inoculation of the cow-pox will be ulti-"mately and completely fulfilled."

Discussion in Parliament.

The second inquiry was even more critical. The then Chancellor of the Exchequer, (now Lord Lansdowne) asked the attention of the House of Commons (July 2, 1806) "to "a subject of general importance.... totally unconnected, "indeed, with all party principles.... but concerning the "welfare, health, and existence of a large portion of His "Majesty's subjects, and therefore well deserving of the "consideration and support of Parliament;.... that very "remarkable discovery.... a substitute for the loathsome "small-pox, an evil which has spread a dreadful desolation "throughout the whole world. He stated to the House "facts, derived from the experience of vaccination in (alas!) "other countries than England, illustrative of those advan-"tages to society which we were neglecting to realise. He "expressed a profound regret, that in this country alone, "in which the discovery had originated, the salutary practice

"of vaccine inoculation had been undergoing a retrograde "movement. He referred to the objections and to the "manner in which they had been promulgated; to pre-"judices which had been excited, and to their fatal effect "in bringing back nearly that average degree of depopu-"lation which had been experienced previous to the intro-"duction of the vaccine discovery. He had not the smallest "inclination to propose any compulsory measures,.... but "felt it a duty incumbent on him.... to submit a plan "by which the House should become possessed of a mass "of evidence as to the real merits of this discovery;.... "a procedure which would tend to enlighten the public, "by informing them in a formal and regular manner of "what appeared to be the truth,.... and would give this "valuable discovery the advantage of having all the weight "of promulgation which the high character and popularity "of Parliament is capable of. He concluded by moving that "an humble address be presented to His Majesty, praying "that he will be graciously pleased to direct His Royal "College of Physicians to inquire into the state of the "vaccine inoculation in the United Kingdom, and to report "their opinion as to the progress which it has made, and "the causes which have retarded its general adoption." Mr. Wilberforce (from the other side of the House) and Mr. Windham (then Secretary of State) with others, spoke at length and with great earnestness, in the same general sense as Lord Henry Petty; so the motion passed *nem. con.*

Report of Royal College of Physicians.

Nine months passed before the College of Physicians (April 1807) made its Report:—"Deeply impressed with "the importance of an inquiry which equally involves the "lives of individuals and the public prosperity, they had "made every exertion to investigate the subject fully and "impartially: In aid of the knowledge and experience of "the members of their own body, they had applied sepa-"rately to each of the Licentiates of the College; they had "corresponded with the College of Physicians of Dublin "and Edinburgh; with the College of Surgeons of London, "Edinburgh, and Dublin; they had called upon the Societies "established for vaccination for an account of their practice,

" to what extent it had been carried on, and what had been " the result of their experience; and they had by public " notice invited individuals to contribute whatever infor- " mation they had severally collected."

An inquiry of this nature and extent, conducted under a sufficient sense of responsibility by the first medical corporation of the kingdom, could not fail to deserve public confidence. Nearly every passage in the Report applies to the present juncture, as well as to the purpose for which it was written; and I subjoin the whole of it (Appendix D.) as recording by far the most important investigation to which Jenner's discovery has been submitted in the country of its birth. Having already quoted the words with which the Report opens, I will here also repeat the remarkable paragraphs which close it:—

" The College of Physicians feel it their duty strongly to " recommend the practice of vaccination. They have been " led to this conclusion by no preconceived opinion, but by " the most unbiassed judgment, formed from an irresistible " weight of evidence which has been laid before them. For, " when the number, the respectability, the disinterestedness, " and the extensive experience of its advocates is compared " with the feeble and imperfect testimonies of its few " opposers; and when it is considered that many, who were " once adverse to vaccination, have been convinced by " further trials, and are now to be ranked among its warmest " supporters, the truth seems to be established as firmly as " the nature of such a question admits; so that the College " of Physicians conceive that the public may reasonably look " forward with some degree of hope to the time when all " opposition shall cease, and the general concurrence of man- " kind shall at length be able to put an end to the ravages at " least, if not to the existence, of the small-pox.

The discussion exhausted.

With this Report terminates, for all practical purposes, the early history of vaccination in England. The result was of course brought (July 29, 1807) under notice of the House of Commons; and again, in such a debate as is seldom given to matters of concord, the foremost members of the House honoured themselves by honouring the great benefactor of

mankind. Henceforth, the public mind was apparently quite satisfied on the subject;* and from this period, I repeat, begins to date the almost universal vaccination of children of the educated classes in this country.

General assent of the medical profession.

The general assent of the Medical Profession dated from an earlier period, and soon became all but unanimous. An infinitely small amount of *bonâ fide* dissent probably continued; in reference to which I will only observe, that allowance must be made for two sorts of personal influence which tended, and perhaps still tend to occasion it.

Individual exceptions.

Even now among the living contemporaries of Jenner's discovery, there must be men whose fathers and friends and teachers of fifty years back denounced the new practice. Among such as remember the warmth of that contest, perhaps not all discriminate the error. The old allegiance of studentship binds, possibly, here and there a surviving follower of Birch. An hereditary admirer of small-pox inoculation, he may remember only its advantages as compared with the evils of natural small-pox; may forget the fatal objections to its general employment, and may still hesitate to replace that practice of his youth by the "speculative " novelty" of vaccination.

Also to a very small extent allowance must be made for personal eccentricities, which—in respect of vaccination, as of every other subject—have ever caused solitary voices to be raised against the common convictions of mankind. This influence can scarcely cease to operate. Occasionally, no doubt, till the end of time there will be found some lover of paradox, ready, in mere wantonness of authorship, to choose his text from Squirrell or Rowley, and to write dispraise of Jenner, as Cardan wrote his encomium on Nero.

* There always has been, and there always must be a kind of opposition to which my text does not refer, and against which it would be ridiculous to argue. What has sounded like a voice of dissent has sometimes been only the jingle of an advertising cart. What has looked like a conflict of opinion has sometimes been the mere hustling of pickpockets in the crowd. For quacks with their touters have often found it convenient to hitch themselves on to the skirts of a discussion in which the public has been interested; ready for any chance of reviling the science which condemns their wretched arts; but above all, eager to assure their dupes that, while vaccination is so worthless a precaution, life may be prolonged and youth made perpetual by one incomparable pill or elixir.

Subject only to these qualifications, it may be said, as regards England, that the convictions of the medical profession on this important matter were fixed fifty years ago. Even then, probably, they would have been expressed with the same sort of unanimity as prevails among the professors of any other department of knowledge, in respect of their most familiar and elementary teaching.

Whether my present inquiry has brought to light any subsequent divergence of opinion, is a question on which the evidence (App. E. to K.) is before you, and to which I shall presently return.

III.—Small-pox since the Use of Vaccination.

Evidence on the protectiveness of vaccination must now be statistical.

In the earlier days of Jenner's discovery the evidence which led men to adopt vaccination depended on a somewhat minute inquiry into individual cases. In thousands of instances (as I have already mentioned) the patient after being vaccinated, was deliberately tested by inoculation with small-pox matter; in other instances, chance supplied equivalent means of trial; and the results of these very numerous experiments were sufficiently uniform to convince the public judgment.

At present it may be reasonably claimed that the evidence shall be of a more comprehensive kind. From individual cases the appeal is to masses of national experience. Tested by half a century's trial on the millions of civilized Europe, what has vaccination achieved? Comparing the small-pox mortality of the last forty or fifty years with that of as many years in the last century, do we find a sensible difference? Has progress been made towards that final result which (App. A.) Jenner anticipated,—the annihilation of the most dreadful scourge of the human species?

Foreign information obtained by the Epidemiological Society.

In respect of certain countries, these questions are admirably answered in papers already before Parliament. Four or five years ago the Epidemiological Society of London appointed a committee of its members to conduct inquiries connected with small-pox and vaccination. The committee,

having obtained from foreign governments the communication of most important statistical facts as to the decline of small-pox, reported (inter alia) these results to the Society; and soon afterwards this valuable report, specially the work, I believe, of Dr. Seaton, honorary secretary to the committee, was ordered to be printed for presentation to both Houses of Parliament.

For reasons with which I need not trouble you, I neither quote at length the statistical tables of that Report, nor exactly follow their form; but, extracting from the foreign communications of its Appendix such particulars only as relate to population and small-pox, and distinguishing these into two periods, I obtain all requisite means for comparing the past and present ravages of the disease. On this plan the following table has been constructed; and in observing the last columns (calculated by Mr. Haile from the materials referred to) you will notice, side by side two series of facts:—1st, how many persons in each million of population annually died of small-pox before the use of vaccination; and 2ndly, how many persons in each million of population have annually died of small-pox since the use of vaccination. And lest these facts should appear a whit stronger or less strong than they really are, I have set in the other side of the table, opposite the name of each territory, a statement of what periods of time are referred to in the particular comparison.

Its results in tabular form.

The results are truly conclusive.

Contrast of periods before and after vaccination in Austria, Prussia, Sweden, and Copenhagen.

Compare, for instance, in the case of Sweden, the twenty-eight years before vaccination* with forty years soon afterwards:—during the earlier period there used to die of small-pox, out of each million of the Swedish population, 2,050

* The small-pox death-rate for this earlier period has been calculated from the numbers given in an important paper which we owe to the Swedish Board of Health. Before 1774, measles and small-pox were unfortunately not distinguished in the mortuary registers of the kingdom; so that the first section of the table must be read with allowance for this combination. During the period referred to in the text small-pox deaths were separately enumerated, and of course are alone counted in the estimate there given of the small-pox death-rates for 1774–1801 and 1810–50. The first successful vaccinations in Sweden were performed at the end of 1801, namely (in Malmö) November 23, and (in Stockholm) December 17. About 1810, the vaccinations were amounting to nearly a quarter of the number of births.

victims annually;—during the later period, out of each million of population, the small-pox deaths have annually averaged 158.

Or compare two periods in Westphalia: during the years 1776–80, the small-pox death-rate was 2,643: during the thirty-five years 1816–50, it was only 114.

Or taking together the three lines which belong to Bohemia, Moravia, and Austrian Silesia, you find that where formerly (1777–1806) there died 4,000, there now die 200.

Terms of Years respecting which Particulars are given.	Territory.	Approximate average Annual Death rate by Small-pox per Million of Living Population.	
		Before Introduction of Vaccination.	After Introduction of Vaccination.
1777–1806 and 1807–1850 -	Austria, Lower -	2,484	340
1777–1806 and 1807–1850 -	„ Upper & Salzburg	1,421	501
1777–1806 and 1807–1850 -	Styria - - -	1,052	446
1777–1806 and 1807–1850 -	Illyria - - -	518	244
1777–1806 and 1838–1850 -	Trieste - - -	14,046	182
1777–1803 and 1807–1850 -	Tyrol and Voralberg	911	170
1777–1806 and 1807–1850 -	Bohemia - - -	2,174	215
1777–1806 and 1807–1850 -	Moravia - - -	5,402	255
1777–1806 and 1807–1850 -	Silesia (Austrian) -	5,812	198
1777–1806 and 1807–1850 -	Gallicia - - -	1,194	676
1787–1806 and 1807–1850 -	Bukowina - -	3,527	516
1817–1850 -	Dalmatia - - -	—	86
1817–1850 -	Lombardy - -	—	87
1817–1850 -	Venice - - -	—	70
1831–1850 -	Military Frontier -	—	288
1776–1780 and 1810–1850 -	Prussia (East. Provs)	3,321	556
1780 and 1810–1850 -	Prussia (West. Provs)	2,272	356
1780 and 1816–1850 -	Posen - - -	1,911	743
1776–1780 and 1810–1850 -	Brandenburgh - -	2,181	181
1776–1780 and 1816–1850 -	Westphalia - -	2,643	114
1776–1780 and 1816–1850 -	Rhenish Provinces -	908	90
1781–1805 and 1810–1850 -	Berlin - - -	3,422	176
1776–1780 and 1816–1850 -	Saxony (Prussian) -	719	170
1780 and 1810–1850 -	Pomerania - -	1,774	130
1810–1850 -	Silesia (Prussian) -	—	310
1774–1801 and 1810–1850 -	Sweden - - -	2,050	158
1751–1800 and 1801–1850 -	Copenhagen - -	3,128	286

Or taking two metropolitan cities; you find that in Copenhagen, for the half century 1751–1800, the small-pox death-rate was 3,128, but for the next half century only 286; and still better in Berlin, where, for twenty-four years preceding the general use of vaccination, the small-pox death-rate had been 3,422, for forty years subsequently it has been only 176.

In other words, the fatality of small-pox in Copenhagen is but an eleventh of what it was; in Sweden little over a thirteenth; in Berlin and in large parts of Austria, but a twentieth; in Westphalia but a twenty-fifth. In the last-named instance, there now die of small-pox but four persons, where formerly there died a hundred.

Other national statistics are not sufficiently accurate for the purposes of an equally exact comparison.

From such information as exists it seems probable that the small-pox death-rate of London within the Bills of Mortality, during the eighteenth century, ranged from 3,000 to 5,000. During the ten years 1846–55, it was under 340.

Dr. Lettsom, in his evidence before the Parliamentary Committee of 1802, stated reasons for estimating the small-pox death-rate of England at about 3,000; and Dr. Blane's evidence was nearly to the same effect. Reference to the adjoining table (where the death-rates of other countries are given) and to subsequent tables (where the death-rate of London at different periods is minutely examined) leads me to believe that such an estimate by no means exaggerates our average losses before the discovery of vaccination. In contrast therewith I shall hereafter have occasion to show, that for the years 1841–53 the average small-pox death-rate of England and Wales was only 304; in 1854, only 149; in 1855, only 132.

Further exclusion of Small-pox in proportion as vaccination is general.

But even the later rates, reduced as they are, belong to a population of which some considerable section is unprotected; and it is easy to observe, that, in proportion as vaccination becomes more general among the given number of persons, so is the small-pox death-rate further lessened. Sufficient proofs are given by those public establishments—

army, navy, and schools—in which it is the rule to vaccinate on admission all unvaccinated subjects who do not show marks of previous small-pox. Thus, in an important paper, which I subjoin (App. E., reprinted from the *Transactions of the Medical and Chirurgical Society of London*) Dr. Balfour shows that the small-pox mortality of the British navy has not reached a third, nor that of the British army a fourth, of the London rate; and that in the experience of the Royal Military Asylum for 48 years (within which time 5,774 boys have been received for training) only four deaths by small-pox have occurred, and *these all in non-vaccinated boys* who were believed already to have suffered small-pox once before becoming inmates of the school. In two severe epidemics of small-pox which prevailed in Malta in the years 1830–1 and 1838–39, the death-rate of the general population was just twenty times the death-rate of the military population.* Other evidence of the same nature may be collected from materials in the Appendix, to which I shall hereafter more particularly refer.

A check.

It is a vast improvement which the above figures demonstrate. Yet, unequalled as have been already the benefits to mankind conferred by the discovery of vaccination, the gain would have been greater but for a disappointment, which I have now to mention.

Post-vaccinal small-pox.

In the early days of vaccination it was noticed that every now and then small-pox would attack a person said to have been vaccinated. Enemies used this fact with so much exaggeration and spiteful triumph that sober persons at first hardly gave it the attention it deserved. But though often vaunted in mere malice, it was in substance true, that vaccinated persons did not, even then, *invariably* resist small-pox. In the two reports (1806 and 1807) to which I have already referred, these exceptional failures were admitted in the following terms:—

Early illustrations.

First, (Rept. R. Jenn. Institution, seq. page 4):—

"That most of the cases which have been brought forward as "instances of the failure of vaccination to prevent the small-pox, "and which have been the subjects of public attention and conversa-

* Wunderlich's Handbuch der Pathologie u. Therapie, vol. iv. p. 207.

"tion, are either wholly unfounded or grossly misrepresented; that "many persons have been declared duly vaccinated, when the opera-"tion was performed in a very negligent and unskilful manner, and "when the inoculator did not afterwards see the patients, and there-"fore could not ascertain whether infection had taken place or not; "and that to this cause are certainly to be attributed many of the "cases adduced in proof of the inefficacy of the cow-pox: that some "cases have been brought before the Committee on which they could "form no decisive opinion, from the want of necessary information as "to the regularity of the preceding vaccination, or the reality of the "subsequent appearance of the small-pox: that it is admitted by the "Committee that a few cases have been brought before them, of "persons having the small-pox, who had apparently passed through "the cow-pox in a regular way: that cases, supported by evidence "equally strong, have been also 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: that in many cases in which the small-pox has occurred a "second time after inoculation or the natural disease, such recurrence "has been particularly severe and often fatal; whereas, when it has "appeared to occur after vaccination, the disease has generally been "so mild as to lose some of its characteristic marks, and even "sometimes to render its existence doubtful."

And, secondly, (Rept. Coll. Physicians, seq. page 7):—

"The security derived from vaccination against the small-pox, if "not absolutely perfect, is as nearly so as can perhaps be expected "from any human discovery; for among several hundred thousand "cases, with the results of which the College have been made "acquainted, the number of alleged failures has been surprisingly "small, so much so as to form certainly no reasonable objection to the "general adoption of vaccination; for it appears that there are not "nearly so many failures in a given number of vaccinated persons as "there are deaths in an equal number of persons inoculated for the "small-pox: nothing can more clearly demonstrate the superiority of "vaccination over the inoculation of the small-pox than this considera-"tion; and it is a most important fact, which has been confirmed in "the course of this inquiry, that in almost every case where the "small-pox has succeeded vaccination, whether by inoculation or by "casual infection, the disease has varied much from its ordinary "course; it has neither been the same in violence nor in the duration "of its symptoms, but has, with very few exceptions, been remark-"ably mild, as if the small-pox had been deprived, by the previous "vaccine disease, of all its usual malignity."

Increased numbers.

During the next twenty or thirty years the proportion of these puzzling cases was constantly on the increase, and in some epidemic seasons they presented a very alarming total.

Excessive anxiety;

Allowance might be made for many instances in which vaccination had evidently been performed without care or

knowledge; for some, in which spurious lymph had been used; for others, in which the immediate success of the operation had not been verified, and so forth; but, with all reasonable deduction from the aggregate, there still remained much to perplex and disappoint every honest observer. Injudicious friends of vaccination strove to disguise these facts; but there were still living some of their old antagonists who were not sorry to have another chance of victory; and happily there were also competent inquirers willing to look only for truth in the matter. And at no moment in the progress of Jenner's discovery had impartial investigation been more needed than now; for, partly by the facts themselves, and partly by hostile over-statement of them, public confidence began to be disquieted. There seemed a breach in the contract under which vaccination had been accepted. In what had promised so much, failures were all the more conspicuous: men looked to them, even where most exceptional, rather than to the successes of vaccination; and there were (1820–35) not a few persons whose minds began to misgive them, whether the old plan of small-pox inoculation had not perhaps been too easily abandoned.*

which further observations relieved.

To us, in the present day, this doubt cannot occur. The statistics I have quoted show beyond question that, whatever partial unexpected weakness may have been discovered in the protectiveness of vaccination, still—even with that weakness—its adoption has been followed by a reduction of

* Persons entertaining this doubt overlooked a possibility which happily for mankind has never been fully tested—a possibility that small-pox inoculation, *if it had been generally adopted at a sufficiently early period of life to prevent infantine deaths by natural small-pox*, might itself have proved in many instances an impermanent protection. The following passage from the French Academical Report on the vaccinations of 1850 (p. 25) points in the direction here suggested, but is not sufficiently definite for a proof:—"L'inoculation elle-même n'était pas "plus efficace. De tous temps on a cité des faits contre son infallibilité. Elle "n'a pu se soutenir en Chine au delà de cinquante ans; après qui des épidémies "sont venues qui en ont montré les faiblesses; et, sans chercher si loin, "M. Debourge de Rollot nous apprend que sous le règne d'une épidémie à "Edimbourg et dans le Devonshire les inoculés ont eu plus à se plaindre que "les vaccinés." In the French Report there are no references which might enable the reader to verify these important assertions, and study in detail the experience which they represent.

small-pox mortality to a tenth and a twentieth of its former magnitude. But, in fact, long before these statistics could be compiled, popular observation, with rough and ready induction, had come to the same result. Every one could see that a vast majority of vaccinated persons escaped small-pox; every one could also see that if a vaccinated person caught small-pox he suffered from it comparatively little. And on those very occasions when the large number of persons suffering small-pox after vaccination was most calculated to weaken confidence in its absolute powers of prevention, there were the best opportunities to learn that if it sometimes failed to prevent, at least it might be relied on to mitigate.

Habitual mildness of post-vaccinal small-pox.

Thus, for instance, in a very severe epidemic of small-pox which prevailed at Norwich in 1819, Mr. Cross minutely observed 112 families, in all of which there were cases of the disease; and the annexed table shows the result. Among

Norwich.

——	Number.	Cases of Small-pox.	Deaths by Small-pox.
Total number of persons in the 112 infected households - - -	603	202	46
1. Protected by previous small-pox* -	297	—	—
2. Protected by vaccination - -	91	2	—
3. Unprotected - - - -	215	200	46

* Mr. Cross mentions that he met with several who were supposed to have had small-pox ormerly, yet notwithstanding took it on this occasion; but he does not state whether such cases are included in the above summary.

215 persons unprotected by vaccination there were 200 cases of small-pox, and of these 46 proved fatal; while among 91 vaccinated persons the only effects of this terrible infection were, (1) that one girl, who had been vaccinated nine years, "had a mild disease, limited to twenty pocks, "and lasted only six days before it began to decline,"

and (2) that another, who had been vaccinated five years, "went through the disease in half the time (of her un-"vaccinated sister) without danger or detriment; a few "very minute pits upon the tip of the nose being the only "permanent traces."

Edinburgh.

Similarly, Dr. Thomson, of Edinburgh, recounting, some years afterwards, his experience at about the same period, says*: "My observation of the very severe small-pox "epidemic which prevailed in Scotland from 1818 to 1823 "was carried on until I had had an opportunity of seeing "not fewer than 1,500 individuals affected with small-pox "after vaccination; and of this number only three died, "but none of them with the disease in that form which is "termed malignant. I saw also about 85 cases of small-"pox in persons who had previously passed through either "natural or inoculated small-pox, and of this number three "also died. In addition to these, I saw also 400 cases of "primary small-pox, out of which 100 died. These results "gave me a confidence in the conservatory effects of vacci-"nation, which nothing has since occurred to shake. Small-"pox has twice prevailed epidemically in Scotland since "1823, and from all I have seen and heard I am satisfied "that the proportion of deaths in the several classes of "patients I have mentioned did not materially differ from "that above specified. In the first of these epidemics the "deaths that occurred in the vaccinated were of adult males, "and in the second chiefly, I believe, of adult females."

Marseilles.

Similarly again at Marseilles†:—the number of cases and of deaths in the severe epidemic of 1828, and their relation to the vaccinated, non-vaccinated, and variolated masses of exposed population, were stated as follows; the first column

* Seventh Report of Poor Law Commissioners, p. 148. In explanation of the very large number of cases of post-vaccinal small-pox witnessed by Dr. Thomson, it must be observed, that *chicken-pox* was epidemic in Scotland at the same time as small-pox; and Dr. Thomson, considering these diseases to be of identical nature, counted them both together in his total. Also see his "Account of the "Varioloid Epidemic, 1820," and "Historical Sketch of Opinions respecting "the Secondary Occurrence of Small-pox," 1822.

† Bousquet, Traité de la Vaccine; Paris, 1833; p. 195.

of figures representing an estimate (which of course can only be approximative) made for the purpose by the Société Roy. de Médecine:—

——	Number.	Cases of Small-pox.	Deaths by Small-pox.
Total number of persons at the ages (0–30) which were almost exclusively susceptible - - - -	40,000	6,020	1,024
1. Protected by previous small-pox -	2,000	20	4
2. Protected by vaccination - -	30,000	2,000	20
3. Unprotected - - - -	8,000	4,000	1,000

Copenhagen.

So also (as quoted by Steinbrenner) in Copenhagen:—of 659 vaccinated persons who suffered in the variolous epidemics 1823–27, only five died, being at the rate of 1 in 132; while of 176 unvaccinated persons who caught the disease, more than a fourth seem to have died; and of 153 others, who professed previously to have had small-pox, there died 31. And similarly in the epidemic of 1828-30, and part of that of 1832–37, it seems that out of 228 unprotected patients 63 had died; but of 1,373 cases of post-vaccinal small-pox only 14 were fatal.

Numerous other illustrations.

Observations, more or less to the same effect, have been made, I believe, in every country to which vaccination has extended, and at every time when epidemic small-pox has prevailed. Sometimes the difference has seemed less, sometimes more; but the fact of difference, and very great difference, in favour of vaccinated persons, as regards the severity of small-pox if it should happen to befall them, is made certain by the general and strong testimony of innumerable observers. In the adjoining table are illustrations selected from various sources, and it would be easy to multiply their number to any desired extent. The largest illustrations are generally least likely to be deceptive: I would therefore

point especially to the case of Bohemia, where (according to observations made for twenty-one years on four millions of

Places and Times of Observation.	Total Number of Cases observed.	Death-rate per 100 Cases.	
		Among the Unprotected.	Among the Vaccinated.
France,‖ 1816–41	16,397	$16\frac{1}{5}$	1
Quebec,* 1819–20	?	27	$1\frac{2}{3}$
Philadelphia,† 1825	140	60	0
Canton Vaud,† 1825–9	5,838	24	$2\frac{1}{6}$
Darkehmen,† 1828–9	134	$18\frac{4}{5}$	0
Verona,‡ 1828–39	909	$46\frac{2}{3}$	$5\frac{2}{3}$
Milan,** 1830–51	10,240	$38\frac{1}{3}$	$7\frac{2}{3}$
Breslau,† 1831–3	220	$53\frac{4}{5}$	$2\frac{1}{9}$
Wirtemberg,†† $1831\frac{1}{2}$–$5\frac{1}{2}$	1,442	$27\frac{1}{3}$	$7\frac{1}{10}$
Carniola,§ 1834–5	442	$16\frac{1}{4}$	$4\frac{2}{5}$
Vienna Hospital,† 1834	360	$51\frac{1}{4}$	$12\frac{1}{2}$
Carinthia,§ 1834–5	1,626	$14\frac{1}{2}$	$\frac{1}{2}$
Adriatic,† 1835	1,002	$15\frac{1}{5}$	$2\frac{4}{5}$
Lower Austria,† 1835	2,287	$25\frac{4}{5}$	$11\frac{1}{2}$
Bohemia,¶ 1835–55	15,640	$29\frac{4}{5}$	$5\frac{1}{6}$
Gallicia,† 1836	1,059	$23\frac{1}{2}$	$5\frac{1}{7}$
Dalmatia,† 1836	723	$19\frac{2}{3}$	$8\frac{1}{4}$
Lond. Small-pox Hospital,¶ 1836–56	9,000	35	7
Vienna Hospital,¶ 1837–56	6,213	30	5
Kiel,¶ 1852–3	218	32	6
Wirtemberg,‖ no date	6,258	$38\frac{9}{10}$	$3\frac{1}{2}$
Malta,‡‡ no date	7,570	21·07	4·2
Epidemiolog. Soc. Returns,‡‡ no date	4,624	19·7	2·9

* Thomson, Small-pox, p. 376. The Quebec epidemic is described to "have spread "rapidly among the unvaccinated, and carried off many adults as well as children. The "proportion of deaths in the unvaccinated was from 1 to $3\frac{1}{2}$ to 1 in 4."

† Steinbrenner, op. cit. pp. 105, 110, 231, 232, 280, 281, 283, 295. In the Breslau epidemic one patient is stated to have suffered small-pox for a third time.

‡ Rigoni-Stern, as quoted (p. 50) by Prof. Haeser; die Vaccination und ihre neuesten Gegner, 1854. It is mentioned that of twenty-four persons who during this period suffered second attacks of small-pox, no fewer than eight died.

§ Med. Jahrb. d. Œesterr. Staates, 1838.

¶ Details annexed in Supplement. The twenty years' experience of the Vienna Hospital is detailed in the Report of the College of Surgeons, and in the statement of Professor Hebra.

‖ Wunderlich's Handbuch d. Path. u. Therap. 1855, iv. 201.

** Canstatt's Jahresbericht, 1852.

†† Heim, op. infra citat. In these epidemics there were reported 57 cases of persons suffering small-pox for a second time; and of the 57, there were 16 fatal. In the Wirtemberg epidemics afterwards referred to, there were reported 86 cases of secondary small-pox, among which 12 were fatal.

‡‡ Seaton, on the Protective Value of Vaccination. Dr. Seaton quotes 203 cases of secondary small-pox, as reported to the Epidemiological Society. Of these 17 were fatal. In Mr. Marson's paper relating to the London Small-pox Hospital there are mentioned 47 cases of secondary small-pox. Of these 8 died from the disease, and 1 from an accidental complication.

people) the risk of death to vaccinated persons, if they happen to contract small-pox, is at the rate of $5\frac{1}{6}$ per 100 patients; but to non-vaccinated persons, when they contract small-pox, at the rate of $29\frac{4}{5}$ per 100 patients; or to the concurrent testimony of London, Milan, and Vienna, as showing, on an experience of nearly 26,000 cases, that post-vaccinal small-pox, if it occurs, is but a fifth or a sixth as dangerous as natural small-pox.*

Danger of small-pox to persons nominally vaccinated chiefly dependent on badness of vaccination.

This, however, is only a part of the case; and I venture especially to beg your attention to what remains, as it is of much administrative importance. When the above and similar statistics are seen in mass, it is merely noticed that,

* It will be observed in the foregoing table that the fatality of small-pox, as it occurred in unprotected persons, ranged from under 15 (Carinthia) to 60 (Philadelphia) per cent.: while in persons who contracted the disease after previous vaccination its fatality ranged from an inappreciable smallness to 11 (Lower Austria) and even $13\frac{5}{11}$ (Vienna Hospital) per cent. This extensive range in each column depends on various circumstances. Sometimes, no doubt, material differences of classification have been made, one observer having included while another has excluded cases of *true chicken-pox;* sometimes (where the observation is that of hospital practice) only the graver cases of small-pox have been admitted for treatment; sometimes, a particular epidemic has been in its form milder or more severe; sometimes (as the reporter mentions of 15 out of the 25 deaths in the Vienna Hospital in 1834) cases are included in which the fatal issue was not due to small-pox. But, generally speaking, such circumstances would affect equally both enumerations (vaccinated and unvaccinated) in any one epidemic, and would certainly give no fallacious result in favour of the former. And in comparing together the enumerations of *any one epidemic*, it will be noticed that always there is a marked difference in favour of the vaccinated class; so that they, if infected with small-pox, have not, even in extreme cases (Lower Austria or Dalmatia), incurred half the risk of non-vaccinated patients. In many lines of the above statistical table, true chicken-pox is no doubt often reckoned as small-pox. In the returns of the London Small-pox Hospital a distinction is drawn between it and the *varicelloid modification of small-pox:* the former is excluded, and the latter (almost entirely occurring in vaccinated persons) is retained. This plan probably gives the most correct means of comparison. From the line which relates to the Vienna Hospital in 1834, there are excluded 533 cases of so-called chicken-pox; and judging by the high death-rate which results for the vaccinated persons, I should suppose that "varicella" had there been allowed to include many cases which in England would have been grouped as "varicelloid modifications"—*i.e.* vaccinal mitigations—of small-pox. For the reverse reason, the Vienna experience of 1837–1856 gives rates lower than they would have reckoned here; for the total number of cases (6,213) includes 3,415 of so-called varicella; and of these, no doubt, a certain proportion would in England have been excluded as cases—not of vaccinal modification, but—of true chicken-pox.

among a number of persons suffering small-pox, those who have previously been vaccinated incur much less risk than others. But when such a mass is dissected, there comes out as a second fact, that this lesser risk of the vaccinated has a graduated scale of its own; and that, *among vaccinated persons infected with small-pox, the danger of the disease is chiefly determined by the badness and insufficiency of their vaccination.*

Mr. Marson's observations.

The establishment of this truth is the work of Mr. Marson, who for more than twenty years has been Resident Surgeon of the London Small-pox Hospital, and who founds his conclusion on many thousands of cases, which during this time he has attended, and of which he has kept accurate notes.* Conceiving it to be, for practical purposes, a discovery of high importance, I annex a copy (App. F.) of the original paper, in which Mr. Marson, four years ago, communicated it to the Royal Medical and Chirurgical Society of London; and likewise (App. G.) a copy of the petition, last year addressed by

* Dr. Kinnis, formerly Superintendent of Vaccination at Colombo, in his "Report on Small-pox as it appeared at Ceylon in 1833–34," and in an Appendix relating to observations made by Dr. Forbes in the epidemic of 1830, gives enumerations from which the annexed table is compiled. It will be observed, that the gradation of death-rates, marked in the last column, though far less detailed than in Mr. Marson's statement, is to the same general effect. And in the cases noticed by Dr. Kinnis himself the difference is further developed; for he distinguished persons pretending to have been vaccinated into such as had *no marks* and such as had *unsatisfactory marks* of vaccination, and found that the death-rate of the latter was 26⅓, that of the former 32½. Cases of chicken-pox are not included in the annexed table; and Dr. Kinnis gives at length (pp. 10–14) his reasons for concluding "that the febrile eruptive disease known "in Ceylon by the name of chicken-pox, arises from an infectious matter, "essentially different from that which produces small and modified small-pox." —Op. cit. Colombo Govt. Press, 1835.

Occurrence and Fatality of Small-pox.

	Number of Cases.	Number of Deaths.	Per-centage of Deaths.
(1) In persons decidedly not vaccinated	351	146	41½
(2) In persons having no marks, or but unsatisfactory marks of vaccination	199	52	26 1/10
(3) In persons having satisfactory marks of vaccination	187	3	1⅗
(4) In persons having marks of small-pox	4	2	—

Mr. Marson to the House of Commons, in which he briefly states the result of his large and laborious experience in small-pox and vaccination.

His conclusions, so far as they relate to my present point, are as follows:—That the fatality of small-pox, when it attacks the unvaccinated, is 350 per thousand; that its fatality to such vaccinated persons as it infects is, taking them indiscriminately, 70 per thousand; but, distinguishing vaccinated persons into two classes,—those, (first), who have been vaccinated in the best known manner, and those, (secondly), who have been badly vaccinated,—the fatality of small-pox, if it infects the former, will be 5 per thousand; if it infects the latter, 150 per thousand: that the risk of the one will be thirty times the risk of the other.

Almost perfect security given by good vaccination.

Such being the *almost perfect security* which well-performed infantine vaccination confers against death by small-pox, it remains to be considered whether here is the necessary limit of Jenner's benefaction to mankind. The remnant of danger is not great. But, such as it is, can it be prevented?

Further inquiry into post-vaccinal small-pox. Two supposed causes of its occurrence.

Thirty years ago, when it first became notorious that small-pox might affect a certain proportion of persons previously and properly vaccinated, this partial failure of protection was explained on one or other of two suppositions:—Either (it was said) the vaccine contagion,* in its transmission through so many human subjects, must have lost by degeneration some of that specific protective influence which, in its former condition, it exerted on the human economy; or else there must be something essentially of uncertain constancy, something impermanent or liable to be impermanent, in the privileges which vaccination confers.

* I avoid speaking of the vaccine *lymph*, as being weakened by transmission through many human subjects, because this expression often represents a misunderstanding of what really occurs in the propagation of disease by morbid poisons. Lively arguments 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 .... *Mutatis mutandis*, it might equally have been used to prove that the power of human procreation could not but cease soon after the days of Adam.

To the former of these possibilities I shall presently revert, and will now only remark, that, viewed as an alternative to the other, it was judged to be an insufficient explanation.

Lapse of time as a cause.

For what chiefly attracted attention was this: not that persons vaccinated by the surgeons of 1820–30 with the lymph of 1820–30 were less protected against small-pox than persons who had been vaccinated in 1798: but, generally, that persons who had been vaccinated ten or fifteen or twenty years, and who, during this interval, had perhaps repeatedly resisted small-pox, would at length, in a certain proportion of their number, yield to the infection. This had most frequently happened during times when small-pox was severely epidemic among the unvaccinated; and the earliest notice of the fact on a large scale in Scotland in 1818–20 merely meant that then, for the first time, large masses of persons with vaccination of many years standing were exposed to the test of a strong epidemic influence. Under this ordeal it had become evident that, for some vaccinated persons, the insusceptibility conferred by cow-pox was not of life-long duration. And from careful analysis of cases it was shown, that this lesser protectedness of certain vaccinated persons bore at least some proportion to the number of years which in each case had elapsed since vaccination. Some proportion, I say:—for, (first), there were not materials to prove any uniform rate of increase from year to year; and (secondly), the increase, such as it was, apparently continued up to about thirty years of age; after which period it seemed that, in the class of persons now under consideration, the liability to contract small-pox underwent a continuous decline. Thus (to select an illustration from a work to which I shall presently make more particular reference) Professor Heim, taking 1,055 cases of modified or unmodified small-pox in vaccinated persons, distinguished them under thirty-five heads corresponding severally to the number of years—from 1 to 35—which had elapsed since vaccination.* The thirty-five

* In a medical pamphlet of thirty-five years ago (Address to Parents and Guardians on the Present State of Vaccination, by a Candid Observer; London, 1822; p. 47) I read, "There are strong grounds for believing that this pecu- "liarity of constitution, which disposes to attacks of modified or vaccine small-pox is hereditary." A medical friend writes to me, that he and his two brothers were vaccinated in infancy to the satisfaction of their then doctor, that some years subsequently, when they were severally aged 13, 11, and 7, the second of them contracted small-pox in a very severe form, and the other two caught the disease from him; that my correspondent himself, when 20 years of age, having occasion to attend the post-mortem examination of a patient who had died of small-pox, again contracted the disease, and in his turn communicated a second infection to both his brothers, who, like himself, had suffered it before. Dr. Neil Arnott tells me, that he attended in Spain a case of post-vaccinal confluent small-pox, where the patient's father had had small-pox twice, and her uncle three times, another uncle having died with a first attack of the disease. I have notes of an instance—published, I believe by Dr. Webster—where three brothers and sisters had had post-vaccinal small-pox; one of them once; another twice; and the other three times, including a last and fatal attack.

numbers corresponding to the thirty-five successive years are severally as follows:—15, 4, 4, 7, 10, 9, 12, 16, 17, 14, 14, 21;—44, 45, 62, 48, 59, 43, 57, 68, 44, 40, 50, 53, 52, 46, 41, 27, 41;—17, 16, 13, 6, 32, 8. It is true that, taken year by year, this series is irregular, as might be expected in so limited an experience; but, when it is divided into three successive parts—one for *the first twelve* years after vaccination, one for *the next seventeen*, and one for *the following six* years,—it appears that the average number of cases for each year is, in the first division 12, in the second division 48, in the third division 15. Or if the series be divided into seven successive parts—one for each quinquennium comprised in it—the seven quinquennial sums read thus:—40, 68, 186, 275, 239, 172, 75; and a corresponding subdivision of 653 cases which occurred at Copenhagen (according to Möhl, as quoted by Gregory) gives the series 14, 102, 173, 187, 156, 19, 2. A calculation of similar materials made by Professor Retzius (Gaz. Méd. de Paris, 1843), with respect to 961 cases in the Stockholm Hospital, gave the following series to express the average allotment of small-pox to each year of life in eleven successive quinquennia up to the age of fifty-five:—$3\frac{1}{5}$, $4\frac{2}{5}$, $13\frac{1}{5}$, $45\frac{2}{5}$ $51\frac{3}{5}$, 40, 20, $17\frac{3}{5}$, $3\frac{4}{5}$, $2\frac{1}{5}$, 1. Mr. Marson's copious information (App. F. pp. 19—21) tends to show the same thing.

Post-vaccinal small-pox made manifest by signs of artificial interference in the present distribution of small-pox deaths, as contrasted with their natural distribution before the discovery of vaccination.

This re-development of susceptibility to small-pox, as affecting a certain proportion of the vaccinated population, is a fact which becomes most evident when one compares the present ages of small-pox death with the ages of small-pox death before the discovery of vaccination. Formerly, the

entire number of such deaths, distributed among the ages of life, constituted, from first to last, a declining series. Duvillard gives an analysis of the 6,792 small-pox deaths which happened during nearly two centuries (1580–1760) in the city of Geneva; and the numbers belonging to the six successive quinquenniads of life up to the age of thirty were 5,467, 1,058, 126, 54, 39, and 31; only 17 cases having fallen to all ages above thirty. In the adjoining table the difference between that former distribution and the distribution which now prevails in partially vaccinated populations is shown.

Proportionate Distribution by Age of 1,000 Small-pox Deaths in Geneva before the Discovery of Vaccination, and of the same Number in England, London, and Paris respectively, at Periods subsequent to its general Practice.

Ages.	Geneva, 1580–1760.	England, 1839 and 1847.	London, 1848–51.	Paris, 1842–51.
0–5	805	739¼	684	338
5–10	155¾	127½	131	59
10–15	18½	24½	29⅓	132¾
15–20	8	25¼	30	
20–25	5¾	30¼	48	329½
25–30	4½	18½	35	
30–35	2½	11½	19¾	109⅓
35–40		7¾	12	
Over 40		15¼	10½	31½
Total	1,000	999¾	999¾	1,000¼

The 6,792 small-pox deaths of Geneva during the period 1580–1760, and 12,941 registered small-pox deaths of England during the years 1839 and 1847, and 3,699 registered small-pox deaths of London during the years 1848–51, and 3,323 deaths reported by the Epidemiological Society to have occurred in Paris during the years 1842–51, are severally analyzed according to the ages at which they took place. For convenience of comparison they are all reduced to the scale of 1,000 and are reckoned for each age in reference to this total. In the column which relates to Geneva, the declining series from 805 to 2½ expresses what may probably be considered to have been the *natural* distribution of small-pox deaths among different ages in cities where it was frequently or constantly present. In its general signification, this declining series closely resembles the present distribution

of those infectious infantile diseases (measles, hooping cough and scarlet fever) for which hitherto no prevention has been found, and which therefore in their distribution express unmodified natural affinities.* In the remaining three columns of the table—those which relate to England, London and Paris, in the present century, and particularly in the column which relates to Paris during the ten years 1842–51, it will be seen that there is no longer an unbroken decline of the small-pox mortality, but that, after decline, there is again (for a time) increase.† This interruption is certainly artificial; and no doubt chiefly denotes the mortality of post-vaccinal small-pox. In other words, vaccination has established an interference with the natural series: at a certain period this artificial interference is to some extent withdrawn, and the death-list begins to contain cases which formerly would have belonged to early periods of life: cases, where vaccination has only sufficed to postpone the fatal infection.

I refrain from inserting in the text of this Letter any discussion of the very interesting pathological considerations by which those new facts in the science of vaccination may to some extent be interpreted. You will chiefly care to notice their practical result; namely, that men soon began to inquire, and by experiment to test, whether that absolute immunity against small-pox, which a vaccinated person in the lapse of years had partially lost, could by a second vaccination be renewed to him. And again, without dwelling on an immense detail of literature which records the tenta-

Re-vaccination proposed as the preventative of post-vaccinal small-pox.

* *See Note* III., page 306 : Relation of Current Contagia to Ages of Population.

† That nearly one-third of the whole number of small-pox deaths in Paris happens between the ages of 20 and 30 is one of the most startling facts I have learnt in my study on the subject. I can conceive for it no other explanation than that given in the text, and, if this be the true one, there must prevail in Paris an appalling amount of post-vaccinal small-pox. I cannot say whether difference of race may make any difference to that re-development of susceptibility to small-pox; still less can I venture to surmise whether so extreme an instability in the results of French vaccination may depend on anything peculiar to the French administration of this important agency. But if those indications be sound, which in a later part of this section I deduce from the history of re-vaccination in the Prussian army, there would apparently be cogent reasons for inquiring very critically into the *quality of lymph* which is current for the vaccinations of France.

tive re-vaccinations of private practitioners (among whom Dr. Harder of St. Petersburg deserves especial credit) it is enough to study what has been observed in the re-vaccination of great masses of men in various military establishments, especially in Germany.

Extensive trial in Wirtemberg.

The earliest large experience of this kind came from Wirtemberg. In 1829 the practice of re-vaccinating the troops of that kingdom was commenced; and its collective results for the next few years are recorded in an elaborate

—	Total.	Ratio of Success per 1,000 Cases Vaccinated.		
		Perfect Success.	Modified Success.	No Success.
Vaccination of the Wirtemberg Army in the five years 1831½–5½ - -	14,384	340·2	248·3	411·5

13,681 of the above-mentioned 14,384 military vaccinations being classified according to the marks of previous vaccination or small-pox, the results were as under:—

Degree of Success of Re-vaccination.	Of Cases with Normal Cicatrices of Vaccination there were 7,845, and among these the results per 1,000 were,	Of Cases with Defective Cicatrices of Vaccination there were 3.545, and among these the results per 1,000 were,	Of Cases with no Cicatrices of Vaccination or Small-pox there were 2,025, and among these the results per 1,000 were,	Of Cases bearing marks of previous Small-pox there were 266, and among these the results as per 1,000 were,
Perfect -	310·4	280·7	337·3	319·5
Modified -	280·5	259	191·1	248·1
None - -	409·2	460·4	471·6	432·3

11,565 of the same number being distributed according to age, the results were as under:—

Degree of Success of Re-vaccination.	Under 20 Years of Age there were Re-vaccinated 124 Persons, and the results as per 1,000 were,	Between 20 and 30 there were Re-vaccinated 11,157 Persons, and the results per 1,000 were,	Above 30 Years of Age there were Re-vaccinated 284 Persons, and the results as per 1,000 were,
Perfect - - -	338·7	285·6	426·1
Modified - -	322·6	259·2	207·7
None - - -	338·7	455·2	366·2

form* by Professor Heim, of the Wirtemberg military service. The adjoining table presents an abstract of these results in relation to five years terminating with June 1836. There are parts of it from which (because of the complicatedness of the conditions) I will not venture on attempting to draw conclusions. But there are other parts of which the meaning is obvious.

First, let me observe that one line of the figures corroborates, in an indirect manner, the conclusions recently quoted from Mr. Marson. Besides 5,919 of the vaccinated on whom the operation produced no vacciniform result, there were 3,571 (or about 248 per 1,000) in whom it produced results approaching, but not quite attaining, what was strictly enforced as the criterion† of perfect success. These "modified "successes" form for comparison a group, less subject to accidental sources of fallacy than some other combinations in the table; and such *modification* is in its way (like an attack of small-pox) a measure of how far the influence of previous protection survives in those persons in whom it has begun to decline. Now, in tracing the degrees of this influence as present in the four different categories of vaccinated persons, and as expressed in proportions of those classes, it is seen that

"Modified" results of re-vaccinations.

* Historisch-Kritische Darstellung der Pocken Seuchen, etc., im Königreiche Württemberg, innerhalb der fünf Jahre Juli 1831 bis Juni 1836. Professor Heim also reports (though with less exactness) the results of 29,864 re-vaccinations performed by civil practitioners in different parts of Wirtemberg, and the general results were as in the annexed form.

Ratio of Success per 1,000 Cases Re-vaccinated.		
Perfect Success.	Modified Success.	No Success.
517·7	176·2	306·1

† Heim, op. citat, p. 594. Beim K. Militär wurde jede nicht mit dem reinsten Bilde einer vollkommenen Kuhpocke, oder mit zu grosser Randröthe und dem Anschwellen des Oberarmes verbundene Impfung unter den modificirten Erfolg locirt; wohin alle übrigen pustulösen Abnormitäten des Exanthemes gerechnet wurden, die manchen Impfchirurgen verleitet haben könnten, sein "guter Erfolg" auszusprechen. Als erfolglos wurde jeder nicht bis zur Blasenbilding gesteigerte Lokalprozess, und das was man falsche Kuhpocken zu nennen pflegt, aufgerechnet. Nur das ungetrübte Abbild der bei erstmals geimpften Kindern für gut erklärten Schutzpocke wurde auch an den Revaccinirten "gut" prädicirt.

the proportion is highest (280½) in those who showed normal marks of previous efficient vaccination; next (259) in those whose previous vaccination marks, though visible, were imperfect; next (248) in those who had had small-pox; and least (191) in those who, whether they had previously had small-pox, or been vaccinated or not, showed no scars of either infection.

More than a third of the whole perfectly susceptible of re-vaccination.

But the table shows, even more unquestionably, another great fact. It shows that on the average of more than 14,000 experiments (an immense majority performed at between 20 and 30 years of age) 34 out of every 100 re-vaccinated persons developed the same sort of vesicle as would arise from a first insertion of vaccine lymph. And it is important to observe, that this renewed susceptibility to cow-pox did evidently not depend, so far as could be traced, on any original ineffectiveness of the former vaccination; for (as is expressly set forth in the second part of the table) among the 14,384 subjects of vaccination there were 7,845 who presented strictly normal scars of previous vaccination; yet nearly a third of this large number gave again exactly such local phenomena as arise in children when vaccinated for the first time.

What inference may be drawn from this?

Is it then a legitimate inference from these figures, that, if the same 14,384 soldiers had been exposed to an atmosphere of small-pox infection, every third man would have caught the disease? Certainly not. Inoculation of lymph (whether vaccine or variolous) is, so to speak, a finer and more delicate test of susceptibility to the small-pox poison than is the breathing of an infected atmosphere; so that many persons, when the lymph of cow-pox or small-pox is inserted in their skin, will give—locally at least—evidences of susceptibility which no atmospheric infection would have elicited from them. And of this, perhaps, there can be no more ready illustration than by noticing (either in another part of the annexed table, or on a still larger scale in a subsequent table, which represents the re-vaccinations at Kasan) that persons who bore marks of previous small-pox were, in at least equal proportion with previously vaccinated persons, capable of producing perfect vaccine vesicles: and probably they too, if tested with variolous matter, would have shown at the inoculated part similar signs of susceptibility; whereas, notoriously, of persons who have once had small-pox, not nearly one-third becomes afterwards capable of contracting small-pox by frequenting the neighbourhood of the sick.

For this reason (greatly corroborated by what had already in every-day practice been observed of the immunity of once-vaccinated persons) it was evidently impossible to argue that *all* who on re-vaccination yielded perfect vaccine vesicles would, on ordinary exposure to small-pox infection, have become infected with small-pox. On the other hand, it might fairly be suspected that they would have been distinctively *the endangered class:* not that all or nearly all of them would have suffered; but that from among them more than from among other vaccinated persons, the occasional sufferers by small-pox would have come.

Prussian re-vaccinations.

The experience of other countries did not fail, so far as it went, to confirm the general accuracy of the Wirtemberg observations. Especially in the Prussian army, in 1833—at the commencement of a system to which I shall presently revert as having given other remarkable results—there were re-vaccinated between forty and fifty thousand adults, and in about 33 per cent. of the entire number this re-vaccination took with perfect success. In a re-vaccination of Russian soldiers at Kasan,* Dr. Thiele observed that in 28 of each

Russia.

Results of 1,795 Adult Vaccinations at Kasan.

In Subjects as follows:—		Perfect Success per 100 Cases.	Imperfect Success per 100 Cases.
Presenting marks of previous small-pox	1,436	$18\frac{7}{8}$	$5\frac{6}{7}$
Presenting marks of previous vaccination	247	$18\frac{3}{5}$	$9\frac{3}{4}$
Presenting neither	112	$29\frac{6}{13}$	$16\frac{1}{12}$

Results of Danish Re-vaccinations.

Perfect success	12,041
Modified success	6,131
Perfect or modified success obtained at a second trial	1,532
Complete failures	4,241
Total	23,945

* Henke's Zeitschr., 1839.

hundred cases the operation succeeded perfectly or imperfectly; that the rate of perfect success was $18\frac{3}{5}$ per cent; and (as there happened to be vaccinated at the same time 1,436 persons presenting marks of previous small-pox) that perfect vaccine vesicles would arise just as often on persons who had once had small-pox as on persons who had once been vaccinated.

Denmark.

Of nearly 24,000 re-vaccinations practised in the Danish army* in the four years 1843–5 and 1847, more than half were attended with perfect success, and more than a quarter with modified success. There remained between a fifth and a sixth, on whom (though most were submitted to a second trial) no impression could be produced.

Brunswick.

Of 1,050 re-vaccinations, practised in the Brunswick army* in 1844, 502 gave the perfect and 130 the modified result.

Baden.

In 1844 there were practised, in the army of Baden,† 20,483 vaccinations, and the results stated in per-centages were as follows:—perfect success, 38·6; modified success, 26·6; failure, 34·7. In a less extensive re-vaccination (3,170 cases), which had taken place four years earlier, the perfect successes had been at the rate of $26\frac{1}{3}$ per cent., and the modified successes at the rate of $38\frac{1}{3}$. The proportion of perfect successes was also 27 per cent. in 2,355 re-vaccinations which took place in Baden in 1842.

Effects of re-vaccination against post-vaccinal small-pox.

By the earliest of these various independent observations it was put beyond question, that the same lapse of time, which renders some vaccinated persons again susceptible of small-pox, renders them also again susceptible of cow-pox. But it remained to be seen whether that second dose of the latter infection, which it was the object of re-vaccination to introduce, would restore such persons, either permanently or for a long while, to the state of security from which they had declined; whether, by successful re-vaccination, their revived susceptibility to small-pox would once more be extinguished.

Nearly thirty years have elapsed since the commencement of this practice on a large scale, and it may now fairly be judged by its fruits.

In Wirtemberg.

As early as 1838 Professor Heim reported its results in Wirtemberg to the following effect:—That during the five

* Oppenheim's Zeitschrift, vol. 27. † Henke's Zeitschr., 1842.

years 1833–7, though small-pox infection had been sixteen times imported into different regiments of the army, there had ensued among the 14,384 re-vaccinated soldiers only—in the person of one whose re-vaccination two years before had been followed by "modified" success—a single instance of varioloid. And, similarly, in the civil practice of the kingdom during the same time, among nearly 30,000 re-vaccinated persons, there had occurred only (1) a mild case of varioloid in a woman who four years before had been re-vaccinated apparently with "modified" success, and (2) a case so trifling that it was called chicken-pox in a man who, fifteen years before, at the age of 13, had been, if not re-vaccinated, at least successfully vaccinated. Yet, within these five years, the infection had been present in 344 localities of Wirtemberg; producing 1,674 cases of true or modified small-pox among the not re-vaccinated and in part not vaccinated population of 363,298 persons, in those places where it had prevailed.*

In Prussia.

Better, because longer and larger, experience of the same kind is that of the Prussian army, as recorded year after year, by Dr. Lohmeyer, in the successive volumes of the *Berliner Medizinische Zeitung*, from 1833 to the present time. In Prussia (just as in Wirtemberg) the practice of re-vaccination grew out of the knowledge that small-pox

* In these epidemics (as in all where small-pox has attacked a certain proportion of the vaccinated population) the mildness of the disease in such vaccinated persons, as compared with the unvaccinated, and even with those who had previously suffered small-pox, was constantly observed. The annexed table, compiled from Heim's material, illustrates the fact. Its chief results are

Total of Variola and Varioloid.	Cases, 1,677.	Deaths, 198.
1. Bearing marks of vaccination, or said to have been vaccinated -	1,055	75
2. Unvaccinated - - -	587	96
3. Having previously had small-pox	57	16
4. Undetermined - - -	178	11

inserted in the table at page xix. It should be added, that, in Wirtemberg, great pains were taken, by isolation of the sick, to prevent any general spread of contagion.

would ultimately attack a certain proportion of those who had been vaccinated only in infancy. This knowledge, too, had been dearly purchased in the Prussian army; for, during the ten years preceding 1831, cases of post-vaccinal small-pox were increasing in number and fatality; attacks were counted annually by many hundreds; and within the three years 1831–3 there had occurred no fewer than 312 deaths by small-pox. For the last twenty years the Prussian army has represented an almost entirely re-vaccinated population. And what has been the contrast? 104 annual deaths by small-pox was the last experience of the former system; 2 annual deaths by small-pox has been the average for the re-vaccinated army. Analysing moreover the 40 fatal cases of small-pox which, during the last 20 years, have occurred in the Prussian army, we find that only 4 of the number were of persons who (it is said) had been successfully re-vaccinated.

In Bavaria, Denmark, and Sweden.

Other illustrations of the same conclusive kind may be gathered from the experience of other countries. From 1843 re-vaccination has been compulsory in the Bavarian army; and from that date to the present time (we are told) neither a single death by small-pox, nor even a single case of unmodified small-pox, has occurred in that population.* For the last 21 years re-vaccination has been general in the Danish army, and for the last 13 years in the Danish navy; and these two populations (we are informed) have almost entirely escaped contagion during several epidemics of small pox.† The practice of Sweden has been similar, and its results also satisfactory.‡

Dependence of post-vaccinal small-pox on original incompleteness of vaccination.

The preceding pages have shown that a liability to post-vaccinal small-pox does, in considerable numbers of persons, tend to develop itself from about the period of puberty, and that against this danger re-vaccination gives the desired security. It remains to be considered, as an important practical question, whether that occasional tendency to lose the advantages of a first vaccination depends on such vaccination having itself been originally imperfect.

* App. p. 170. † App. p. 171. ‡ App. p. 185.

Mr. Marson's observations have shown that the severity of post-vaccinal small-pox is least where the local signs of vaccination are sufficient and satisfactory. Whether post-vaccinal small-pox be less frequent (as well as less dangerous) in the same ratio, is as yet not certainly known. But, while recognizing the affirmative to be in the highest degree probable, we must admit that small-pox—though commonly in its most modified degrees—does occur in some whose scars of vaccination are in every respect normal. So that, according to such experience as hitherto exists on the subject, it may be said that, by some change proper to the vaccinated body itself in the course of its development, the protective influence even of apparently perfect vaccination tends, more or less, with time to become weakened.

Does vaccination become less protective by a weakening of its contagion in successive transmissions?

But—now reverting at length to a doubt which I have already mentioned—is there any reason to believe that this occasional impermanence of protection has, directly or indirectly, depended on impairment in the specific power of vaccine contagion? an impairment become possible, since Jenner's first collection of facts? an impairment arising in the transmission of that contagion through many generations of men? On this difficult question contrary opinions have been expressed.

Opinion of Nat. Vaccine Establishment.

In a recent Annual Report (1854) of the National Vaccine Board the following paragraph occurs:—"We feel it our "duty, in order to dispel any doubts which may still affect "the public mind, to repeat what we have so frequently "stated with unabated confidence 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." This opinion, advanced with the authority of an establishment which, for nearly fifty years, has been concerned, and of late almost wholly concerned, in the distribution of vaccine lymph, is entitled to very respectful consideration. It represents, probably, the convictions of the permanent officers of the Board, Dr. Hue and Mr. Tomkins, founded on their own observations and correspondence, and endorsed by the three ex-officio members

of the Board, who, on occasion of this Report, were Dr. Paris, Mr. Luke, and Dr. Nairne.

Contrary opinions.

The opinion, however, does not seem to be universally shared in other countries of Europe; and, even in England, it has been received with much hesitation by those unofficial persons who have given most labour and ability to the study of vaccination. Some have argued that the vaccine contagion must naturally and inevitably become deteriorated in its successive human transmissions*; and perhaps, it is only as against this unqualified belief that the above quoted, equally unqualified, opinion, has many adherents. Others believe such degeneration to be only a contingent danger.* But in a large concurrence of testimony it is recognized at least as a possibility which has very frequently been realized.

Facts alleged.

From so long as forty years back, definite allegations have been made, purporting to prove that the power of vaccine lymph, as derived from successive contagions of the human subject, had progressively diminished. For instance, M. Brisset,† as early as 1818, declared that the past ten years had made a very marked difference in the visible characters of the vaccine vesicle; adding, that, for protective purposes, it was now necessary to produce, instead or Jenner's two vesicles, eight or ten points of infection; and Dr. Meyer,‡ of Kreutzburg, not only made the important remark, that, on examining in 1824–25 nearly 4,000 vaccinated persons of all ages, he had found the older scars of vaccination much better marked than the recent ones, but also stated, on the authority of the district vaccinators, that the proportion of unsuccessful to successful vaccinations was every year growing larger; and further, happening at this time to obtain

* *See Note* IV., page 308 : Degeneration of Vaccine Contagium.

† M. Brisset discusses the question in the Mém. de la Société de la Faculté de Médecine de Paris, 1818, and in his Réflexions sur la Vaccine et la Variole; Paris, 1828. In the latter (p. 166) he says :—"La manifestation et surtout la "cessation des symptomes de la vaccine me paraissent notablement abrégées; "la marche de cette maladie est plus prompte..... La tumeur vaccinale "(dont le développement est si essentiel pour constater l'activité du virus vaccin "et l'efficacité de la puissance préservatrice de la vaccine) est infiniment moins "proéminente, si même on peut dire qu'elle existe."

‡ Quoted by Steinbrenner, op. cit. p. 493.

for his own vaccinations a regenerated supply of lymph, he was able to make the supplementary observation, that this almost invariably acted with effect, and that the resulting cicatrices were again after the old normal type. Other assertions to the same effect were not infrequent; but opportunities of verification were rare, and the most important investigations of the subject belong to the last twenty years.

Comparative experiments.

Successive comparative experiments by M. Bousquet, Dr. Gregory, Mr. Estlin, Professor Hering, M. Fiard and Dr. Steinbrenner, have established, I think, beyond the possibility of reasonable doubt that certain original properties of the vaccine contagion have very generally declined, after its long, successive descent from the cow. It may require separate discussion whether all of these properties are of primary importance to the purpose of vaccination: but the fact at least seems certain, that, when the first difficulties of converting the cow-pox into a human contagion have once been overcome, this newly-humanized contagion shows an amount of infective power which is not usual in lymph of long descent. The former *takes*, as the phrase is, in persons with whom the latter has failed; often, for instance, in re-vaccination. It excites local changes of an intenser kind; so active, indeed, as to render caution necessary in its use. The vesicle produced by it runs a full course; compared with which the progress of common vaccine vesicles seems unduly rapid and their termination premature. Also it renders more certain, and apparently more characteristic, that slight febrile disturbance which is proper to the action of cow-pox on the human system.

Importance of these facts in relation to the continuance of small pox:

Now it is important to remember, that, in the comparative observations referred to, the lymph which has been stated more or less to have lost its original properties, has commonly been the current lymph of the country—the lymph of the public service. Those experiments, therefore, virtually say that millions of vaccinations have been performed with lymph not fully possessing its original endowments; and they make it at least very questionable, whether an indefinite length of transmission of the vaccine contagion, without renewal from the cow, has not been of public detriment.

Namely (1) of infantine and other natural small-pox;

For, assuming only that vaccine lymph is generally more likely to produce its expected *immediate* results in proportion as it is of short pedigree, I think this difference not unimportant. Frequent failures in vaccinating not only disappoint and annoy both parties concerned, not only discredit the operation and the operator, but likewise too often lead to an ulterior evil. Ignorant persons look rather to the mere doing of the operation than to the subsequent signs of its success; and it thus constantly happens that children who have been but nominally vaccinated are left with no further attempt to secure them against small-pox.

and (2) of post-vaccinal small-pox.

Likewise, looking to some other peculiarities which mark the action of vaccine lymph in its earlier generations, especially to that more prolonged course of the local eruption, and to that more decided febrility which attends it; symptoms, both of them, which seem to say that this infection grasps deeper and more largely into the system; I should very much hesitate to consider their occurrence indifferent to the ultimate issue of the operation. Not venturing to speak otherwise than with sincere diffidence on what I deem one of the deepest problems in pathology, I may yet urge at least the *probability* that these symptoms may be the very signs and measures of that total bodily change which vaccination is intended to effect. If this be a true interpretation of their meaning, surely a vaccination which is deficient in such consequences must inspire less confidence than another. And from the observations I have quoted, it would then apparently result that, after long periods of human transmission, the contagion of cow-pox has proved unable to excite in the vaccinated body its *maximum* of protective change; that lymph of shorter descent has been more successful in dispossessing the body of that ingredient which constitutes its susceptibility to small-pox.

Statistical test.

Is it, then, the case that an extensive use of degenerated lymph has determined that too frequent impermanence of protection against post-vaccinal small-pox? It is chiefly from national statistics that the answer must be sought; and the critical question to be asked in any country where the vaccine supply has seldom or never been renewed from the cow, is this:—Assuming that, from 1800 to 1840, every year's vaccination has included *a certain proportion* of infants who eventually (say 15–25 years afterwards) have become re-susceptible of small-pox—*has this proportion from year to year progressively increased.*

Increasing re-susceptibility of small-pox in the vaccinated?

Increasing re-susceptibility of vaccination?

In respect of small-pox itself there are no facts, I believe, nearly sufficient in amount for even an approximative answer to this question;* but in respect of a closely kindred issue there are some materials of a very suggestive sort. For, if it should appear that the proportionate re-susceptibility of vaccination at a given age were undergoing a uniform progressive increase, this—like a uniform progressive increase of post-vaccinal small-pox—would make it almost certain that primary vaccination had progressively become less effective. And it is difficult to conceive how the infantine generations of a country could, crop by crop, successively derive less permanent constitutional impressions from vaccination, unless the efficient cause of those impressions—the vaccine contagion itself—had year by year undergone enfeeblement of its powers.

Successive reports of re-vaccination in the Prussian army.

The case which I put as hypothetical, apparently represents the actual and immense experience of the Prussian army. There, the re-vaccination of recruits is a very uniform test. It extends annually to some forty or forty-five thousand operations. It is reported on annually. Its records run back twenty-four years. Its total result must tell of a million experiments: and the subjects, naturally, are of like age, in like proportions, and under like circumstances. I have already had occasion to say, that when, in 1833, this system of re-vaccination commenced, the proportion of successful

* It deserves to be noticed, however, that so long ago as 1833, Mr. Loy, of Whitby, gave (Med. Gaz. vol. xii., p. 48) an affirmative answer to the question, "I have observed (he says) in my own practice for many years that vaccination "afforded uniform protection; and since then an influence from vaccination "less and less effectual in resisting the contagion of small-pox;" and after citing instances to justify his belief, that post-vaccinal small-pox was progressively becoming both more frequent and less modified, he comes to a "conclu-"sion, that the vaccine virus had lost parts of its virtues," and recommends "reverting to its origin" as a remedy for this evil.

results (including cases in which the success came only with a second attempt) was 33 in every hundred vaccinations. Now the annual per-centages of successful results, for the whole time during which re-vaccination has been practised in the Prussian army, beginning with that number, run thus:—33, 39, 42, 46, 49, 50, 51, 54, 57, 58, 57, 57, 58, 60, 64, 64, 64, 61, 64, 69, 69, 69, 69, 70. The last proportion of success exceeds the double of that with which the series commenced. Thirty-three per cent. expresses the proportion in which persons vaccinated, say twenty years previously, had, in 1833, to a certain extent lost the influence of their infantine vaccination: it measures the impermanence of certain impressions produced by the vaccinations of 1813. And that impermanence (such as it was) in the effects of vaccination has increased, almost without exception, year by year, during this quarter of a century; so that the vaccinations of 1836—tested by eventual re-susceptibility to cow-pox—were not half so stable as the vaccinations of 1813.

Inferences as to the frequency of post-vaccinal small-pox.

That post-vaccinal small-pox may depend to some considerable extent on a primary incompleteness of that specific change which vaccination should have excited in the system; and that such incompleteness may have depended on an inactive degenerated state of the vaccine contagion;—these would seem, on analogy, reasonable inferences from the facts I have stated.* More than this I will not venture to say; for that remarkable series of figures, even with the observations previously alleged, does not constitute a proof, though it amply justifies suspicion.

The subject is one that deserves full and patient inquiry. Post-vaccinal small-pox has been a disappointment both to the public and to the medical profession. It has indeed been well to know of it that its attacks are mild in proportion as vaccination has been well performed. But better still

* It would not also follow that the imputed condition of lymph had been an inevitable consequence of its long descent. The alternatives apparently would be these:—either the enfeeblement of the contagion has resulted, slowly but necessarily, from this mere fact of its many successive transmissions;—or else, the effects of personal carelessness in the selection of lymph (see *Note* V) are capable of perpetuating and diffusing themselves enough to affect, very considerably, the national statistics of small-pox.

would be its utter absence. The information I have quoted to you encourages a belief that, with uniformly thorough infantine vaccination, such attacks would be extremely infrequent as well as extremely mild; provided—on the strength of these last intimations—that an essential condition of thorough vaccination shall be the employment of lymph in its utmost original efficiency. Fortunately Mr. Ceely's scientific experiments, and the very useful proceedings of Mr. Badcock at Brighton, have taught the medical profession in this country that it is not requisite to depend, for renewed sources of cow-pox, on the casual occurrence of this disease in the dairy. And, although I do not feel justified in stating it as proved, that what partial insecurity still attends even well-performed vaccination would certainly cease under a more frequent (if careful) imitation of those expedients, yet, at least, I would urge them as deserving deep consideration.

General results as to the good of vaccination.

Finally, then, to sum in a few paragraphs the practical results of this section, the last half-century's experience of vaccination justifies the following assertions:—

that in countries where vaccination is general, the fatality of small-pox has under its influence declined to some small fraction of that which formerly prevailed; that where formerly, in a given population, there would have occurred one hundred deaths by small-pox, there may now occur as few as four or five; and that in this very greatly diminished number annually dying of small-pox the immense majority are unvaccinated or ill-vaccinated persons:

that vaccination performed in infancy in the best manner gives to most persons through life a complete security against attacks of small-pox:

that (in some—hitherto undetermined—proportion to the whole number of the vaccinated) certain persons, as they approach adult life, partially or wholly recover that susceptibility to small-pox which vaccination had once extinguished in them:

that perhaps more universal permanence might be given to the protective influence of infantine vaccination by

well-devised arrangements for the periodical renewal of lymph; but certainly, that the renascent liability to small-pox may be guarded against by re-vaccination performed at about the period of puberty:

that even when small-pox is contracted by persons who, having been vaccinated in infancy, have not afterwards thus renewed their protection, the disease is greatly mitigated in favour of these exceptional sufferers; so that among the best-vaccinated of their number, according to the experience of the London Small-pox Hospital, its fatality is but $\frac{1}{70}$ and its chance of being confluent but $\frac{1}{10}$ as compared with the fatality and the chance of confluence of natural small-pox in unvaccinated persons:

that if, beyond the above qualifications, there still remain apparent exceptions to the uniform protective power of vaccination, they illustrate only that very infrequent peculiarity which occasions some individuals (especially in certain families) to suffer natural small-pox itself twice or thrice or even oftener; and

that, if vaccination were universally performed in the best known manner, deaths by small-pox would be among the rarest entries in the death-register.

IV.—Alleged Drawbacks from the Advantages of Vaccination, and alleged Dangers of its Practice.

[Note.—*In revising this chapter for the Editor, and here and there amending sentences, where I have believed I could thus give clearer expression to my original meaning, I have, at pages* 268–9, *omitted (but with marks of omission) some bits of argument which seem to me to have become obsolete; and at page* 275 *I have interposed, within brackets, a reference to some later knowledge which modifies the opinions of thirty years ago.*—J. S., 1887.]

Retrospect.

In England, since the termination, fifty years ago, of that important inquiry which was conducted by the College of Physicians, medical literature, even of the obscurest class, contains no more mention of "new, unheard of, and monstrous

diseases," ascribed to the influence of vaccination. Nor, so far as I know, can it be said that any person enjoying in the smallest degree the confidence of the profession, or in the smallest degree entitled to offer an opinion on medical evidence, maintains that properly-performed vaccination is a dangerous proceeding. Diseases produced by vaccination occupy in medical teaching and medical conversation about the same space as diseases produced by witchcraft and the evil eye; and it seems a waste of time to revert to what, even half a century back, was recognized to be mere stupidity or mischief-making.

Foreign echoes of our old controversy.

But in some other parts of the world these questions were not in the first instance so freely canvassed as in England; and perhaps on this account it may be that within the last ten years there have been published abroad papers which correspond to our Stuart-and-Rowley period in the history of vaccination. To the English medical reader such papers, if they come at all, come only as a kind of literary fossil; reminding him of something so utterly unpractical, antediluvian, and extinct, that the last act he would think of committing against them, would be to argue. Yet these foreign publications obtained a momentary notice in the last Parliament. And now, standing at the very threshold of the subject on which I must enter, they compel some recognition at my hands.

It is really quite impossible for me to speak of such writings with even the semblance of respect. I am willing to believe that the authors are not actuated by unworthy intentions. But the works are so ignorantly and so impudently written, their staple consists of such reckless guesswork or such mere declamation and balderdash, that it would be a mockery to treat them as belonging to the literature of science.* I can regard them only as trivial romances; and accordingly, while I propose discussing in this section of my Letter every substantial statement which has been raised against the practice of vaccination, I must claim to leave unfollowed the mere meanderings of nonsense in which those

* *See Note* V., p. 311 : Renewed attacks on Vaccination.

writers indulge. Instead of arguing with them whether vaccination has increased men's consumption of tobacco and lessened their tendency to dance, I will bring before you—in reference to more important issues—such accurate knowledge as I can gather, from national statistics and from the records of scientific experience, as to the real health of vaccinated populations.

Questions which may fairly be asked.

I. Undoubtedly, as to alleged incidental evils of vaccination, there are questions which may reasonably be asked. The fifty-nine years' experience which has established the merits of vaccination—has it shown any countervailing harm? Have vaccinated persons, in acquiring their insusceptibility to small-pox, become more suspectible of any other disease? Has anything tended to show that vaccination, however perfect for its purposes, is in other respects a disadvantage?

Fallacy to be guarded against in putting the question.

In proceeding to investigate this matter, there is, first, a source of fallacy to be guarded against. Those millions whom vaccination saves from one kind of premature death must of course die eventually. Susceptibility to small-pox is a very definite state of body; equally definite and distinct are the susceptibilities to other specific diseases; and it has never been pretended that man becomes less susceptible of one because he is less susceptible of the others. Vaccination is directed against the one susceptibility only; and a child whose liability to small-pox has just been extinguished by well-performed vaccination may to-morrow, like an unvaccinated child, be run over, or be drowned, or sicken of measles, or suffer with teething, or be struck with any other of the numberless shafts of death. And the vaccinated subject advancing to adolescence, to mid-life, or to old age, must encounter, like the unvaccinated, the several risks of each period of life. And obviously, if vaccination on a given day in England secures a thousand lives against death by small-pox, sooner or later those lives will be subject to the inevitable lot; sooner or later the thousand deaths will be written against the names of other diseases than small-pox; and such diseases may then be said to have been rendered more frequent by vaccination. In the same sense every life that is

snatched from fire, or flood, or poison, counts at last as a death from some other cause; and to say *in this sense* that such causes are more fatal than before vaccination, is but another form of saying, what Jenner would most have wished to hear, that small-pox is less fatal than it was.

Question in its amended form.

But are deaths *proportionally* more numerous? On a given number of persons (say a million) is the general death-rate higher, or is the death-rate at any particular age higher, or is the death-rate of any particular disease higher, now, than in the days of inoculated or natural small-pox? Has the suppressed mortality of small-pox commuted itself for other premature death?

The material of vital statistics is hitherto not sufficiently perfect; indeed, the science in its more precise applications is of too recent date, for this question to be answered exhaustively. But I have collected some very strong statistical evidence on the subject; and, such as it is, it tallies very thoroughly with what pathology would suggest as probable—that to have mitigated the horrors of small-pox, is, indeed, an unmixed good.

I. General death-rates.

First, for the *general death-rates*:—Taking all ages together and all diseases together, what used to be before the practice of vaccination, and what has been since the practice of vaccination, the annual proportion of deaths to a given number of living persons?

England. London.

As regards England, the means of comparing death-rates are confined to London; for before 1838 there was no general registration of deaths; and even in London they must be regarded as only approximative to the truth. During times before vaccination, there were the old Bills of Mortality; and for the last twenty years there are the Registrar General's reports. The Bills of Mortality are notoriously imperfect. They record not deaths, as such, but burials; and not all burials within the given area, but only parochial Church of England burials. Therefore much may have been omitted from them. But it is satisfactory to know, for the purposes of the present comparison, that whatever imperfectness there is in these records would make the older times appear less unhealthy than they were.

Now the question being—whether in proportion to the diminution of small-pox, there have grown up other influences to neutralize or even reverse the advantage, I am able, so far as the general death-rate of London is concerned, to give you the following evidence. My colleague, Dr. Greenhow, Lecturer on Public Health at St. Thomas's Hospital, has made an elaborate examination of the Bills of Mortality at two different periods, far apart, before the discovery of vaccination; selecting the two particular decennial terms, 1681–90 and 1746–55, only because at a central year in each of these terms the population of London was estimated, and this estimate of population is a necessary element in the comparison. Dr. Greenhow has kindly assisted me with a paper (Appendix H.) in which he gives at length the results of this interesting comparison; and I attach the more importance to his conclusions as I know that they have been arrived at with caution and impartiality. The annexed Table gives an abstract of

Average Annual Death-rates in London from all Causes and at all Ages.

Date.	Per 10,000 living.
1681–90 - -	421
1746–55 - -	355
1846–55 - -	249

so much as relates to the present point. It enables you, at a glance, to judge, in respect of London at least, how far it would be correct to say, that, with the decline of small-pox, the general death-rate of the population has increased. You will notice that in the decennial period 1846–55,—*though epidemic influenza and two visitations of cholera* fell within it,—the general death-rate per 10,000 of living population was 25 per cent. less than in the decennial period 1746–55, and 40 per cent. less than in the decennial period 1681–90; having successively declined since the remoter period from 421 to 355, and from 355 to 249.

Materials for a similar but more extensive comparison are given from the pen of Dr. Farr, in the fourth edition (vol. ii. p. 613) of McCulloch's "Descriptive and Statistical Account of the British Empire." From this valuable paper I have extracted (seq. pag. 256) a Table which is of great interest in reference to all the present section of my subject; and I here insert from it those totals which illustrate the point I am discussing.

You will observe, that in the successive lines of the annexed Table the general death-rates of London are given

Average Annual Death-rates in London from all Causes and at all Ages.

Date.	Per 10,000 living.
A. 1629–35	500
B. 1660–79	800
C. 1728–57	520
D. 1771–80	500
E. 1801–10	292
F. 1831–5	320
G. 1840–54	$248\frac{9}{10}$

for seven different periods of time during more than two centuries. The first line (A) shows for the period 1629–35 (though almost exempt from epidemic disease) a general death rate just double our present one; in the second line (B) it is seen that for the twenty years 1660–79 (including the fatal one 1665) the rate was $3\frac{1}{5}$ times as great as it now is;* and in the fourth line (D) it is shown, that during ten years (1771–80) towards the end of last century, when small-pox was fourteen or fifteen times as fatal as now, the general death-rate was still double.

Means of extending such comparisons to other countries than our own are but scanty; yet fortunately there are illustrations enough to show that London is not alone in

* See foot-note to the table at p. 256.

Denmark.

respect of the evidence which it gives. A statistical sheet (App. p. 171) which accompanied the general information given us by the Danish Government, contains an account relating to the city of Copenhagen, not only of deaths by

Births and Deaths in Copenhagen.	Excess of Births over Deaths.	Excess of Deaths over Births.	Average Annual Excess.
1750–75	—	22,186	Deaths 853
1776–1815	—	3,285	Deaths 82
1816–50	10,648	—	Births 304

small-pox for the years 1750–1850, but also of the total deaths, and of the births and population, during the same long period—half a century before and half a century after the introduction of vaccination. Causes of death are not (except small-pox) specially noticed; but the general result is enough to show that the statistics of Copenhagen concur with the statistics of London; for the sheet in question gives evidence of progressive improvement in the health of the population, and the year 1823, when for thirteen consecutive years there had not been a single death from small-pox, was also in other respects among the healthiest of the series. And the general progress of the population may be inferred from these particulars:—Of the 26 years 1750–75 there were 23 in which the deaths exceeded the births:—of the 40 years 1776–1815 there were 25 in which the deaths exceeded the births:—during the 35 years 1816–50 the births have exceeded the deaths on all but six occasions. Annually during the first period there were on an average 853 more deaths than births: annually during the last period, there were on an average, 304 more births than deaths.*

* Eighty years ago the notion that London might contain an increasing population seems to have been strange to men's minds. In a pamphlet of that period (Letter to Dr. Lettsom, by an uninterested Spectator of the Controversy upon General Inoculation: London, 1779) I read the following paragraph:—"I claim not the merit of starting this idea of an increased population in "London as a novelty; it has been hinted by others, particularly by yourself in "your medical memoirs, and by a writer who signs J. S. . . . but I think his "reasoning is not quite conclusive."

Sweden.

The more minute statistics of Sweden (to which I must presently refer again) are equally silent as to those compensatory deaths which the suppression of small-pox is imagined to cause. In the annexed Table, ranging through

Average Annual Death-rate in Sweden from all Causes and at all Ages.

Date.	Per 10,000 living.
1755–75 - -	289
1776–95 - -	268
1821–40 - -	233
1841–50 - -	205

N.B.—The *annual* small-pox death-rate during the period 1841–50 averaged less than the *weekly* death-rate from small-pox and measles during the period 1755–75.

the past hundred years, it is seen that in that well-vaccinated country the general death-rate of the population in 1841–50 is 29 per cent. lower than it was in 1755–75. If a third of this improvement be due to the comparative absence of small-pox, the remaining two thirds must be referred to the simultaneous decrease of other diseases.

So far, then, as these populations are concerned, it appears that, while under the influence of vaccination small-pox has been diminishing its ravages, so under other influences have other diseases been diminishing theirs. Under other influences, I say:—for the causes of fever, the causes of cholera, the causes of consumption are several and special causes. Each disease is affected for better or worse by influences proper to itself; and the prevention of small-pox no more implies the prevention of fever than to sow barley implies the reaping of wheat. But what has to be noticed (so far as these materials inform us) is, that annihilation of small-pox may be tried for as an unqualified physical good; that hitherto there is no trace of evidence that other diseases become more malignant in proportion as that one is subdued.

Conclusion from general death-rates.

II. Death-rates at particular ages and from particular diseases.

It now remains to be seen, whether, by a more detailed analysis of mortuary records—by inquiry into the death-

rates of particular ages and into the prevalence of particular diseases—it may perhaps be possible to discover any kind of evil which the general death-rates have failed to betray.

M. Carnot's doctrine.

Recent pamphleteers against vaccination chiefly rely on certain fragmentary statistics, collected with more zeal than judgment by a former artillery officer, M. Carnot.* This writer believes he has discovered what he calls a *displacement of mortality;* namely, that within the present century deaths which used to occur in early infancy have come to occur between the ages of 15 and 30. He alleges that the female death-rate in Paris for the ages 15–25 has doubled in the last 38 years; that the annual mortality of the French army on home-service was 2 per 100 during the period 1819–47, but had been only 1 per 100 before the Revolution of 1789; that of male and female deaths in Paris at ages above 15 only 35 per 100 used to happen between the ages of 15 and 45, and that now 50 per 100 are in this category: that the chances of an infant reaching 41 years of age are the same now as they were in the last century; that the death-lists of Paris for 1840–49, compared with those for 50 years previously, show some diseases (typhus, cholera, dysentery, and colic) to have increased almost as much as others (small-pox, measles, convulsions, and croup) have declined; that the annual marriages in France exceed twice as much as they 40 years ago exceeded the marrying proportion ($\frac{4}{5}$) of females who annually (on Duvillard's estimate) reach the connubial time of life, and that this increase denotes a doubled annual number of second marriages, or in other words a doubled annual quantity of early widowhood; that with a greatly increased number of marriages in France there is a diminished number of births; that the births are rapidly tending to become less numerous than the deaths; that the depopulation of France is an imminent danger, which must begin to realize itself within the next few years; that gastro-intestinal disease—especially typhoid fever—is the agent of

* Essai de Mortalité comparée avant et depuis l'introduction de la Vaccine en France; Autun, 1849; followed by an *Appendice*:—Analyse de l'influence exercée par la variole, ainsi que par la réaction vaccinale; Autun, 1851:—Parallèle de l'état sanitaire de Paris avant et depuis la vaccine; Rév. Méd. 1856.

this destruction; and finally, that the cause of this complicated derangement is the practice of vaccination.

Its logic.

Now, first, let the concluding word of the summary be criticized. M. Carnot's statistics allege a difference in adult vitality between the France of to-day and the France of last century. Supposing the statistics to be correct, does he give any sufficient reason for ascribing to vaccination that deteriorated state of adult life which he professes to have discovered? So little does he this, that in any of the sentences where damnatory conclusions are drawn, if there were substituted at hazard for his word *vaccination* the mention of any other historical event belonging to about the same period of time as Jenner's discovery, M. Carnot's logic would scarcely suffer by the change, or his new conclusion be less warrantable than his first. *Post ergo propter* was never more whimsically illustrated. For the argument goes simply to claim as the *effect* of vaccination whatever evils have happened *since* its discovery; and M. Carnot's moderation may be praised, that, with the infinite resources of this proof, he did not also convict Jenner of causing last year's inundations of the Rhone.

Its facts.

But are the facts such as M. Carnot pretends? I do not feel myself competent to discuss a doubtful question in the vital statistics of France; for I am but imperfectly acquainted with the relative value of those semi-official documents to which reference is made.*

M. Dupin's counter-statements.

Instead of offering opinions of my own, I will inform you that immediately after the publication of M. Carnot's first statements, M. Charles Dupin, before the Academy of Sciences (Nov. 20, 1848) treated the pretended discovery as an unmodified mare's-nest, and soon afterwards (Dec. 4) advanced

* Only I must observe that M. Carnot's superstructure of arithmetical conclusions rests on a treacherous basis; for his main argument proceeds from certain assumptions as to the ages of the population, and I have reason to believe that such assumptions are little warranted by existing knowledge. Death-rates at given ages, and expectations of life at given ages, are questions of proportion between the two quantities—how many at such ages are *living* and how many at such ages *die?* The latter element may generally be gathered from civil registers; but the former can only be got from a census of the population classified according to ages; and I am not aware that any such census had been made in France before the present century.

counter-statistics, which claimed to show the expectation of human life at every age in France as having notably improved since the last century.*

Dr. Bertillon's calculations.

More recently, Dr. Bertillon, Physician to the Hospice de Montmorency, after statistical researches which include both periods under discussion, has communicated to the Academy of Medicine results which are in direct opposition to M. Carnot's deductions.† In the Vaccination Report for 1854 of the Academy of Medicine, M. Bertillon's labours are mentioned in terms of the highest praise, and his conclusions are adopted without reserve.

The subjoined Table gives a summary of these conclusions, as stated in the report of the Academy. It states, for eleven periods of life, what was and what is the average expectation of death, viz.:—first, for different times in the last century, according to the several accounts successively published (1749–1806) by Dupré St. Maur, Montyon, Messance, and Duvillard; and, secondly, for the years 1849–50, according to M. Heuschling's account of the deaths in France and to several recent accounts (one of them founded on census) of the French population. In the fourth line (which is critical for the present question) the Table is read thus:—For persons aged between 20 and 30 the chance of dying was, in the first period, one in 67·97; in the second period, one in 66·40; in the third period, one in 64·67; in the fourth period, one in 73·55; in the fifth period, according to various more or less defective estimates of the population (the first of which specially illustrates a statistical fallacy) one in 73·38,

* M. Dupin concludes his paper in the following terms:—"L'allongement de "la vie à toutes les époques de l'enfance, de l'adolescence, de la virilité, de l'âge "mûr et de la vieillesse, pour les personnes de conformation pareille, voilà le "grand fait établi par les comparaisons rigoureuses que nous venons de présenter. "C'est le bienfait obtenu par les progrès des sciences et des arts appliqués au "bien-être du genre humain. Formons des vœux pour que nos demonstrations "mathématiques mettent un terme aux assertions erronées, et désolantes, "propagées par mille écrits et par mille déclamations qui s'appuient sur les "mortalités prétendues croissantes par l'effet du malheur et de la misère, qui "diminuent au lieu d'augmenter notre patrie."—Comptes Rendus de l'Acad. vol. xxvii. p. 571.

† L'Union Médicale, 1855; and Rapport sur les Vaccinations pratiquées en France pendant l'année 1854. This Report, though relating to 1854, is but recently published, and was not received here till March 25, 1857.

one in 86·20, one in 92·80; or finally, according to the census of the population, one in 93. Or if—simplifying the comparison—we take only the first column, which corresponds to the middle of last century, with the last column, which purports to be the most trustworthy account of the present state of life in France; and reduce the figures in both to the form of *death-rates per* 10,000 *living at the ages in question*, we find it stated, that for persons aged between twenty and thirty the death-rate used to be 147, and is now only 107½; that for persons aged between thirty and forty the death-rate used to be 215, and is now only 97.

Chances against death $\left(\frac{\text{Pop.}}{\text{D.}}\right)$ at different Ages of Life.	Successive periods of 18th century.				1849-50. Deaths by Heuschling, and Population by various authorities.			
	Dupre St. Maur.	Montyon.	Messance.	Duvillard.	Population cited as fallacious.	Population by Guillard.	Population by Mathieu.	Population by Census of 1851.
0 to 5 years -	7·17	7·05	9·59	8·28	12·05	13·60	14·80	13·19
5 „ 10 „ -	50·16	48·90	41·93	88·10	78·11	91·80	98·80	93·57
10 „ 20 „ -	113·90	103·80	85·30	108·00	124·74	146·30	157·90	151·50
20 „ 30 „ -	67·97	66·40	64·67	73·55	73·38	86·20	92·80	93·00
30 „ 40 „ -	46·45	47·56	58·00	58·73	78·85	92·66	95·80	103·00
40 „ 50 „ -	38·34	38·67	45.00	46·14	60·57	71·20	70·40	77·00
50 „ 60 „ -	26·92	28·11	32·00	30·72	34·47	51·00	48·20	54·00
60 „ 70 „ -	17·17	17·17	18·00	17·31	21·78	25·28	23·30	24·20
70 „ 80 „ -	8·21	8·21	10·35	8·84	10·37	12·18	10·58	10·50
80 „ 90 „ - }	5·63	{ 5·56	6·68	4·68	5·21	6·12	4·78	4·48
90 „ 00 „ - }		{ 3·84	5·34	3·87	3·76	4·17	2·82	2·73

Estimate by the French Academy of Medicine of the above statement and counter statements.

The following are the terms in which the French Academy of Medicine reports its judgment on Dr. Bertillon's work, and on the controversy which occasioned it:—

"De cette longue et laborieuse investigation il résulte que, de "quelque manière qu'on interprète les documents anciens et nouveaux "de la statistique, à la condition de n'abdiquer ni les lois de la logique "ni celles de la science, on arrive à des conclusions écrasantes pour "les adversaires de la vaccine en particulier, et en général pour les "contempteurs sceptiques du progrès. Car ce n'est pas par l'examen "d'un ou deux documents individuels, c'est par l'accord unanime de "tous les documents, qu'il est démontré que, depuis le siècle passé,

" depuis l'époque qui a précédé immédiatement notre grande révolu-
" tion, la mortalité s'est considérablement atténuée à toutes les périodes
" de la vie ; que particulièrement de vingt à trente ans, âge auquel,
" d'après les anti-vaccinateurs, la variole, d'abord vaincue, exercerait
" sournoisement de mortelles représailles, le danger de mort a diminué
" d'environ un quart. Aujourd'hui, 1,000 citoyens de vingt à trente
" ans ne fournissent que 10 à 11 décès, tandis qu'autrefois le même
" nombre de sujets en donnait au moins 13 à 14. Et les autres âges
" sont beaucoup plus favorisés que celui-ci !

"Enfin, bien que, pour l'armée et pour la ville de Paris, les docu-
" ments soient insuffisants pour mesurer avec exactitude, même depuis
" 1820, la diminution de mortalité, ils suffisent pour affirmer qu'il n'y
" a eu nulle aggravation ; tandis qu'au contraire des considerations
" puisantes démontrent pour Paris une tendance manifeste, dans un si
" court espace de temps, à la diminution des chances de mort, bien que
" le regrettable silence de la municipalité ne nous permette pas de
" dégager complément cette tendance pour l'apprécier numériquement.
" Rien, par consequent, absolument rien qui puisse motiver les excen-
" triques et persévérantes assertions des détracteurs de la vaccine.

"Si nous voulons résumer les causes qui les ont égarés, nous dirons
" que toutes leurs erreurs ont pour source commune l'ignorance des
" principes de la statistique et l'inexpérience de sa méthode, le
" manque complet de discussion et de critique, critique d'autant plus
" indispensable que les documents sont plus imparfaits. A chaque
" instant on les voit s'appuyer sur des hypothèses en contradiction
" formelle avec les conclusions bien connues de célèbrès et nombreux
" travaux. On les voit prendre pour mesure de la mortalité moyenne
" d'une nation, ici la mortalité allégée des rentiers, ailleurs la mor-
" talité aggravée des soldats. Plus loin, il confondent la table de
" survie avec la table de population, et tirent de l'une les conclusions
" que l'autre seule permettait. N'ayant aucune notion des lois qui
" régissent les mouvements de population, ils prennent pour une
" calamité la diminution lente et progressive des naissances, bien que
" ce mouvement régulier suive la prolongation de la vie humaine, et
" détermine dans la nation la prédominance des âges producteurs.
" S'ils veulent la survie applicable à une ville dont la population est
" la plus mobile, la plus incessamment et profondément remuée dans
" toutes ses parties, ils se servent d'une methode qui suppose l'immo-
" bilité et la régularité absolue dans la succession des vivants et des
" mourants. Ils supposent stationnaire une population croissante ;
" ils la supposent décroissantes suivant les âges, quand elle croît d'un
" âge à l'autre.

"Il ne leur suffit point de se jouer si audacieusement de la statistique ;
" ils ne respectent pas davantage les simples lois du calcul. Ils raison-
" nent, avec des quantités qui ne sont vraies que relativement à
" d'autres, comme si elles étaient vraie absolument. Ailleurs, au
" contraire, quand un rapport seul peut les instruire du danger de
" mort, ils omettent de s'en informer. Et ce qui est plus étrange
" encore que tous ces contre-sens, que tous ces défis portés à la science,

" c'est l'aisance parfaite avec laquelle ils s'y abandonnent, ne parais-
" sant pas se douter que ces matières aient pu être traitées avant eux ;
" c'est sans discussion préalable qu'ils supposent non avenus les
" célèbres travaux des Malthus, des d'Ivernois, des Benoiston des
" Villermé, des Quetelet, en sorte que ce qu'on peut faire de mieux
" en leur faveur est d'accuser leur instruction pour disculper la
" légèreté de leur procédés."*

Observation of other countries.

Thus much in answer to the question, whether the main facts of the case are such as M. Carnot pretends. A very slow increase, or possibly a decrease, of the French population at the present time seems indeed to be an admitted fact: and it is stated (I believe on the authority of official documents) that the standard of height for admission to the French army has of late years of necessity been reduced, because of the decreased stature of the general population; while nevertheless the proportion of conscripts found physically incapable of service has undergone a continuous increase.†

Be it so. Admit these allegations. Admit also every arithmetical conclusion, however contested, which M. Carnot founds on ambiguous fragments of imperfect local evidence. Admit every hypochondriacal presentiment—every assertion which M. Dupin and Dr. Bertillon and the French Academy of Medicine concurrently declare to consist in mere statistical error. And what then? Would any reasonable person proceed from these particulars to construct a universal theory (the first deduction from which must be that such particulars are general in Europe) never verifying his theory by any second instance, never looking for those imputed effects of that same cause in other lands where it operates? Should it not be a first impulse to ask, are these things so elsewhere? Do other countries suffer like this pitiable image of France? Is England beginning to be depopulated? are its women becoming less fruitful? Does Sweden show a *déplacement de la mortalité?* is its adult life now more precarious than

* Rapport sur les Vaccinations de 1854, pp. 66–9.

† It is beyond my present business even to question the truth of these assertions ; much more, to investigate, what, if they be true, may have been the real causes of the alleged deterioration and comparative sterility of the French people. The subject has been a good deal discussed in the periodical literature of the day ; and there M. Carnot may easily learn that for his favourite facts there exist more reasonable explanations than his own.

fifty years back? In Geneva, where mortuary records have been kept for three centuries, are any such results reported? Is the re-vaccinated army of Prussia wasting away with a quadrupled mortality? Does Bavaria, among its conscripts for military service, show an increased proportion of incapables?

Increase of population in Great Britain.

The most cursory examination of this kind might have convinced M. Carnot, that, whether his local arithmetic be right or wrong, his general medical conclusion is untenable. He might have read, for instance, in the Report of the Census of Great Britain in 1851, an announcement (I. p. 82) that "the most important result which the inquiry establishes " is, the addition in half a century of ten millions of people " to the British population; that the increase of population " in the half of this century nearly equals the increase in all " preceding ages; and that the addition in the last ten years " of 2,300,000 to the inhabitants of these islands exceeds " the increase in the last fifty years of the eighteenth " century." Or, so far as relates to the nineteen years during which a general registration of births has existed in England, he might have learned that, with us, at least, there is no evidence of a failing fecundity; that in the early part of this period (1838–40) for every 1,000 women aged between 15 and 45 there were registered 133⅓ living births, and in the latter part of the period (1851–56) for every 1,000 such women 144⅓ living births.

Death-rates of different ages in Sweden.

And whatever fallacy belongs to the imperfect condition of vital statistics in France might have been avoided, if M. Carnot had but studied the admirable records of Sweden; where not only would he have found, in respect of that well-vaccinated country, no evidence of the "displacement " of mortality" which he ascribes to vaccination, but would have seen how much better now than during last century are the chances of every period of life. In the annexed Table (for which I have to thank Dr. Farr) an abstract is given of the Swedish returns. You will observe that even in the penultimate period (within which the fatal cholera epidemic of 1834 killed 12,637 persons) the population at all ages under 30 years of age, consisting of course for the most part of vaccinated persons, showed a much less death-

rate than the population of the like ages in the former century. And in the next period (1841–50) when vacci-

ANNUAL MORTALITY TO 1,000 PERSONS LIVING.

Ages.	21 Years (1755-75).	20 Years (1776-95).	20 Years (1821-40).	10 Years (1841-50).
0-5	90·1	85·0	**64·3**	**56·9**
5-10	14·2	13·6	**7·6**	**7·8**
10-15	6·6	6·2	**4·7**	**4·4**
15-20	7·6	7·0	**4·9**	**4·8**
20-30	9·2	8·9	**7·8**	**6·8**
30-40	12·2	11·6	11·8	**9·8**
40-50	17·4	16·1	16·7	14·5
50-60	26·4	23·9	26·0	23·6
60-70	48·1	49·3	49·4	46·3
70-80	102·3	104·1	112·9	102·8
80-90	207·8	197·4	243·7	228·5
90 and upwards	394·1	351·3	396·4	375·8
All ages	28·9	26·8	23·3	20·5

The figures which are put in heavier type relate to that section of the population which has been born since the introduction of vaccination, and of which (persons under 30 in the fourth, and under 40 in the fifth column) the greatest part is undoubtedly vaccinated. Of persons ten years older, especially in the last column, many are vaccinated; of persons still older, a diminished and diminishing proportion.

nation would have affected at least all ages up to that of 40 years, the corresponding death-rates show an improvement on the earlier vicenniad 1821–40, and a still more striking improvement on the death-rates of the last century.

As regards the City and Canton of Geneva—specially interesting for comparison because of the great length of time over which the records extend—M. D'Espine, with no controversial object, arrived some years ago at results which can afford no encouragement to M. Carnot; and the appended Table is part of one in which M. D'Espine has very compendiously expressed his conclusions. You will observe, that although in its first column it bears testimony to the diminished pressure of infantile disease, the mortality which has been saved to infancy and childhood shows no signs of having been displaced into the next following periods of life. On the contrary, while the per-cental chance at birth of living

to 10 years of age has increased in Geneva within the last century from 60 to 74; the per-cental chance for those who

Survivance in Geneva at various Periods from 1560 to 1843.	Per-centage of those Born who reach 10 Years of Age.	Per-centage of those Living at 10 Years of Age who survive to 40.
City of Geneva :		
1560—1600	42	43
1601—1700	48	53
1701—1760	60	68
1761—1800	61	71
1801—1813	69	72
1814—1833	74	72
City and Suburbs: 1816—1830	74	74
Canton: 1838—1843	74	71

Annales d'Hygiène publ. et de Méd. légale, tom. xxxviii.

complete 10 years, that they will continue living to the age of 40, has increased from 68 to 72.

England. The English population was never classified according to ages till the census of 1841; and therefore a similar comparison between its past and present condition is not possible. But at least, in looking at the composition of a given number of deaths now and in the previous century, it is easy, where one compares similar populations, to see that deaths in early adult life have not taken the place of those which formerly befell infancy. Thus, if I contrast Dr. Short's account* of 405,951 deaths within the Bills of Mortality of London for the years 1728–43 with an account† which I kept of 22,332 deaths registered within the City of London during the

* New Observations on City, Town, and Country Bills of Mortality, &c. By Thomas Short, M.D. London, 1750, p. 92.

† Report on the Sanitary Condition of the City of London for the year 1854–5, Table VI.

years 1848–55, I find (as in the annexed Table) that the two periods differ considerably as to the proportion which

Composition of 1,000 Deaths in London at two Different Periods.

Ages.	Bills of Mortality, 1728–43.	Registration of City of London, 1848–55.
0–5	455	375
5–10	36	42
10–20	31	42
20–30	76	63
30–40	91	80
40–50	93	90
50–60	82	92
60–70	62	100
Over 70	74	116

different ages contributed to every thousand deaths. In the former period, persons aged sixty and upwards were only 136 per 1,000; in the latter period, were 216. In the former period, deaths under forty years of age were 689 per 1,000; in the latter period, only 602. And of deaths at ages above fifteen, those between fifteen and forty-five constituted in the later period not (as in Paris) 50, but about 37 per cent. This argument, of course, is not nearly so good in kind as might be drawn from the divisional death-rates of a population classified according to age; but the latter material, as I have said, is inaccessible;* and I adduce the present argument, though unsatisfactory, chiefly because M. Carnot has used it in respect of the Parisian population: and I wish to notice, in illustration of the essentially local character of his facts (if facts they be) that the mortuary records of London and Paris would lead him to opposite conclusions.

Military establishments. Similarly, when M. Carnot deplores — it is said, mistakenly—the enfeebled health of the French army, *infiniment moins capable que leurs devanciers de supporter les privations*

* *See Note* VI., p. 312: Comparison of English Death-rates from all Causes in Pre-Vaccination and Post-Vaccination times.

et les fatigues inséparables de la guerre; and when another statistician of the same school alleges that the proportion of French conscripts declared physically unfit for military service has, since 1816, been an increasing one; how obvious the course, if one would understand such facts (assuming them for the moment to be facts) to inquire whether they belong only to France, or are common to many European countries. Such an inquiry would have led the alarmists to doubt the accuracy of their own local observations. It would have told them that in the Bavarian army,* during the period 1821–51, the per-centage of physically unavailable conscripts has not increased, but diminished, from $23\frac{1}{3}$ at the beginning of the period to $21\frac{3}{4}$ at its close: that in this army, vaccinated and re-vaccinated as it is, the death-rate for the years 1844–47 has been even better than that somewhat arbitrary standard of healthiness which M. Carnot adopts from Deparcieux's *select* lives of the last century; and that in the Belgian and Prussian armies, according to the same authority, the death-rates were little less favourable.

The preceding evidence will have satisfied you, I think, that M. Carnot's assertions are such as he cannot substantiate. You have seen that, even as regards France, his fundamental statements are flatly contradicted; and that the sanitary statistics of France, if they were such as M. Carnot pretends, would bear no such particular reference to the subject of vaccination, nor be so corroborated by the statistics of other countries, as in any degree to justify his conclusions.

Death-rates by particular diseases.

Yet let me beg you, before leaving the subject, to look at it in one other aspect. Although the accusers have not been very scrupulous about their arguments, still they have thought it necessary to enter into some detail as to the mode in which the world is to be depopulated, and as to the symptons of that vaccination-poisoning which they denounce. It is well that they have done so. The more detailed an inquiry, the more advantageous it becomes to truth; and those who are accustomed to the cross-exami-

* Würdigung der Vortheile der Kuhpockenimpfung, von Dr. Reiter, p. 40; and Die Vaccination und ihre neuesten Gegner, von Dr. Haeser, p. 32.

nation of witnesses, will not wonder that the traducers of vaccination have committed themselves to opposite details. "Under the mastick-tree" and "under the holm-tree" were the small but sufficient discrepancies of two famous accusers; and this case is recalled to one's mind, as one finds that the theories which charge vaccination with destructive results differ as to the diseases by which it kills. "Les maladies "du poumon n'ont pas eu de part sensible à l'accroissement "de la mortalité de la jeunesse," is the result of M. Carnot's arithmetic: "le vaccin a corrodé les poumons" is among the invectives of M. Verdé de Lisle. To the former accuser, croup is among the diseases which have diminished; while to the latter (who will admit no gleam of hope for mankind) it is among those which are "presque généralisés par "le vaccin."

Whether these gentlemen agree or differ is, after all, of little importance. They are so ignorant of medicine, that what they accept or reject is a matter of no scientific moment. But the question whether vaccination, in rendering persons less susceptible of small-pox, renders them more susceptible of any other disease, is one of pathological interest, and one which may reasonably be considered.

To a great extent it is already answered, and especially so in a practical sense. The preceding statistics having shown you for the present century frequent instances of large reduction in general death-rates, with improvements in the expectation of life at all ages, it becomes comparatively unimportant to consider whether this or that disease contributes more or less to the diminished total. But there are two special classes of disease to which it is well to advert; because, respecting them, some random assertions have been made, that they, since the introduction of vaccination, have become more numerous.

Scrofula and fever.

I refer first to what are called *scrofulous affections*— including that terrible scourge of human life, pulmonary consumption, or phthisis; secondly, to *continued fevers*, and especially to that kind or variety (typhoid fever) in which

certain glands of the intestinal canal undergo a characteristic inflammation.

Sources of fallacy in comparing past and present diseases.

It will be obvious to you that the comparison of present with past diseases is one extraordinarily liable to fallacy. Names of disease are constantly varying: not only because the language of physic changes with the general language of the country; but more especially because, as the anatomical and chemical knowledge of disease is extended, nomenclature becomes more precise, and maladies which had been lumped together under one undescriptive name get their several distinctive titles. Instead of troubling you with medical instances of this very notorious fact, I may remind you that zoology and botany and chemistry illustrate the same process. This may be seen in comparing our scientific lexicons with those of the last century, and observing that animals and plants, and chemical elements and compounds, have "increased since the practice of vaccination," simply because the study of nature has not stood still since the age of Linnæus, Buffon, and Scheele. Later science has added facts to their inventory, has recognized old affinities in altered light, and has broken into new parcels the former groups of premature classification. So it has been with diseases: our increased vocabulary has been in proportion to the great scientific progress of the last thirty years; it denotes that more distinctive enumeration of disease by anatomical or chemical characters which is due to the labour of Laennec and Louis, and Rokitansky and Bright, and innumerable others who have developed these studies of medicine.

Statistics of the subject.

Therefore I cannot refer to statistics with entire facility. But, taking such as can be found, you will notice that all their evidence points one way.

London.

The two annexed tables (to which I have already referred) furnish the means of comparison as regards London. The former of them gives the abstract of Dr. Greenhow's investigation: the latter is the work of Dr. Farr. As you glance below at the names of disease transcribed from the old Bills of Mortality, and as you read the notes to

Dr. Greenhow's table in the Appendix (p. 29) you will appreciate the difficulty to which I just referred. Both tables have been constructed with due regard to those sources of fallacy; and it seems impossible to examine their details without being satisfied on the matter in hand.

General and Differential Annual Death-rates in London per 100,000 Living at Three different Periods during the 175 Years 1681–1855.

Date.	From all Causes.	From Small-pox.	From Pulmonary Affections.		From Fevers.	From Strumous diseases.
			Including Pneumonia.	Exclusive of Pneumonia.		
1681–90 - -	4210	313·9	693	693	633	801
1746–55 - -	3550	304·4	734	734	539	1099
1846–55 - -	2490	33·8	682	528	385	206

Fever.

First, with regard to fever:—Dr. Greenhow, throwing into one group all those deaths of the present day which might have been included under the old application of the word "fever" (counting scarlet-fever and inflammation of the brain, and inflammation of the lungs in this category) still finds that, even with this large addition, the so-called "fever" of the present day occasions only a death-rate of 385 per 100,000, whereas a century ago its death-rate was close on 539. And Dr. Farr, in commenting on the somewhat similar materials which he contributed to McCulloch's work, remarks, without reference to any controversial point, that "fever has progressively subsided since 1771;" and that the combined mortality of small-pox, measles, and scarlatina is now "only half as great as the mortality formerly occasioned by small-pox alone."

Scrofula. Consumption.

So again, says Dr. Greenhow, with scrofulous affections. Exclude phthisis from the comparison (because of the formerly imperfect means of recognizing its presence) and the scrofulous death-rate per 100,000, which in 1681–90 was

801, and in 1746–55 was nearly 1099, is now but 206; so that, looking to the middle of the last century,—the

GENERAL and DIFFERENTIAL ANNUAL DEATH-RATES in LONDON per 100,000 Living at Seven different Periods during the 226 Years 1629–1854.

Causes of Death.	Bills of Mortality.						Registration Returns. (Dr. Guy.)
	1629–35	1660–79*	1728–57	1771–80	1801–10	1831–5	1840–54
Small-pox	189	417	426	502	204	83	40
Measles	16	47	37	48	94	86	58
Scarlet fever	?	?	?	?	?	53	90
Fever	636	785	} 785	621	264	111	101
Spotted fever	45	90					
Plague	125	1225	—	—	—	—	—
Dysentery	221	894	50	17	1	1	9
Surfeit or cholera	63	148	1	?	?	135	78
Pleurisy	14	6	10	5	4	39	6
Asthma and tisick	?	?	112	85	89	136	45
Consumption	1021	1255	905	1121	716	567	323
King's evil, scrofula	14	19	5	5	?	3	12
Dropsy	146	349	218	225	131	133	59
Apoplexy and suddenly	47	30	48	55	49	59	81
Palsy and lethargy	14	17	12	18	19	28	46
Old age, bedridden	370	388	415	324	241	357	130
Casualties	65	76	85	70	40	57	77
Childbed and miscarriages	80	100	43	47	32	43	19
Chrisomes, overlaid, convulsions, worms, teething, mold-shot head, dropsy on the head, inflammation of brain, rickets, liver-grown, canker, thrush, croup, hooping-cough	1681	1591	1827	1682	789	625	} 1314
Inflammation	?	?	10	31	101	307	
Unknown causes	?	?	?	?	?	88	
Other diseases	253	565	211	144	146	289	
All causes	5000	8000	5200	5000	2920	3200	2188

golden age of the vaccino-phobists,—we find *a scrofulous death-rate more than five times as great as our present*

* That death-rate of 8 per cent., the average for London during the twenty years succeeding the Restoration, may have been in Mr. Macaulay's mind when he criticised in his history (end of Chapter III) the delusion "which leads men "to over-rate the happiness of preceding generations." "It is now (he says) the "fashion to place the golden age of England in times when noblemen were

one. And then trying by a different process to estimate the former fatality of phthisis—examining, namely, for the three periods compared what deaths have been attributed to diseases of the respiratory organs—we find that, even with the utmost amplification of this list (including pneumonia, which formerly may have been counted to "fever," and including respiratory affections of infancy, which would formerly have been counted to "chrisomes," and including similar affections of advanced life which would formerly have been counted to "old age") still the *pulmonary death-rate of the present time is seven per cent. lower than the pulmonary death-rate of* 1746–55. Dr. Farr's conclusions quite confirm the tendency of Dr. Greenhow's evidence; and he remarks, as the general result of his inquiry, that "the "proportion of persons "destroyed by consumption with "other forms of scrofula, has (except in the anomalous "period 1771–80) progressively declined in London."

Circumstantial inquiry in particular cases fatal to M. Carnot's theory.

As regards more detailed statistical inquiries — such, namely, as depend on the minute examination of particular cases—it may be observed that there has never been adduced a tittle of evidence to show that vaccinated individuals suffer more than non-vaccinated individuals from any ail-

"destitute of comforts, the want of which would be intolerable to a modern "footman; when farmers and shopkeepers breakfasted on loaves the very sight "of which would raise a riot in a modern workhouse; when men died faster in "the purest country air than they now die in the most pestilential lanes of our "towns, and *when men died faster in the lanes of our towns than they now die on "the coast of Guiana.*" According to M. Carnot there ought to have been very little natural small-pox in those days. What say our diarists of London life? In the pages of Pepys and Evelyn there are many references to small-pox; from 1660—when "in the midst of all this joy and jubilee, the Duke of Gloucester "died of it in the prime of youth, and a prince of extraordinary promise"—to January 1695, when (the disease having already raged for two months, and the queen having died of it) "the deaths by small-pox increased to five hundred "more than in the preceding week;" and perhaps the strongest expression occurs in the very middle of that period when other diseases were so fatal. In 1668 (Feb. 9) Pepys writes, "and among other things, if I have not already "set it down, it hardly ever was remembered for such a season for the small-"pox as these last two months have been; people being seen all up and down "the streets newly come out after the small-pox." It was in 1685 that Evelyn related, "in bitterness of sorrow and reluctancy of a tender parent," the loss of his own daughter by the disease.

ment whatsoever. On the contrary, where such inquiries have been made, they have distinctly refuted the supposition.*

As soon as M. Carnot's assertions were made public—as soon as he had committed himself to a statement† that typhoid fever was to be considered as the vaccinational substitute for small-pox, there was something definite for the physicians of France to investigate. They proceeded to do so. They did not shelter themselves under any general arguments. They did not confine themselves to saying to M. Carnot, that where he had found a new disease there was really but a new name. They did not superciliously refer him to common text-books of medicine from which he might learn, what were the ravages of typhoid fever—

* In the year 1814 Mr. Macgregor, then Surgeon to the Royal Military Asylum at Chelsea, published (Med. Chi. Transact. Vol. v.) an account of observations which he had made in that establishment during the ten preceding years in order to ascertain "whether measles, hooping cough, and scarlet fever had been more "fatal and severe in the children, male and female, that had undergone vaccination, than in those that had been subjected to the casual or inoculated small-pox." Of children in the latter category there had been 1550; among whom had occurred 420 cases of measles, hooping cough, and scarlet fever, leading to 19 deaths. Of children in the former category there had been 891; among whom there had been 239 cases of the same diseases, leading to 9 deaths. The fatality of these diseases, then, to such as they attacked, was 1 in 22 among the variolated class; 1 in 26½ among the vaccinated class; so that what difference existed was in favour of the latter.

† In this doctrine M. Carnot has found two adherents, whose works require no distinctive notice; viz., M. Ancelon, who has written "des transformations des fièvres essentielles dont le cowpox est la cause," and M. Bayard, who has communicated similar crudities to the Academy of Sciences. The following passage from the *Comptes Rendus* of this body (Feb. 10, 1851) may be conveniently quoted, as expressing in a succinct form those doctrines of which my text shows the refutation:—"M. Bayard, dans cette nouvelle note, présente une série de "propositions se rattachant toutes plus ou moins directement à cette idée déjà "soutenue par lui dans ses précédentes communications, que la maladie désignée "sous le nom de fièvre typhoïde n'est qu'une variole interne attaquant les "individus que la vaccine a préservé, dans leur jeune âge, de la variole avec "éruption externe. De ces douze nouvelles propositions, nous nous contenterons "de reproduire les deux suivantes. XI. La variole confluente et la fièvre "typhoïde ne sont, très probablement, qu'une seule et même maladie, externe "dans un cas, interne dans l'autre, produite par la combinaison du typhus et de "la variole. XII. L'inoculation du virus varioleux dans l'enfance préserve le "sujet inoculé des complications, souvent mortelles, dues à la combinaison de la "variole avec les causes morbides intercurrentes."

under other names—long before the discovery of vaccination. But with a candour and humility which did them honour, they accepted the medical hint of their arithmetical opponent, and set to work on the subject. And with what result? Why, that as fast as facts could be collected, the facts refuted him; that the typhoid infection was observed not only to pay no special regard to the unvaccinated, but even to attack persons in the very hour of their emergence from small-pox; that, conversely, small-pox would attack others in their actual convalescence from typhoid fever; that to have had the one disease, or to have escaped it, made absolutely no difference to having the other disease or escaping it; susceptibility to the one infection standing in no discoverable relation towards susceptibility to the other; and vaccination having no more to do with typhoid fever than with any other casualty of life which befalls vaccinated and unvaccinated alike.*

Summary of results of detailed investigation.

Apart from those demonstrations, a second great series of facts, observed for the last fifty years, is conclusive against M. Carnot's imagination. When masses of vaccinated persons are exposed to the infection of small-pox, if some of them suffer, do they suffer typhoid fever or any intestinal ulceration, inflammation, or disturbance? Here is exactly M. Carnot's postulate, small-pox infection acting on the vaccinated body; and the result is among the most extensively and most accurately observed phenomena of clinical medicine. In it there is the utmost possible refutation of M. Carnot. On his showing, there should be typhoid fever. In fact, there is nothing like it. Under the happy influence of Jenner's discovery, the small-pox is mitigated, perhaps almost to nothing. A few pustules, rapidly drying up, may alone attest that the once dreadful enemy is working in vain against a protected body. Of typhoid fever, of intestinal complication, of any other like disturbance, there is literally not a trace. But, just in proportion as the pustules are few, just in proportion as the protectedness against small-

Second class of facts fatal to M. Carnot's theory. What happens when vaccinated persons are exposed to variolous infection?

* *See Note* VII., p. 313 : Indifference of Typhoid Fever to difference between Variolated and Vaccinated persons.

pox has been all but complete, so—in diametrical contrast to M. Carnot's notion—the other sufferings of the patient will be slight, and his convalescence rapid.

Sanitary experience of the real causes of typhoid fever.

It may further be observed, that investigations made in this country have established among the certainties of medicine that typhoid fever mainly depends on causes quite remote from the causes of small-pox. And in respect of those districts or institutions in France where this disease is said to decimate the inhabitants, I will venture to affirm, as confidently as if I had visited the localities, that any qualified person inquiring into the *diet and atmosphere* of such populations, especially into their drinking-water, drainage, and domestic arrangements for cleanliness and ventilation, would be able readily to explain from local circumstances, and almost as readily to obviate by local improvements, any such specific mortality as M. Carnot alleges to exist.

Scrofulous affections.

As regards the second class of diseases to which special reference has been made—the scrofulous or tubercular class—the pathological argument is at least equally applicable. The causes of such diseases are radically different from the causes of small-pox. To talk of such diseases being the vaccinational varieties or introversions of small-pox—to talk of their promising to be developed in proportion as small-pox becomes suppressed—is simply to talk at random.

What is meant by scrofula.

There are two senses in which the word "*scrofulous*" is used in pathology: first (somewhat indefinitely) in reference to such sub-acute and chronic *inflammations*, often of an ulcerative kind, as are apt to arise with little or no exterior provocation in various textures of feeble and ill-nourished persons; secondly and more strictly, as appropriate to the specific constitutional fault which in certain persons disposes certain organs to suffer *tubercular* disease.

Scrofula without tubercles.

"Scrofula" in the first-mentioned sense is not independent of hereditary influences, but its principal causes have to do with the mere keeping and feeding of the individual

Its real causes.

sufferer. Scientific experiments have been made to imitate it in the brute creation; and unintentional experiments on millions of mankind have shown, on an awful scale how

naturally it associates itself with insufficiency of nourishment, with exhausting toil, with care and grief, with squalid cheerless circumstances of life, and with other like influences; how large an element it therefore is among the diseases of the poor, and often of the imprisoned; how habitually it is but the sequel and index of pre-existing depression of health. To say then of "scrofula," when the word is used in the above sense, that the practice of vaccination has tended to increase its prevalence, is to allege against vaccination a charge which would seem peculiarly inapplicable. If you compare the degree in which natural small-pox weakens and exhausts those whom it refrains from killing, with the contrary and entire absence of such results among the ordinary effects of vaccination, you have in this comparison a measure of the important influence which Jenner's discovery has exerted, not in aggravating, but in mitigating, the prevalence of such "scrofula" as is here meant.

Vaccination a powerful indirect influence against it.

Scrofula with tubercles. Phthisis.

Almost the same may be said of "scrofula" in that second-mentioned and more definite sense in which the tendency to pulmonary consumption and to other tubercular affections is meant. Scrofula in this sense is eminently apt to be hereditary. In persons who have inherited the tendency, some circumstances will very much favour, while other circumstances will very much disfavour, the actual manifestation of tubercles; but the tendency itself, the root of the disease, is in no immediate dependence on exterior conditions. It lies in those laws of development under which the chemical changes of the body, like its growth of stature and of features, are made conformable to a particular parental type; it belongs to the likeness between parent and child; it forms part of the family entail; and so little does it stand in any apparent connexion with vaccination, that on the contrary, it even shows marked preference for those very periods of life, when the protective influence of infantine vaccination has often partially become obliterated. What then do those writers mean who talk of tubercular diseases being made more frequent by vaccination? They can hardly mean that vaccination propagates from one person to another the developmental peculiarity which I have described; for

Its real causes.

this would be almost as if they said that vaccination could determine the future length of the legs, or the future shape of the nose. If on the other hand they mean, that, where the tendency to tubercular disease has been inherited, vaccination is a circumstance to favour, and small-pox a circumstance to disfavour, the actual manifestation of tubercles, then, again I would say, only let them read the history of small-pox. Among recognized developing conditions of "tubercular affections" just as among the causes of the "scrofulous inflammations" previously spoken of, impoverishing and depressing influences hold, by common consent, the most considerable place;* and, so far as we know, it is only as an impoverishing and depressing influence that either small-pox or vaccination can be imagined to operate,

Vaccination indirectly preventive of tubercular, as of non-tubercular, scrofula.†

Thus, in short, in whichever of its two senses the word "scrofula" be used, all writers on small-pox attest the frequency with which "scrofulous" affections follow in the train of small-pox; and in such measure as vaccination is less

* Monsieur d'Espine, of Geneva, has attempted to measure, with some degree of statistic precision, the influence of poverty in producing certain diseases. He says:—"Les décès par vice scrofuleux forment le $\frac{21}{1000}$ des décès déterminés "dans la mortalité générale, le $\frac{6}{1000}$ des décès des riches, et le $\frac{34}{1000}$ des décès "des pauvres. La prédisposition scrofuleuse chez les pauvres est ici aussi "frappante que l'influence préservatrice de l'aisance. Les décès par vice tuber- "culeux entrent pour les $\frac{155}{1000}$ dans les décès déterminés de la mortalité générale, "tandis que chez les riches il n'y a que 68 décès pour 1,000 qui se rapportent "aux tubercules; chez les pauvres, on en compte 233 pour 1,000. Ici encore "on trouve une influence très prédisposante de la misère et une action préser- "vatrice de l'aisance."—Annales d'Hygiène Publique, t. xxxviii.

† It deserves notice, that this indirect *prevention of scrofulous affections* was among Jenner's hopes when he announced the discovery of vaccination. In various passages of his writings (e. g. op. cit. pp. 60, 116, 181) he refers to the notorious frequency with which such affections were excited by small pox; and he appeals to general consent as to inoculated 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." It is worth while to remember that these charges were brought against the practice of small-pox inoculation long before the discovery of vaccination; and not only amid the frantic prejudices against its first introduction but even to the end of the century, when certainly its dangers in this respect must have been greatly diminished by the improved methods of treating inoculated

impoverishing and less depressing than small-pox, in just such measure should we expect that its substitution for small-pox would act, not in extension, but in prevention, of scrofula.

Summary of results on the morbid liabilities of vaccinated persons.

So far, then, as regards properly-performed vaccination, there is absolutely no reason to believe or suspect that, in rendering persons less liable to contract small-pox, it renders them eventually more liable to contract other diseases. Neither in speculative pathology, nor in common practice, is there the slightest semblance of support for any such doctrine. It ranks with the old misgiving, that vaccination would make horns grow and cover the body with cow-hair. Those who would have believed the one may believe the other.

What does vaccination really do to the human body?

Is properly-performed vaccination, then, an absolutely inoffensive proceeding? No, nor does it pretend to be so. Its very intention is, that it shall artificially produce a transient and trifling indisposition; that for some days the infant shall be uncomfortable with a sore arm and a slight irritation of the adjacent axillary glands, and a perceptible amount of general feverishness. Within the limits of this description, one child may be a little more, another a little less, inconvenienced: but those limits are rarely exceeded. And if it cannot strictly be said that the immediate effects of well-performed vaccination never exceed the intentions of the vaccinator, at least it may be affirmed that any permanent injury resulting from it is an accident barely known in the practice of surgery.

Does vaccination cause cutaneous eruptions and glandular swellings?

Persons hostile to vaccination allege against it, that it produces eruptions on the skin and glandular swellings: and

patients. In a pamphlet written between 1793 and 1798 earnestly in defence of inoculation (Advice to Parents on the Management of their Children in the Natural Small-pox and during Inoculation; Newark and London, n. d., p. 3) I find the following passage:—"The propriety of inoculation is confirmed as well "by reason as experience; and though some unfavourable circumstances have "happened in the hands of ignorant and illiterate persons; though repeated "eruptions have given rise to the false report of patients having the disease a "second time; though the *vis vitæ* of some whose constitutions were not very "strong, and the proper medicines through a want of skill not duly proportioned, "has been injured; though persons with weak lungs have been thrown into "pulmonic complaints; yet these contingencies are by no means to be charged "to the method itself."

others, not unfavourable to the practice, doubt whether this may not to some extent (and especially as regards unhealthily-predisposed scrofulous children) be a true allegation. Vaccination might afford to bear these imputations. For, to what do they amount? Were they ever so true, the alleged evil—even to the sufferer—would be little in comparison with his gain; and the total amount of such evils, compared to the social advantages of vaccination, would, literally speaking, be too small to appreciate.

Circumstances under which these disorders occur.

But, in fact, the imputation is, at least generally, erroneous. It generally expresses the common fallacy, *propter quia post*: that whatever ailment has happened to come after vaccination is too hastily judged to be its effect. An infant is commonly vaccinated at three or four months of age: thus whatever physical or moral evils belong to human life are very likely to have been preceded by vaccination; and it would be wonderful if ignorant persons did not often ascribe to the operation a very undue share of responsibility for those evils. When you consider, too, that the few months after vaccination include events which are very critical to infant life, you will see what frequent room there must be for misconception. Even to the healthiest and best cared for of children, weaning and teething are not perfectly safe and comfortable processes; to delicate and ill-nurtured children they are often fatal; to vast numbers they occasion, sometimes during many months, distressing or alarming symptoms. Such symptoms, I need hardly tell you, affect both vaccinated and unvaccinated. They have been known as incidental to infancy from periods long anterior to Jenner's existence. Now, an extremely frequent one of such symptons is an inflammation of skin (known by the technical name of *eczema infantile*) producing on the child's head and face, or on other—perhaps many or most—parts of the body a dense eruption of little pimples, which presently convert into an itching and discharging surface so much of the skin as they occupy: and since irritations of the skin are peculiarly apt to propagate themselves in the direction of the return-current of the circulation of blood to the so-called lymphatic or absorbent

glands which are subsidiary to this circulation, so it very commonly happens that more or less irritation and swelling of those glands will accompany that eczematous eruption; and that, for instance, the child who has the eruption about its head and face (which are among the most usual seats of the unsightly disease) will often be still further disfigured by glandular swellings in the neck. Though I have spoken of this infantile complaint as incident to the time of teething and weaning, yet in fact it may arise at earlier periods of life—even within a few weeks of birth—and of course before vaccination as well as after it. Indeed, frequently it is a reason for which vaccination is postponed; and perhaps I can give you no readier means of estimating how little vaccination has to do with its occurrence, than by telling you, first, that before the discovery of vaccination small-pox inoculation was charged with producing it; and, secondly, that in 1714, when even small-pox inoculation was yet unknown in England, Dr. Daniel Turner* expressed himself in the following terms:—"Among diseases of infants and young "children scarce any attends more frequently than pustulary "or scabby eruptions in several parts of their bodies, as "in the breech, but more especially their foreheads, brows, "and other parts of the face, which we find oftentimes over-"run with dry and crusty scabs."

Their relation, direct and indirect, to vaccination.

The circumstances under which both infantile eczema and glandular swellings arise are familiarly known to the medical profession. To say that properly-performed vaccination can have *directly* to do with them—that it can directly cause general eczema, or directly affect any glands but those which it is intended and expected to affect—would be an assertion not warranted either by practical experience or by any pathological probability. To say that *indirectly* it may do so—that, in the very few instances where it produces excessive results, the disturbance thus occasioned may, by depressing or fevering the child, temporarily assist or excite other causes of disturbance—that, under such very exceptional circumstances, it may for the

* Treatise on Diseases of the Skin, p. 44, where the references given by Turner extend back to Galen.

time of its operation dispose the child to this complaint and to that, may excite the scrofulous child to show its scrofula, and the eczematous child to show its eczema—these are assertions which may or may not be true; which are more easily made than either established or refuted; but which, if admitted in their utmost scope, really allege against vaccination nothing which might not as practically be alleged against a cold in the head, a cut finger, an undigested meal, or any other one of the thousand minor accidents of every-day life.

So much for what has been alleged against properly-performed vaccination—against such vaccination as alone ought to prevail in any country where the State requires its performance. So much for the natural drawbacks which have falsely been said to detract from its inestimable advantages, and the dangers which with almost equal falsehood have been said to attend its performance.

Ill-performed vaccination.

II. It is less easy and less necessary to dispose of what may be said against ill-performed vaccination; understanding in this phrase not merely such vaccination as is done with an unskilful hand—(for commonly the worst effect of clumsiness is only that the operation fails)—but especially referring to such vaccination as is done without due inquiry into *the health of the child* to be vaccinated, or without due care for *the quality of lymph* to be employed.

Extreme necessity for carefulness in vaccination;

If local scandals have arisen against vaccination, and if some prejudices against it seem to have in them a show of reason, those are the sources from which such serious evils have come. All that belongs to the mere manual trick of vaccination is learnt from a minute's teaching and an hour's practice; but not so easily the philosophy of the procedure, or the precautions which are requisite to make it harmless and useful. From Jenner onward, all great masters of vaccination have urged that its merits will always appear proportionate to the merits of its performers; that if sickly children are vaccinated without due regard to their actual condition of health—children breeding other disorders—children having skin-disease—children teething—and the

like; or if children, healthy or unhealthy, are vaccinated with improper material, the results must be at least unsatisfactory, and possibly dangerous. And all competent persons accordingly recognize that one who would vaccinate must thoroughly study these things.

especially as to choice of lymph.

Especially as regards the quality of vaccine lymph, the careless or uneducated vaccinator is using a dangerous weapon. It is only during part of the course of a vaccine vesicle that its lymph is suitable for further vaccinations: for after a given moment, at which the contents of the vesicle possess the maximum of simple contagiousness, they tend more and more towards the quality of common inflammatory products; and matter now taken from the vesicle is no longer the simple agent of a specific infection, but both has less efficiency for its real purpose, and is specially able to produce other undesired results. A danger of somewhat similar kind is that of taking lymph from vesicles which already have been accidentally ruptured, or where from any other cause—local or constitutional—their specific fluid is likely to have been modified by common irritative processes. Still more critical changes occur in lymph when removed from the body, unless appropriate means be taken to preserve it; for, under the influence of air and moisture, it tends, like other dead organic matter, to putrid decomposition; and inoculation with it, when thus changing, can hardly be more useful or less dangerous than a casual scratch inflicted in the dissecting room. According to the usual practice of vaccination, error is less likely to be committed in this particular than in the one first mentioned; for, when the operation is not performed from arm to arm, use is very generally made of lancets or ivory points, on which lymph has been allowed to dry. Under this system (at least in our climate) the matter is almost secure from change; and there is little room for such accidents as might arise from failure in those delicate procedures by which lymph is sometimes kept moist for use. But the danger of taking matter from irritated vesicles, and from vesicles at too advanced a period of their course, is one which circumstances render frequent; and there is reason

to believe that, in at least a very large proportion of those cases where abnormal effects have resulted from so-called vaccination, it has been the employment of this ambiguous irritative matter which has occasioned the mischief and scandal.

Can accidental infections occur in vaccination ?

Suspicions are sometimes expressed that a slovenly vaccinator, careless in his choice of lymph, may thus communicate to one child the constitutional or local diseases of another. If this were true, it were nothing against vaccination. It is no argument against bread, that alum constipates the bowels; still less is it an argument against quinine, that some drunken shop-boy may give one strychnia instead of it..... A vaccinator must forget his duty in more than one particular—must be indifferent both to the feelings of others, and to the social progress of the great good which he claims to administer, if he affronts the natural antipathies of those who bring their children to be vaccinated, by drawing his lymph for vaccination from the vesicles of diseased subjects. And, practically speaking, I can conceive no circumstances in this country which would justify a departure from the rule—recognized by the medical profession as unreservedly as it is desired by the public—that lymph be taken only from healthy subjects.

Opportunity of testing it ought in fact never to occur.

But, supposing that, in breach of this rule, lymph be taken from the Jennerian vesicle on the arm of a subject suffering constitutional disease, what then? On the assumption that it be a true Jennerian vesicle at the proper period of its development, there are [1857] cogent reasons for believing that such vaccination will produce none but vaccine results..... It has been proved on a large scale that vaccine lymph, taken from persons actually suffering small-pox, conveys to those who are vaccinated with it no other than the vaccine infection.* .... The diseases which it has been

Vaccine lymph from persons suffering small-pox.

Maladies which are alleged to have been communicated by vaccination.

* This most remarkable truth has been established, I say, on a large scale; for, not once or twice, but at least hundreds of times, something to the following effect has occurred. A patient has been vaccinated a little too late for protection. He had previously been exposed to an atmosphere infected with small-pox. Warned of his danger, he has had recourse to vaccination when already small-pox was latent in his system; and (under a law which expresses the intimate affinity of these two agents) the operation of the inhaled variolous contagion, and the

suspected that vaccination might communicate have chiefly been scrofulous and syphilitic complaints, and various eruptions of the skin..... Of some among the diseases referred to, it may no doubt be admitted that their specific products are infectious; but then again comes the question, whether the constitutional existence of such diseases can specifically infect the contents, without modifying the characteristic development, of a true Jennerian vesicle.

Experiments on the subject.

Experiment, where it has been deliberately addressed to the solution of this question, has invariably answered *No;* and such experiment is worth more than many arguments.

M. Taupin.

The early Reports* of the French Academy contain numerous

operation of the inoculated vaccine contagion, have proceeded simultaneously on his person; the former producing the general disturbance and general eruption of small-pox; the latter producing, at the vaccinated spots, characteristic Jennerian vesicles. And with the lymph of these vesicles, again and again, successful vaccination has been performed. Again and again it has been shown that such lymph is capable only of communicating the Jennerian infection.

* Rapports présentés à M. le Ministre de l'Intérieur par l'Académie Royale de Médecine sur les Vaccinations pratiquées en France. From four of these Reports I extract the following paragraphs:—(Rapport 1808–9., pp. 54, 55.) "M. Pellieux, médecin à Baugency, nous a paru avoir fait l'expérience la plus "concluante en inoculant le vaccin d'un sujet varioleux à vingt-trois sujets qui "ont eu simplement la vaccine. . . . Des sujets dartreux, galeux, teigneux, "vénérieux, scrofuleux, ont également fourni à quelques praticiens de la matière "vaccinale, dont l'inoculation a produit son effet ordinaire sans donner la "moindre marque de la maladie dont les enfans étaient attaqués." (Rapport 1821–22, p. 41.) "Quelques personnes peu éclairées répugnent encore à faire "vacciner leurs enfans parcequ'elles supposent que les maladies des individus "qui fournissent la matière, peuvent se transmettre par l'intermédiaire de la "vaccine aux sujects sur lesquels on l'inocule. Cette crainte, détruite dans nos "premières expériences et toujours combattue depuis cette époque, l'a été de "nouveau par plusieurs de nos correspondans. Ainsi M. Rochot, médecin à "Seurre, a vacciné dans un village du département de la Côte d'Or un enfant de "six mois, dont la mère était atteinte du mal vénérien, et qui lui même avait "quelques pustules au front. Il inocula le vaccin de cet enfant à plusieurs "autres sur lesquels la vaccine se développa sans aucune complication d'affection "syphilitique. M. Debar, médecin à Rue, a fait la même expérience, et avec le "même succès. M. Voisin, officier de santé à Solignac, a inoculé le vaccin d'un "sujet galeux sans donner la gale. Enfin, M. Labesque a inoculé quatre "personnes avec du vaccin provenant d'un sujet qui était en pleine suppuration "de petite vérole et la vaccine s'est développée seule." (Rapport 1829, p. 15.) "On sait depuis longtemps que le virus vaccin ne se charge d'aucun principe "contagieux. Cette année plusieurs médecins, parmi lesquels se trouve M. Bou-"cher de Versailles, l'ont inoculé après l'avoir puisé chez des varioleux qui "avaient à la fois la variole et la vaccine, et n'ont donné que cette dernière "maladie." (Rapport 1834, p. 45.) Le virus vaccin ne communique et ne développe que la vaccine.

particulars on this interesting subject; but observations on the largest scale appear to have been made by M. Taupin during his residence as medical officer in the Paris Hospital for Sick Children; and Messieurs Blache and Guersant, Physician and Surgeon to this Institution, having occasion to discuss the general question, have included an account of M. Taupin's experiments in a passage which altogether is of so much importance that I transcribe it at length from their paper.* "Le virus vaccin ne paraît pas s'allier " avec d'autres virus: lorsqu'on inocule un mélange de virus " vaccin et de varioleux, on n'a qu'une de ces maladies, " ou, si elles se développent toutes les deux ensemble, elles " marchent chacune séparément avec le caractére qui lui " est propre. Dans un très-grand nombre d'expériences " tentée par le comité de vaccine ou par ses correspondants, " on a pris du vaccin sur des pustules vaccinales développées " à dessein au milieu de dartres, d'ulcères scrofuleux, de " teigne favus, de vésicules de gale: on n'a remarqué que " la vaccine sans aucun mélange de gale ou d'autres maladies. " De nombreuses expériences sur ce sujet ont été répétées " par la Docteur Taupin, à l'Hôpital des Enfants Malades. " Nous empruntons ce qui suit à un mémoire inédit sur la " vaccine, et qu'il a eu l'obligeance de nous communiquer. " Pendant les quatre années qu'il a passées à cet hôpital, " il a sous les yeux des chefs de service vacciné plus de " deux mille sujets placés dans des conditions différentes " d'âge, de santé, &c.; il a suivi et noté avec soin le résultat " de l'inoculation, et il s'est surtout attaché à observer quelle " modification les diverses maladies pouvaient faire éprouver " à la vaccine, et quelle influence celle-ci pouvait exercer " sur elles à son tour. Il a pu observer que le vaccin " recueilli chez des enfants atteints de maladies aiguës ou " chroniques, de fièvres essentielles, affection typhoïde, fièvres " éruptives, de phlegmasies thoraciques, cérébrales, abdomi- " nales, de névroses, telles que chorée, hystérie, épilepsie, &c., " était tout aussi actif que s'il eût été emprunté à des enfants " bien portants; qu'il donnait lieu à une vaccine tout aussi " abondante et regulière, et qui préservait tout aussi efficace-

* Dictionnaire de Médecine (seconde édition) art. *Vaccine.*

" ment de la variole; et ce qu'il n'importait pas moins " d'établir par un nombre considérable d'observations, c'est " que le virus ne transmettait aucune maladie, soit aigue, soit " chronique, contagieuse ou non contagieuse. Un grand nombre " d'enfants atteints de gale, de scarlatine, de rougeole, de vari- " celle, de varioloïde et de variole, ont fourni un vaccin qui " n'a jamais communiqué aucune de ces maladies contagieuses. " Il en a été de même pour le vaccin pris sur des sujets atteints " de rachitis, de scrofules, de syphilis, de tubercules, d'éruptions " chroniques du cuir chevelu, de dartres, &c. Dans aucun " cas, nous y insistons à dessein, le virus n'a rien com- " muniqué que la vaccine toute seule. Loin de nous l'idée " de conclure de cette innocuité qu'on doive employer " indifféremment du vaccin pris sur des sujets sains ou " malades; mais nous voulions rapporter ces faits bien avérés " pour faire justice de ce préjugé qui attribue à du vaccin " malsain les maladies qui surviennent quelquefois chez les " sujets vaccinés, longtemps même après l'inoculation." I am not aware of any counter experiments suggesting different conclusions to those which are expressed and justified in the preceding passage. They assert for vaccine lymph the principle which Dr. Mead a century ago asserted for the virus of small-pox inoculation:—"it is more material into " what kind of body it be infused, than out of what it be " taken."* Indeed in the whole list of diseases, syphilis is

* It deserves mention that these fears about the possible transfer of some unintended contagion belonged to the days of small-pox inoculation, and were then much discussed. In Kirkpatrick's Analysis of Inoculation, mention is made of a case where he tried, with no ill effect, the inoculation of small-pox matter from a syphilitic patient. Dr. Mead (Chap. 5) writes of those 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 scofulous swellings and the venereal " disease. 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 " of a nature 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." It is remarkable, too, that the first opponent of vaccination (Moseley, op. cit. xi.) discusses this point—not in reference to vaccination (against which it had not then been raised) but in reference to small-pox inoculation:—"Suppose a " subject in the small-pox to have inveterate scurvy, scrofula, itch, syphilitic

the only one to which serious suspicion could attach; and, in regard to its communicability by the lymph of a true Jennerian vesicle, various other observers confirm the accuracy of M. Taupin's results.*

Experiments of Professor Sigmund and Dr. Friedinger.

Moreover Professor Sigmund, of Vienna (whose researches on everything relating to the inoculation of syphilis have been on a very large scale), has added to M. Taupin's results one, which, quite in a different manner, is equally against the possible invaccination of syphilis. In an official Report on the division of the Hospital over which he presides (Aerztlicher Bericht des Allgem. Krankenhauses; Wien, 1855) he relates experiments to show that syphilis in its inoculable form prevents, within the sphere of its infection, the simultaneous formation of a vaccine vesicle. The discharge of chancre (in which form alone syphilis is universally recognized to be inoculable) has been designedly mixed—as by nature it never could be mixed—with ordinary vaccine lymph; and the insertion of this compound poison in the skin has been followed only by the ordinary local results of syphilitic infection. No Jennerian vesicle has been formed; no signs have existed of any possible combination of the two infections. Dr. Friedinger, who conducted these important experiments in Professor Sigmund's wards, and under his observation, has also communicated their result to the Society of Surgeons at Vienna.†

" 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."

* Dr. Heymann (Henke's Zeitsch. 1856, p. 195) quotes some experiments by Dr. Schreier, of Ratisbon, which are to the same effect:—" Zwei in hohem Grade " syphilitische Kinder geimpft und aus den volkommen entwickelten Impfblattern " die klare Pockenlymphe auf gesunde Kinder übertragen, was nicht den " geringsten Nachtheil für die Geimpften zur Folge hatte;" and he gives some remarkable observations made by himself at Java. Children having scrofula, syphilis, itch, the endemic frambæsia, and other complaints, were used, indifferently with others, as sources of vaccine lymph; and no evidence ever appeared of any disease being thus communicated. This, he says, was especially observable in vaccination performed on the generally clean-skinned and constitutionally sound Chinese, from the Javans, who were so often the opposite.

† Abhandl. der Gesellschaft der Aerzte zu Wien. 1854–5.

Peculiar source of fallacy in cases of alleged invaccination of syphilis.

It is unquestionable, however, that cases are recorded in which the lookers-on (sometimes including a medical practitioner) have believed syphilis to have been communicated by vaccination. A moment's reflection suggests, that in such cases there must generally be sources of fallacy, which render them, in contrast with experimental results, almost valueless for instruction. When a child is born with the heritage of syphilis (a very frequent incident, if its parents have been suffering from that infection) the characteristic symptoms commonly do not appear till some weeks after birth; and then the scandal discloses itself. Now among persons with any sense of shame the knowledge that one had transmitted syphilis to one's child would always be a sore subject. There would be strong temptations to employ false pretexts. Not only would parents often conjointly wish to disguise from their medical attendant, or from members of their household, the real explanation of the child's ailment; but also, not infrequently, one parent would wish to conceal from the other that the origin of the disease had been a conjugal infidelity. In respect even of unmarried people, every surgeon knows what utterly false, far-fetched, and absurd explanations are given of syphilitic symptoms, primary and secondary; and it requires little experience to imagine how much more pertinacious will be the demand for excuses, and how much more active the supply of falsehood, under the complicated circumstances of connubial syphilis. Accordingly it is matter for surprise, that vaccination has not almost generally been pitched upon by persons in search of an apology for their syphilitic children. But in truth even such allegations against it have been few; and their paucity (assuming them all to have been made in good faith) would be a strong reason for regarding them with mistrust;* for surely

* Medical sources of fallacy are really too numerous for enumeration. But there is one against which, in my opinion, peculiar caution is required. I have personally reason to know that a simple surgical incision, on a child having latent in it the taint of hereditary syphilis, may become the seat of ulceration which will present the ordinary characters and require the specific treatment of a secondary syphilitic sore. Some years ago I performed on a little boy, having no apparent ill health, a very trifling surgical operation—that for phimosis. In

if syphilis could be diffused by the vaccine lymph of 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.*

Real cases of inoculation of syphilis in pretended vaccination have arisen in a different manner.

Among the scanty number of recorded cases in which such allegations have been made, there are, however, some, in which, so far as I can judge, it seems almost certain that a person pretending to vaccinate did really effect a syphilitic inoculation. Properly to estimate these grievous instances of malpractice, two considerations must be adverted to:—First, the already quoted negative results obtained by Taupin and many other observers in their experimental inoculations of lymph from the true Jennerian vesicles of syphilitic children; secondly, the fact that [so far as known in 1857] secondary syphilis itself is very possibly not communicable even by direct inoculation of matter from the ulcers and eruptions which it occasions; for many of the ablest experimenters in Europe declare, that in hundreds of trials they have never once succeeded in thus conveying from person to person the slightest infection of syphilis. And, regard being had to these considerations, it becomes almost certain, that in the cases referred to, the matter of chancres—the matter of primary syphilis—was used instead of vaccine lymph by the vaccinator; a mistake (however it may have occurred) of so gross and criminal a nature,

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. . . . .

* Dr. Heim (op. cit. p. 613) observes that an universal infection (allgemeine Landesseuche) of scrofula must very long since have occurred if this disease could have been communicated by vaccination; and he adds, that perhaps it would not have been much better with the diffusion of secondary syphilis. Dr. Heim is among those who have experimented on the subject; and his results accorded with M. Taupin's conclusions as to the non-communicability of syphilis by the lymph of a Jennerian vesicle.

that the medical profession would feel no sympathy for the person through whose neglect or incompetence it happened.

[*I must not pass this last paragraph for re-print without expressly noting that its two arguments of thirty years ago have ceased to be valid.—First: with the better knowledge which M. Ricord supplied in* 1858 *by the publication of his discoveries relating to the syphilitic contagium, we learnt that the experiments which we had regarded as proving the incommunicability of secondary syphilis had been fallacious, and that secondary syphilis is essentially inoculable. Secondly, regarding the communicability of syphilis by means of vaccination: later knowledge has not led me at all to doubt the veracity of the negative evidence so largely quoted by me in* 1857, *as given by experimenters and practitioners down to that time; but in view of information acquired from* 1860 *onward, including particularly Professor Pacchiotti's publication of* 1862 *as to certain Italian outbreaks of syphilis, and some unquestionable similar experience had by our own country in* 1871, *it has now, for some years, been certain that, notwithstanding the generality of the negative evidence, vaccination from subjects with congenital or secondary syphilis is not invariably without power to propagate syphilis. As the purpose of my present note is only to draw attention to those two advances of knowledge in their immediate logical bearing on the last preceding passage of text, I need not here discuss their wider bearings: but I may state that, from the time when they were made, it of course was my duty always to have them in mind when advising on vaccination: and that whatever I had from time to time to say on the question of vaccinal syphilis will be found at later pages of the present volume—See, for* 1870, *my Twelfth Annual Report to the Privy Council; for* 1871, *my evidence before the House of Commons Select Committee on Vaccination; and for* 1872, *my contribution to the First Annual Report of the Local Government Board.*—J. S. 1887.]

Cases where small-pox matter has been unintentionally used in vaccination.

Other illustrations of culpable malpractice in vaccination, though rare, are not unknown. In the French Report (which has just reached us) on the vaccinations of 1854, mention is made of an outbreak of small-pox due to the unintentional employment of variolous matter—instead of vaccine lymph—for inoculation. And I have been informed that a grievous instance of the same kind, leading to not inconsiderable loss of life, recently occurred in this country. But in coming to cases of this description, there is no longer question of the merits of vaccination. If recorded instances of the kind, instead of being so few that you may count them on your fingers, were of innumerable frequency, they would make no argument against vaccination. Only they would, if possible, bring into stronger light than before,

the expediency and duty of providing that this great self-defence of nations against pestilence be not ignorantly and recklessly administered.

General result.

Here indeed is the whole gist of the matter. Earlier parts of this Letter have shown that by vaccination, properly administered, the once enormous fatality of small-pox may be reduced almost to nothing. The present section justifies a conclusion, that against this vast gain there is no necessary loss to count. Of the alleged natural drawbacks to the great advantages of vaccination, the present state of medical knowledge recognizes no single trace. Jenner's discovery, properly utilized, has been a pure blessing to mankind, an unmixed addition to the strength and happiness of nations. To say of vaccination that it has sometimes been ill administered—to say that, under pretext of its administration, harm has sometimes been given instead of good, poison instead of antidote, is to speak, not against it, but—whether rightly or wrongly—against its administrators. The vaccinations of Europe are now counted annually by millions. It may be vain to hope that every lancet shall be used with equal skill and equal carefulness, or that all populations shall be equally anxious to render those operations successful; but medicine at least has contributed her share, in showing that—subject to these conditions—small-pox needs cause no further fear, nor its antidote be accepted with mistrust.

V. Public Vaccination in England.

More than forty years had passed since the time when Jenner's discovery first became an accepted part of medical science. Throughout the continent of Europe arrangements more or less complete had long been made to render it of universal application. Its triumphs were everywhere recognized. During eight consecutive years in the Grand

Duchy of Baden, during thirteen consecutive years in the city of Copenhagen, there had been no single death from small-pox.

While foreign governments were thus fulfilling the aspirations of the English surgeon, and by vast economies of human life were realizing the new source of national strength which his genius had given to mankind, in Jenner's own country there was less progress to be traced.

Till 1840 no general provision was made.

National Vaccine Establishment.

The action of the British Legislature had been confined to subsidising by an annual grant (finally of 2000*l.*) the National Vaccine Institution. This establishment, directed *ex officio* by the annual heads of the London Colleges of Physicians and Surgeons, had, since the year 1808, fulfilled the indispensable object of maintaining and furnishing supplies of vaccine lymph; but it had never possessed either apparatus or authority for any general system of vaccination. Its labours as a vaccinating establishment were of little importance, except as subsidiary to the other and main object of its existence; for its vaccinations were confined to London, and even here, at their utmost, were but in small proportion to the requirements of the metropolis.*

Charity Vaccination.

Charitable institutions and the generous zeal of the medical profession did very much to diffuse the benefits of vaccination. But, with so great an interest at stake, this dependence on casual good will seemed an uncertain title to the desired possession, especially while it was "held that "an overseer was not bound to take measures to procure "the poor children of the parish to be vaccinated during "the prevalence of small-pox."†

The working of this negative system can be measured but imperfectly by statistical evidence; either as to the defect of vaccination, or as to the consequences therefrom resulting. For on the one hand, no account was kept of

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* The Annual Report of 1839 states, that in 1838 (when small-pox was severely epidemic) the establishment vaccinated 18,659 persons, being "6,241 "more than had been vaccinated in the metropolis and neighbourhood in any "former year," and more than double the present average of its vaccinations. The births in the metropolis in 1838 were about 55,000.

† The Vaccination Acts, by Danby P. Fry, Esq., page 20, note.

persons charitably vaccinated:* and on the other hand, till after 1837 (when general registration began in this country) there could be no authentic knowledge of deaths by small-pox. But, from the establishment of the General Register Office in 1837 to the abandonment of charity-vaccination in 1840, there exist accurate mortuary records; and from their results, as embodied in the Second and Third Reports of the Registrar-General, I learn that nearly 36,000 deaths by small-pox signalized those last three years of non-legislation. Further, an inquiry made into the ages of the victims of 1839 showed that three-fourths of their number were children under five years of age, who, in nearly every individual case, must have been unvaccinated; since death by post-vaccinal small-pox at that early period of life is almost an unknown occurrence.†

Large small-pox mortality of the years 1838–40.

Especially of unvaccinated children.

Seventeen years ago, the Legislature provided (3 & 4 Vict. c. 29) that vaccination at the public cost might be claimed

First provision for general public vaccination under optional system.

* The Recruiting Returns of the Army Medical Board for the years 1846–55 show that, among 136,113 recruits medically inspected and found fit for service, the marks of previous vaccination or small-pox were as in the annexed Table;

Number of Recruits.	Having Marks of Vaccination.	Having Marks of Small-pox.	Having no distinct Marks of either.
136,113 - - -	96,545	29,220	10,348
Rate per 1,000 -	709	215	76

or, in round numbers, that out of every 14 young men of the enlisting population, at least 3 had had small-pox, 10 had been vaccinated, and 1 had undergone neither small-pox nor vaccination. From this it may be inferred that at the birth time of these recruits (20–30 years ago) the vaccination of infants, as compared with the number of births, was very considerably under the proportions $\frac{7}{14}$; because the generation from which these recruits were survivors must have lost a disproportionate number of its unvaccinated, not only by small-pox (which would have affected them almost exclusively) but likewise by those infantine diseases which would have destroyed many before the age at which vaccination is performed.

† Dr. Gregory, in reference to the small-pox deaths of this period, speaks of them as having occurred "in great majority among infants and very young "children, not one of whom had probably ever been vaccinated." He says, "we have satisfactory evidence that under fifteen years of age the deaths by "small-pox after vaccination are scarcely noticeable."

of local authorities in every parish of England and Wales; and this enactment was followed by a further provision (necessary, because Poor Law guardians and overseers were to be the administrators of the law) that gratuitous vaccination should not place its recipient in the position of persons receiving parochial relief.

Small-pox during the years 1840–53.

This measure, after thirteen years experience of its working, was found insufficient for its purpose. There was improvement, indeed, so far as could be ascertained; for the small-pox death-rate during the three years 1838–40 had been 770 per million, and now was only 304; but the

Ages at Death of 9,085 fatal Cases of Small-pox.					
At all Ages.		0–5.	5–10.	10–15.	15 and over.
England in 1847 -	4,227	3,114	527	111	475
London in 1848–52 -	4,858	3,265	659	154	780
Total -	9,085	6,379	1,186	265	1,255

latter death-rate denoted for England more than 5,221 annual deaths, and of these, as before, the vast majority were infantine. A classification made, according to age, of 4,858 small-pox deaths which occurred in London during the five years 1848–52, and of 4,227 small-pox deaths which occurred in England in 1847, shows, as in the annexed table, that more than two-thirds were under five years of age, and that but a sixth of the number had completed ten years.

Continued high mortality of infants under optional system.

With the accurate knowledge already possessed on the protective powers of vaccination, the above facts could be interpreted in only one way. Putting aside all question of the older victims, and omitting all reference to the records of public vaccination, the observer of those facts could be quite certain that in England annually about 4,500 infants and children were dying by one specific parental neglect.

Continued indifference towards early vaccination.

And this certainty was made doubly certain by the annual statements of the Poor Law Board on the progress of public vaccination. During the five years 1848–52 the annual births in England had averaged 568,811; but the public vaccinations of infants under one year of age had averaged only 180,961. It was argued (and subsequent events have shown the argument to have been sound) that, if the Vaccination Extension Act had been working in a satisfactory manner the number of infantine vaccinations would have been double, if not triple, what it was. Indeed the same official statistics which showed the above-stated deficiency of infantine vaccination showed also that this neglect arose neither in reluctance to profit by the new institution of gratuitous vaccination, nor in prejudices against the thing itself, but mainly in men's passiveness of procrastination. For while the annual public vaccinations of infants under one year of age had averaged only 180,961, those at higher ages had averaged 185,139; in other words, public vaccinations were being performed to the amount of nearly two thirds the annual number of births; but with such indifference towards the object to be obtained, that not half of such vaccinations were performed within even the first year, and of course a much smaller proportion within the first six months, of life. No wonder that, with this carelessness on the subject, small-pox continued to be fatal to large numbers of the infantine population. And a further statistical analysis of the material I have already quoted shows, that while more than two thirds of all deaths by small-pox were happening under five years of age, deaths in the first year of life made more than a third of this proportion.

1853. First establishment of compulsory system.

Under these circumstances, some improvement in the law was evidently required; and in 1853 such improvement was partially effected by an Act (16 & 17 Vict. c. 100.) to "Extend and make compulsory the Practice of Vaccination." This law, which has now been in force nearly four years, makes it an obligation on parents and guardians that every child (its health permitting) shall be vaccinated within, at

furthest, four months from birth. It also attaches a penalty to non-compliance with this enactment, and provides that Registrars of Births (who are to keep record of all vaccinations under the Act) shall at the registration of each birth give to the persons concerned a printed notice of their legal obligation.

Principle of the law.

This was indeed a very important measure. Infantine vaccination was at length recognized 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.

To what extent was it an interference with private rights?

Persons, unacquainted with the circumstances under which this law was made, have doubted whether it was not an improper restriction of personal freedom. It being assumed as the limitary principle of human law, that men may be left free to follow every inclination which relates only to themselves, it would certainly at first blush seem foreign to the province of legislation to insist on a man's caring for his own health; and if his having small-pox could affect none but himself, little would need to be said against his right of having it *ad libitum*. The fact, however, is, that the man who indulges a preference for small-pox, does so to the detriment or danger of his neighbours; and in view of their liability to suffer by his infection, they may reasonably claim to be heard on that question of his privilege. But be that as it may, the aim of the obligatory law, as I understand it, is not to prevent adults from cherishing in their own persons, if they be so minded, their individual liability to natural small-pox; its object is to prevent them from compelling (since in this case *allowing* amounts to *compelling*) their children to incur that peril. The interference of the law is an interference between parent and child; a kind of interference very sparingly exercised in this country, and the exercise of which on slight grounds would of course be intolerable. The practical justification of any such law depends on the amount of evil which it is designed to correct; and four or five thousand annual deaths

by one specific parental omission constituted in this case a strong argument. It was under pressure of this appeal, that the Compulsory Vaccination Act was passed. The option which the new law restricted was not that of a conscious agent deliberately preferring for himself the dangers of small-pox to the securities of vaccination. The thousands who annually died of non-vaccination had never raised their voices for the privilege of unrestricted small-pox. The so-called "liberty" thenceforth to be abridged was that of exposing unconscious infants to become the prey of a fatal and mutilative disease. It was this liberty of omissional infanticide which the law took courage to check. It seems to me that persons most careful for true liberty might, on the alleged grounds, be most urgent to provide for the compulsory vaccination of infants: and I believe that the general sense of the public concurred with the conclusion of the Legislature, that here was one of the many occasions on which, for common good, individual crotchets ought to give way.

Doubts might have been felt as to its practical working.

Yet let me confess for myself, that, if I had had occasion four years ago to express an opinion on this subject, I should very greatly (and, the result shows, very wrongly) have feared the operation of such a measure. Not for a moment, indeed, should I have doubted the moral right of the Legislature to interfere—if it could successfully interfere—with that ignorant or wicked negligence which was killing so many thousands of helpless children: but I should have dreaded lest another evil might result from the enactment of a compulsory law. Believing that vaccination is, beyond all comparison, the greatest practical good with which medical science has enriched us, I should have felt the utmost apprehension lest, by association with penal provisions, it might perhaps become unpopular; lest this apparently unnatural combination should excite resistance or suspicion; lest the public should in any degree mistrust a gift which the law would compel them to accept.

Such doubts have been solved.

In fairness towards others who perhaps still entertain these doubts, I frankly confess to you that four years ago, they

would have been my own; but I am now most glad to be able to show that such alarms would have been unnecessary. Experience has already disposed of them. Partly from the English habit of respecting every actual law, and partly no doubt because the justice of this particular one was recognized, the Act for compulsory vaccination was obeyed with alacrity. And many arguments on the subject may be saved by a simple perusal of the annexed table. The first line of

	Annual Public Vaccinations.		Annual Births.
	Under One Year of Age.	Over One Year of Age.	
Average of the five 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

figures gives the average (to which I have already referred) of births and of public vaccinations during the years 1848–52; and you will observe that while the births in England were 568,811, the infantine vaccinations were only 180,960. In 1853 the law was altered. In 1854 you find the infantine vaccinations considerably more than doubled. From 180,960 they had risen to 408,824. And not only this. The indirect action of the law had extended to induce what it could not compel; and vaccinations at ages after the first year of life had likewise been increased by more than 100,000 cases. Thus in 1854, under the immediate influence of the new law, the total public vaccinations of England at all ages exceeded by more than 75,000 the total number of births; the large majority of 290,111 cases in the third column consisting no doubt of young children, whose vaccination under the former defective system had been indefinitely delayed.

Immediate very large increase of infantine vaccination.

The table shows a further important fact. In the line for 1855 and in that for 1856 you will notice again a

Subsequent decline in this increase.

decline in the number of vaccinations; not alone in the third column (where a decline from 290,111, to 109,120, and again from 109,120 to 84,165, might mean only that the first year of activity had so far cleared off existing arrears in the category as to leave but few non-vaccinated children to appear afterwards) but also in the second column; where a decline from 408,824, to 354,979, and from 354,979 to 350,847, infantine vaccinations can only denote that the *stimulus which was given to early vaccination by the new law in the first year of its working, became in the second year less effective than in the first, and in the third less effective than in the second.*

Meaning of the secondary decline in the number of infantine vaccinations.

The explanation is simple. At the first passing of the law people hastened to obey—because they feared to disobey—its imperative provisions. The possibility of a summons and of a fine was before them. This, which would not have conquered any resolute objection, was just enough to stir that mere indifference which among uneducated persons is the main obstacle to universal infantine vaccination. The law commanded *and threatened*; so it must be obeyed. Thus, in the first year: but it was soon discovered that the threat was an empty one, that it could not be fulfilled, that the law had provided no machinery for its execution. And then forthwith obedience began to decline in the proportion which those figures express.

Defect in the Act of Parliament.

In short it is a radical defect in the Act, considered in its compulsory relations, that the duty of warning defaulters, and the discretionary power of proceeding against them, are assigned to no local officer or local authority, and that consequently the compulsory provision of the law rapidly tends to be regarded as a dead letter.*

Progressive diminution of small-pox has followed the successive improvements of the law.

Still it is impossible to overlook that great good has been done. It would be premature to say much on the influence against small-pox which the new law must already have exerted; for conclusions in medical statistics take long to

* See *Note* VIII., p. 315: Early Working of the Compulsory Vaccination Act.

ripen, and here we have only two years' experience to record. Yet I may beg you to read the annexed table, as showing

Periods compared.	Annual Deaths by Small-pox in England and Wales.	Annual Rate per Million of the Population.
Average of three years 1838–40	11,944	770
Average of nine* of the years 1841–53	5,221	304
1854	2,808	149
1855	2,525	132

* N.B.—During the four years 1843-6 causes of death were not distinguished in the reports of the Registrar-General.

that diminutions in small-pox mortality have hitherto kept pace with improvements in the law. The first line of this table expresses the high mortality which belonged to the last three years of the period of *charity vaccination*. Its second line expresses the greatly reduced mortality which belonged to the period of *optional vaccination*. Its third and fourth lines express the very much smaller mortality which has attended the system of *compulsory vaccination* during the two years of its adoption. If such figures are insufficient to sustain a pathological argument, they are at least enough greatly to encourage the Legislature to further improvements of the law.

Further improvements are required.

Precaution to be taken against any too peremptory working of the law.

And such improvements are indubitably called for. First, in order to fulfil those objects which are expressed in the title of the last Act, "To extend and make compulsory "the Practice of Vaccination," it is requisite to amend that defect which I have named. Yet, while for the recited purpose, it is indispensable that the law should be rendered quite stringent and workable, it seems to me scarcely less important that it should never be worked in an oppressive dogmatical manner, and that appeal to its penal provisions should as rarely as possible be made. Against any abuse there would be given, I think, the amplest security which the nature of the case admits, if the power of summoning

offenders before a magistrate could be exercised only under direction of the Local Board. With the threat of this power in the distance—with the knowledge that in cases of obstinate disobedience it could really be invoked and really become operative—I believe that such cases would not exist; that practically the *compulsion* of the law would consist in the fact of a local officer sending his reminder to persons in default; for that this reminder (itself exceptional) would almost invariably produce an immediate compliance with the law.

Provision is required for more uniform good quality of vaccination.

I have said that the compulsory enactment of 1853 *partially* effected the desired amelioration of the law. It was, however, no trifling part which remained for improvement. And not only does it still remain; but indeed the very change which was made has rendered still more imperative the necessity for a further and completing reform.

For surely no principle can be more obvious than this:—that if the State professes to vaccinate the people—above all, if it compels the people to be vaccinated—it must take every possible security for the excellence of the vaccination which it offers.

The Legislature has hitherto not recognised that there is such a thing as bad vaccination. And indeed, in large part, vaccination is certainly good; otherwise small-pox could not, within half a century, have been, as it has been, rendered comparatively infrequent and innocuous. Yet, that there is current in England and Wales not only an appreciable amount of utterly incompetent vaccination, but a very considerable proportion of second-rate vaccination, is quite certain.

Mr. Marson's evidence as to the excess of bad vaccination, and as to its consequences.

I know of no person so qualified to speak on this subject as Mr. Marson; who for more than twenty years has resided as surgeon in the Small-pox Hospital of London, and has continuously applied himself to record the results of non-vaccination and of sham vaccination.

I have already quoted this gentleman's very important observation, that if vaccinated persons happen to contract small-pox, the mortality among the best-vaccinated of the

number is but one-thirtieth part of the mortality among the ill-vaccinated. And as regards the large and lamentable preponderance of the latter class, Mr. Marson's Papers (see page 19) will show you that of 3,094 vaccinated persons whom he has seen suffering with small-pox, only 268 presented what he considered the marks of thorough vaccination. Mr. Marson insists on "evils, more especially "affecting the humbler classes, connected with the circum-"stances under which vaccinations in country districts are "performed;" and further, his opportunities having enabled him to judge of the vaccinations of other kingdoms of Europe, he assigns even a very low relative rank to the performances of England; observing, that "there can be no "justifiable reason why the rural inhabitants of England "and Wales should be, as he knows them to be, far less "well vaccinated than are the rural inhabitants of Denmark, "Sweden, and Prussia."

And—besides the terribly large proportion of patients, nominally vaccinated, whose vaccination, because of unskilfulness, has been but of partial effect—there are other cases "of frequent occurrence at the Small-pox Hospital," where patients are in the category of non-vaccinated persons, simply because bungling operators have failed to vaccinate them. "With good lymph, and the observance of all pro-"per precautions (says Mr. Marson) an expert vaccinator "should not fail in his attempts to vaccinate above once "in 150 times; yet a large number of those, who take "upon themselves the duty think they do very well if they "succeed, however imperfectly, five times out of six: and "patients often present themselves with small-pox at the "hospital, who state they have been cut five, six, eight "times, or more, for cow-pox without effect."

Local prejudices against vaccination often testify to the same effect.

Far less precise than Mr. Marson's experience, but in its own way equally deserving of consideration, there is other evidence which raises great doubts as to the quality of much current English vaccination. Among the so-called prejudices against the practice, there are some which represent a partial truth; erring indeed only in so far as they

impute generally to vaccination what they should have imputed exclusively to the vaccinator. Considerable disturbance of health has often followed—sometimes to a dangerous and even fatal extent—the improper acts of persons pretending to vaccinate. If all operators equally had been impressed with the necessity of following Jenner's short and simple teaching; if all equally had inquired into the state of health of children they were about to vaccinate, and had stayed proceeding till any temporary ailment had been removed; if all equally had been careful as to the condition of children from whom lymph has been taken; if all equally had been content to study the natural progress of the Jennerian vesicle, and the different qualities of material which it furnishes at successive stages, or under accidental disturbances, of its course; if, in short, all equally had recognized that vaccination is not a mere easy trick of the fingers, that it requires to be done, and that its results require to be followed, with the observant eye of an educated special experience;—if, I say, the substance of this had been in the minds of all who have pretended to vaccinate, little, very little, would have been heard of prejudices against that matchless discovery. A local prejudice against vaccination would, in my judgment, be a reason for inquiring into the skill with which, in the prejudiced locality, vaccination has been administered; whereupon I should not be surprised to hear of some individual case in which nominal vaccination has either proved useless as a protection against small-pox, or has occasioned unexpected suffering to the child; and the inquiry, if pressed further, would probably show that the origin of this scandal has either been (on the first supposition) one of those imperfect vaccinations against which Mr. Marson protests, or (on the other supposition) some incompetence or neglect relating to the selection of lymph, or the due preparation of the patient. When I reflect how entirely the local repute of vaccination may be affected by one or two cases of this description, and at the same time remember our present absolute insecurity against their very frequent occurrence, I feel very strongly convinced that vaccination has not had a reasonable chance of becoming popular in this country. "It should be remembered" (says Mr. Marson in his Petition to the House of Commons) "that no authorized system of vaccination has been established in England. All persons—medical men, clergymen, amateurs, druggists, old women, midwives, &c.—are allowed to vaccinate in any way he or she may think proper, and the persons operated on are considered to have been vaccinated." It is certain that the non-medical male and female vaccinators to whom Mr. Marson refers must often have brought scandal on the practice, and that many persons have met their deaths by small-pox under the false security of such unskilful vaccination. The present law requires under penalty that the infant (its health permitting) shall be taken for vaccination to "some duly qualified medical practitioner," who shall afterwards certify the results of his proceeding. It is probable that under working of this provision the number of amateur vaccinations has considerably decreased; but obviously the intention of the law remains liable to be frustrated, while vaccination can with impunity be attempted by persons who cannot even legally, much less competently, give any certificate as to its results.

Miscellaneous practitioners of vaccination.

Probably diminished under existing law.

To what extent vaccination has been unskilfully performed by persons purporting to be members of the medical profession, and to what extent (within a much narrower circle) it has been unskilfully performed by persons possessing legal credentials of their qualifications to practise surgery, are questions which I cannot answer.

Public vaccination chiefly by Poor Law medical officers.

As regards the system of public vaccination in this country, it is principally in the hands of the Poor Law Medical Officers of England and Wales; and I cannot refer to these gentlemen without begging you to understand, that some remarks which I shall directly offer on that system are not intended as a criticism on the staff by which so many of its advantages are dispensed. Indeed I am reluctant to leave unexpressed the very deep respect which I feel for their often ill-requited labours. Among them there are men—not a few—whose lives are continuous acts of unrecorded self-devotion; whose disinterested goodness conduces, equally with the achieve-

ments of our great masters, to ennoble the medical profession. And looking to the whole body, and to its whole ministrations, I will venture to say, that no other walk of human life can show a larger proportion of skill, education, and conscientious industry, than is given by these officers—too frequently under circumstances of non-appreciation and discouragement—to the daily and nightly comfort of their suffering fellow creatures. It is for the interest of this meritorious body of men (not less than of the public) that in a system which they chiefly contribute to work, competence and incompetence should not be confounded together; especially, that all future admissions to the number of public vaccinators should be of persons fully qualified for the duties they venture to undertake.

Absence of provision for general study of vaccination.

Under present system a public vaccinator may be appointed who has in no degree studied vaccination.

Appointment must be of "legally qualified medical practitioner:"

And this brings me to the point at which I am obliged to mention one serious defect in reference to my present subject—the absence, namely, of proper provision for the general study of vaccination. While the law provides a specific machinery for public vaccination, offering it gratuitously to all persons; and still more, while the use of this very machinery is in fact, for at least two-thirds of the population, not optional but compulsory; so long, I have ventured to assert, it is a moral obligation on the State, that what it thus invites and compels people to accept shall be of at least good quality. It was the intention and, I humbly think, a wise intention of the Legislature, that the responsibility of choosing the most efficient person for each appointment as public vaccinator should be vested in local authorities, subject only to the limitation that none but "legally qualified medical practitioners" should be contracted with for the purpose. It was naturally believed that under this limitation every needful security was taken for the uniform appointment of persons possessing familiarity with the practice of vaccination. About two dozen varieties of medical practitioners attest the utter incoherence and insufficiency of our laws relating to the medical profession; and no one, so far as I am aware, has hitherto succeeded in defining what, among these, is a "legally qualified medical "practitioner" in the sense of the law referred to. But,

defined or undefined, that term does not give the security which it surely was the intention of the Legislature to take. There is (I feel some shame in confessing it) *no general test of medical proficiency which implies a knowledge of vaccination.* Nor, so far as I know, have we *any medical school where vaccination is systematically and practically taught.* The young man who formally undergoes the now almost superseded apprenticeship to an apothecary, or who in any other capacity resides during his pupilage with a medical practitioner (especially if that practitioner be in the Poor Law medical service) will generally have had fair opportunities of learning to vaccinate. But this case is far, very far, from being universal; and as regards other students of medicine, I can offer no opinion on the source whence their knowledge is to come. There may be examinations of which I have never heard. There may be schools of which the particulars are not before me. Therefore I will not venture to affirm that no candidate at the College of Surgeons has ever been asked a question on vaccination, or that no medical school in England and Wales teaches the practice of vaccination. But the truth would not be very remote from these assertions. And the point which is of real importance for my present argument is, that a medical student may pass through an industrious and creditable pupilage—may obtain his diploma, license and degree, as physician, surgeon, apothecary, and doctor—may become, in every possible sense of the word, a "legally qualified "medical practitioner"—may be eligible and actually elected for the appointment of public vaccinator—and meanwhile may never have performed, perhaps even never have witnessed, one single act of vaccination. In future modifications of the law these circumstances will require to be considered. It seems a necessary complement to what has already been enacted, that candidates for the appointment of public vaccinator should give evidence of having learnt to vaccinate, and that public facilities should exist for the practical study of vaccination.

but a "legally qualified medical practitioner" may never have seen a vaccination.

Arrangements for national vaccination are

Administrative arrangements for the supply of public vaccination cannot properly be considered a merely secre-

matter of medical science.

tarial affair. What has to be administered is not a mechanical matter of routine and registration; but a system which from beginning to end, and from centre to circumference, requires in all its parts to be vitalized by the *science of medicine*. Only thus, as it seems to me, can that security be given, which the public has a right to demand, for the uniform excellence of public vaccination. Only thus can local prejudices against vaccination be successfully and permanently resisted. Only thus can the thing itself be rendered the unqualified blessing which it ought to be.

Necessary conditions for efficiency of the system.

And it seems to me that arrangements for these ends can only be expressed in some such conditions as the following:—(1) in the special qualification of public vaccinators; (2) in systematic medical supervision of the results of public vaccination; (3) in thorough medical inquiry whenever cause of complaint is alleged or suspected; and (4) in the regulation of details of the service on a uniform plan under the advice of members of the medical profession specially skilled in the subject.

Proposed transfer of superintendence of vaccination to the Health Department of the Government.

Grounds for this proposal.

The accomplishment of these objects was aimed at in that proposed transfer of the superintendence of vaccination to the Board of Health, which was the chief feature of last year's Bill, introduced by the President of this Board, and the President of the Poor Law Board. It was believed by both Boards that the transfer of this important branch of medical administration to that department which has specially to concern itself with medical subjects would conduce to the public service. It was believed that this department (permanently employing a medical officer) would be better able than the Poor Law Board (which has no medical element in its constitution) to give the requisite supervision to the results of public vaccination, and to direct by a medical inspector those inquiries which outbreaks of small-pox, or complaints of mal-vaccination, or other circumstances, might render necessary. It was further believed that the constitution of the Board of Health, while enabling it more easily than the Poor Law Board to effect

de die in diem these acts of supervision, would also give peculiar facilities for a still more important action. It was believed that, by using in the interests of vaccination its powers of appointing a Medical Council, the Board of Health could obtain, in a public and recognized manner, the advice—not only of those eminent functionaries of the Colleges of Physicians and Surgeons who at present, as an annual board, direct the distribution of lymph from the National Vaccine Establishment—but also of other persons, whose special labours in regard of small-pox and vaccination qualify them to be advisers of the Government and guides of the medical profession in whatever relates to the subject. It was believed that under such advice the Board might, with great advantage to the public service, *bring into one system the arrangements for public vaccination and the hitherto separate arrangements for the supply of vaccine lymph;** might *fix conditions of qualification for the future appointment of public vaccinators;* might thus *indirectly promote among medical students the general and thorough study of vaccination;* might *provide that certain large vaccinating stations should become self-supporting schools of practical instruction;* and might *issue regulations of detail for many matters in public vaccination* which at present (not desirably for their object) are left to personal option, or regulated on non-medical grounds.

Especially as to objects which could be attained only after special medical consultation.

Memorial of Epidemiological Society on administrative arrangements for vaccination.

The necessity for some such organization as I describe has long been obvious to the medical profession; and important suggestions on this subject were addressed two years ago to Sir B. Hall, then President of this Board, by the President and Council of the Epidemiological Society

* Obviously these are natural parts of one system; and their present separation in England threatens a serious inconvenience. The first establishment of parochial vaccinations in 1840 had already much reduced the vaccinations of the National Vaccine Board, and the Compulsory Vaccination Act effected a still larger reduction. While its vaccinations have thus greatly diminished, and are liable to further diminution, the demands on it for supplies of lymph have increased, and tend constantly to become larger. Reference to the table at page 177 of the Appendix shows in detail what has been the operation of the last-named Act:—the annual average of vaccinations has fallen from 10,713 to 8,207; while, from this greatly reduced number of arms, the supply of charges of lymph has increased from 211,404 to 220,293.

of London. From the high professional character of the gentlemen whose opinions were expressed in this memorial, it was entitled to have much weight; the more so, as the Epidemiological Society had given special investigation to the subject, and had acquired intimate knowledge of the existing defects of public vaccination. Although the memorial cannot be considered as a paper written in direct reference to my present object (having indeed been addressed to the Board before I had the honour of being its officer) yet it was of so much importance in drawing the attention of the Government to those insufficiencies of administration which you now seek to remedy, that I have inserted it among the documents of my Appendix. Important criticisms on the plan advocated by the Epidemiological Society, and generally on legislation in reference to the present subject, are contained in Mr. Rumsey's learned and thoughtful "Essays on State Medicine;" London, 1856.

Importance of a due recognition by Local authorities of the exertions which are requisite to ensure really successful results.

Finally, with respect to the present system of public vaccination in England, it remains to be remarked, that local vaccination can never be reasonably good, unless Local Authorities estimate the operation at its due importance. I scarcely know any surgical operation in which the result is so much determined by attention to minute particulars; scarcely any which so specially requires not to be done mechanically and *per* contract. If steam-power or clockwork were applied to the purposes of surgery, it would perhaps be as easy by machinery to amputate as to vaccinate; not because vaccination is a thing of difficult handiwork, but because peculiarly it is a thing for painstaking judgment in its details. If the local successes of vaccination are to be considerable, the public vaccinator must very often incur trouble for which there is no language in his legal contracts. Not rarely he must be content to postpone a vaccination; not very rarely he must repeat one, sometimes again and again. Always he has to watch the results and (as he is paid only for successful cases) to report them with strictness. Timing his vaccinations so as to keep up a continuous succession is in itself no easy task. Kindly consideration for people's feelings, often a little coaxing,

sometimes a little authority, always a good deal of discretion, are—if he is to reach his utmost utility—as necessary to him as his lancet. How easily in all these particulars, and many more, might a vaccinator, bound only by his legal contract, escape an infinity of trouble with no ostensible fault! And unless he be fastidious in his choice of lymph, he had better not vaccinate at all; yet the difference between routine lymph and eligible lymph is to him a doubling of his labour. These are matters which can be but imperfectly known to local authorities, and which have, I dare say, seldom been considered in reference to the price to be paid for public vaccinations. Boards of Guardians in making arrangements for public vaccination in their several districts have perhaps not sufficiently regarded another peculiarity of the case: when they contract for bread and cheese, they can themselves verify the fulfilment of the bargain, and pronounce on the quality of supply: when they contract for public vaccination, they can only rely on the honour of their contractor. It is therefore indispensable to the success of public vaccination that local authorities should duly estimate the amount of skill and conscientiousness to which they thus unreservedly trust; and that hoping to find zeal and science enlisted in their service, they should not fix their standard of payment below that which the common opinion of the medical profession would consider a reasonable and remunerating price.

Recent correspondence on the subject of the preceding letter.

In concluding this Letter, I refer but very briefly to that valuable mass of information (App. J and K) which the liberality of foreign Governments and the kindness of distinguished members of my profession enable me to lay before you.* I venture to believe, Sir, that you will share the sense of obligation with which I refer to these large contributions of national and professional experience. Communications so important will best speak for themselves. Any attempt to give an abstract of their contents might end in

* See *Note* IX., p. 316: Mention of some additional sources of information.

frittering away their value; and the respect which I feel for so remarkable a collection of independent testimony leads me greatly to desire that it should be read in the words of its authors.

Circular of questions addressed to members of the medical profession, to departments of the public service, and to foreign governments.

Therefore it is that I append scrupulously *in extenso* the replies which I have received to my Circular of Questions. Throughout the preceding pages I have in no case referred to such of them (J) as are personal, and but very rarely to those (K) which are official. Accordingly, you may consider the answers as representing so many additional witnesses hitherto, almost without exception, unexamined; and you will judge whether their testimony confirms or invalidates that which I have compiled from other sources, or stated as my own conviction.

My four questions are as follow:—

I. 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?

II. Have you any reason to believe or 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?

III. 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; or that unintentional inoculation with some other disease, instead of the proposed vaccination, has occurred in the hands of a duly educated medical practitioner?

IV. Do you (assuming due provisions to exist for a skilful performance of the operation) recommend that, except for special reasons in individual cases, vaccination should be universally performed at early periods of life?

Answers to the first question.

The answers to the first question are of fundamental importance, and will repay careful perusal. Not only those which come from foreign Governments, and of which the gist is already before you in compact masses of national statistics; but also the 542 personal answers, which show as it were, fragment by fragment, the material out of which such statistics are compiled. To me these appear specially interesting, because it is by opinions of this kind, much

more than by columns of figures, that common life is influenced; and the information here collected shows the sort of knowledge of vaccination which is operative throughout Europe on all except the utterly uneducated classes. My question was purposely constructed in such a form as to elicit the expression of every existing doubt on the protective influence of vaccination; and the answers represent, I believe, quite fairly what would have been written by the medical profession if my inquiry had been a hundredfold as extensive as it was. You will observe that, throughout the whole series of 542 respondents there are but 2 whose opinion is negative. One of these gentlemen (No. 508) distrusts vaccination, and "would gladly inoculate his own "children with the small-pox;" the other (No. 219) regards both proceedings with equal disfavour, and considers them alike to be at best but harmless trifling. With these exceptions (against which I do not think it requisite here* to argue) every writer expresses confidence in the practice.

That small-pox may exceptionally occur after even apparently excellent vaccination, is of course made evident in these answers as in the previous statistics; but, in the detail of the answers, perhaps better than in the condensation of the statistics, you are able to see how mild a disease small-pox under such circumstances commonly becomes; and you will be struck with the large number of persons who, with great opportunities of observation—sometimes expressly mentioned as having extended over thirty and forty, even fifty and more years, have never seen a single vaccinated person die of small-pox.

One writer only has taken the trouble of stating at length the grounds of his confidence. But this one is Dr. Alison of Edinburgh; whose name commands respect in the medical profession, among hundreds who have profited by his personal teaching, and among thousands who have gathered instruction from his pen. In a paper supplemental to his answers (No. 10) he reviews both the

* In the margin of Dr. Hamernik's paper, I have taken the liberty of inserting an occasional note at points where he appears to me to have overlooked essential features of the case.

earlier and the later evidence on the subject of vaccine protection, and states his estimate of the argument in terms which must meet almost universal concurrence:—"The "question whether successful vaccination gives security to "a great majority of mankind against any attack of small-"pox in future life, and to a much greater majority against "fatal small-pox, has been generally regarded in this "country for the last half-century as practically decided "in the affirmative;....and, since the date of the papers "which were held decisive of the question fifty years "ago, there has been quite sufficient evidence collected 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."

Dr. Seaton, to whose zealous and valuable labours in the cause of vaccination I have already had occasion to refer, contributes a paper (No. 421) of important supplementary evidence: bringing into relief, unfortunately by contrast, the possible blessings of vaccination; and going no farther than to Scotland and Ireland for illustrations, that—in the absence of this protection—small-pox is still the same deadly and mutilative disease that it was.

Answers to the second question.

Answers to my second question are virtually included in answers to the fourth. Most of the replying Governments have made vaccination compulsory within their dominions; it is therefore superfluous to say that they at least have discovered no drawbacks to its advantage—no vicarious diseases to set against the extinction of small-pox.

So likewise among the 542 personal respondents, not a single one gives the smallest semblance of support to those contra-vaccinal doctrines which I have discussed. Very, very rarely are they even referred to. When I venture to say that M. Carnot's patchwork of figures gives an untrue picture of life, and that M. Verdé de Lisle's presumption and ignorance disentitle him to consideration, I am in the almost solitary position of having felt it a duty to read their writings. I can appeal to few witnesses who have gone through similar fatigue. An occasional German (for those indefatigable scholars read everything on their subject) and

an occasional Frenchman (for the scientific world of France has lately been molested with our old experience of foolish pamphlets) may be found mentioning those doctrines, only to condemn them. A single eminent English pathologist (No. 28) refers to them at my request in a special note. Otherwise they are unmentioned, because they are almost universally unknown. You need as little expect to find Sir Benjamin Brodie arguing against them, as Sir John Herschel against the prophecies of Zadkiel.

Indirectly the question is illustrated by an interesting series of papers (171, 179, 215, 222, 243, 391, 456) communicated by gentlemen in medical charge of schools. Especially the paper on Christ's Hospital, London, which I owe to the kindness of Mr. Stone, is important, from the largeness of its material. It gives for more than a century the mortuary statistics of an establishment which has contained from five to eight hundred young inmates; and you will notice that in this little population, just as in nations of which the statistics are before you, small-pox has gone without giving place to new diseases; that in the half-century 1801–50, while only one death from small-pox had occurred, the annual death-rate from other diseases had fallen from 847 to 585.

Answers to the third question.

With regard to the possible mischief of bad vaccination, there is somewhat less uniformity of tone; partly, perhaps, because of the real difficulty of the subject; but chiefly, because in answering the third question more expression has been given to speculative opinions. A few respondents (apparently on theoretical grounds) think that a vaccinator who improperly derives his lymph from an impure source may thereby invaccinate some second and unintended specific infection. A very few even believe they have seen instances of the kind. But, generally speaking, opinion and experience declare themselves in the opposite sense, and render it in the highest degree probable that, in the isolated instances to which reference is made, there may have operated those sources of fallacy to which I have adverted. Not only the very much greater volume of statement, but a really immense

weight of authority, is on the side of those experimental results which I quoted to you. Men of the largest and oldest consulting practice in the United Kingdom—men who are believed to have seen every variety of disease and accident to which the human body is liable—our leaders who have taught medicine and surgery to the mass of the profession—physicians and surgeons of our largest metropolitan and provincial hospitals in England, Scotland, and Ireland—physicians who have specially studied the diseases of infancy—surgeons who have specially studied the inoculative diseases—pathologists of distinguished insight and learning—have never in their experience "had reason to believe or "suspect" an opposite conclusion to that of M. Taupin's experiments. In the alphabetical series of opinions you will read familiar British names, dozen by dozen, standing beside assertions of this kind. You will read that equally negative in Paris has been the vast experience of Chomel and Moreau and Rayer and Ricord and Rostan and Velpeau; equally negative at Vienna, that of Hebra, Oppolzer and Sigmund. Obviously, then, one at least of two conclusions is inevitable. Either it is the case that, even with reprehensible carelessness as to the source of lymph, vaccination (so long as in the medical sense of the word it is vaccination) cannot be the means of communicating any second infection. [*See* however, the note introduced at page 275. J. S. 1887.] Or else it is the case that, in the world of vaccinators, care is almost universally taken to exclude that possibility of danger. To the public perhaps it matters little which of these conclusions is true. Analogies and experiments, as I have shown, speak almost decidedly for the former. But at least there can be no objection to superfluous precaution. And, in reading the answers written by gentlemen personally engaged in vaccination, you will be glad to observe how many of them, in referring to a possible slovenliness in this matter, speak of it as something which cannot be conceived of any decent medical practitioner.

Answers to the fourth question.

Answers to my fourth and last question are, for all practical purposes, summaries of opinion on the whole subject. For no person—you may be sure—will recommend the universal practice of vaccination, while he doubts its protective influence; nor while (like M. Verdé de Lisle) he regards small-pox as a "sublime crisis," which it is requisite for human health to undergo; nor while he considers that the success of vaccination, in extinguishing that horrible distemper, must develop other varieties of untimely death; nor even while he believes that, in its ordinary practice by competent persons, there are risks of casually inoculating other combined infections. To recommend that, except for special reasons in individual cases, vaccination (skilful, of course) shall be universally practised, is to imply that one's mind is made up on all those subjects. And such, you will observe, is the recommendation—with only two personal exceptions, the unanimous recommendation—of every individual and every Government in the series.

Wonderful unanimity of the answers.

Looking, then, to the whole succession of answers, and describing in few words what to myself has been the effect of perusing them, I would say that—above all—I am struck with their concord. Two hundred and thirty years have elapsed, since Harvey first taught the circulation of the blood: the first announcement of Jenner's discovery was but within the adult memory of men who are still living: yet questions addressed to the Governments of Europe, and to 542 professors and practitioners of medicine with respect to the older truth, basis though it has long become of all physiological teaching, could hardly elicit more unanimous replies than these which record the triumphant successes of vaccination. It can be no common certainty which commands so general an assent. It can have been neither a truthless nor a barren doctrine, which, within sixty years from its rise, has all but universally satisfied private judgment, and has converted nations to be its grateful followers.

Inevitability of some dissent.

No truth can be thought of, against which some one does not rail. And it would be idle to hope, under existing conditions of the human mind, that vaccination should be much more generally credited than it is. Perhaps in no age of the world, proportionately to its instruction, have persons been

readier than now to accept physical marvels, and to modify their conception of natural laws, at the cajoling of quacks and conjurers. It goes with this credulity to be incredulous of proven truth. Alike in rejecting what is known, and in believing what is preposterous, the rights of private foolishness assert themselves. It is but the same impotence of judgment, which shrinks from embracing what is real, and lavishes itself upon clouds of fiction. To some extent, therefore, it may be felt a weary and unprofitable work to have spent time and labour in re-asserting proofs which, fifty years ago, were exhaustive of the subject; and many eminent men who have favoured me with their assistance may grudge to have given it against superannuated error.

Their interest as a conclusive estimate of Jenner's services to mankind.

Yet if, in final acknowledgment of this assistance, I may be permitted to express what—far better than any thanks of mine—may requite those respected contributors for the trouble they have incurred, I would say that they have given to Jenner the monument which, beyond any other, he would have prized. They have made it easy to estimate the full measure of gratitude which is due to the discoverer of vaccination. They have displayed as actual experience, what it formerly must have seemed mere enthusiasm to foretell. You will read it in the skilled evidence of individuals who, solely with the resources of Jenner's antidote, are maintaining day by day against the most dreadful of infections the victory which he commenced. You will read it in the colossal statistics of nations which, till sixty years ago, were still decimated by that one messenger of death.

If utility to human life be any test of what is noble in labour, if our teacher of inductive philosophy have rightly advised us—*non tantum veritati et ordini, verum etiam usui et commodis hominum consulere*, then assuredly the discovery of which those things are told may rank with any achievement of man. "LET MEN REJOICE THAT THERE HAS SHONE SO GREAT A SPLENDOR FROM AMID THEIR RACE" is the bidding which, at Newton's tomb, reminds us of our immortal debt to the greatest Interpreter of Nature, and claims kindred for us with the power of his intellect, passionless and "almost divine." If corresponding honour be due to

the beneficent applications of science, if our mortal state owes love to those who have lessened its weakness and its misery, surely in Jenner has been a second student of nature, who, matchless as Newton in career, might have claimed to lie beside that monarch of the intellect in his last repose, and to share the inadequate homage of that grateful epitaph. For, though a different, it is an equal praise, which the members of Jenner's profession vindicate for his honoured name. He too interpreted nature: but, above all, he rendered her teaching fruitful. To arm mankind against the worst of pestilences, to widen by his one discovery the horizon of human life, to banish a cruel terror from every mother's heart,—such were Jenner's aspirations in his study of nature,—such have been the fruits of his philosophy.

Members of his profession esteem it their noblest vocation to imitate the endeavours which led him to this transcendent result; and I believe that they—whose contributions to the following pages I respectfully lay before you—will have felt an almost filial pride in expressing their knowledge of facts which consecrate Jenner's place in history.

I have the honour to be, Sir,
Your obedient servant,
JOHN SIMON.

Whitehall, May 9th, 1857.

CONTINUATION OF NOTES.

NOTE I.—RAVAGES OF SMALL-POX AMONG AMERICAN INDIANS.

Mr. Lloyd, the translator of Prince Maximilian's Travels in the interior of North America, quotes in the preface to his work the following description of an epidemic of small-pox which befel the Indians twenty years ago, adding that the general correctness of the details had been confirmed to him by several travellers who had subsequently visited those nations :—"The disease first " broke out about the 15th of June, 1837, in the village of Mandans, a few " miles below the American fort Leavenworth, from which it spread in all " directions with unexampled fury. The character of the disease was as appalling " as the rapidity of the propagation. Among the remotest tribes of the " Assiniboins from 50 to 100 died daily. The patient, when first seized, com- " plains of dreadful pains in the head and back, and in a few hours he is dead; " the body immediately turns black, and swells to thrice its natural size. In " vain were hospitals fitted up in Fort Union, and the whole stock of " medicines exhausted. For many weeks together our workmen did nothing " but collect the dead bodies and bury them in large pits; but since the ground " is frozen we are obliged to throw them into the river. The ravages of the " disorder were the most frightful among the Mandans, where it first broke out. " That once powerful tribe which, by accumulated disasters, had already been " reduced to 1,500 souls, was exterminated, with the exception of thirty persons. " Their neighbours, the Big-bellied Indians and the Ricarees, were out on a " hunting excursion at the time of the breaking out of the disorder, so that it " did not reach them till a month later; yet half the tribe was already " destroyed on the 1st of October and the disease continued to spread. Very " few of those who were attacked recovered their health; but when they saw " all their relations buried, and the pestilence still raging with unabated fury " among the remainder of their countrymen, life became a burden to them, and " they put an end to their wretched existence, either with their knives and " muskets, or by precipitating themselves from the summit of the rock near " their settlement. The prairie all around is a vast field of death, covered with " unburied corpses, and spreading for miles pestilence and infection. The Big- " bellied Indians and the Ricarees, lately amounting to 4,000 souls, were reduced " to less than the half. The Assiniboins, 9,000 in number, roaming over a " hunting territory to the north of the Missouri as far as the trading posts of " the Hudson's Bay Company, are, in the literal sense of the expression, nearly " exterminated. They, as well as the Crows and Blackfeet, endeavoured to fly " in all directions, but the disease everywhere pursued them. At last every " feeling of mutual compassion and tenderness seems to have disappeared, " Every one avoided the others. Women and children wandered about the " prairie seeking for a scanty subsistence. The accounts of the situation of the " Blackfeet are awful. The inmates of above 1,000 of their tents are already " swept away. They are the bravest and most crafty of all the Indians, " dangerous and implacable to their enemies, but faithful and kind to their " friends. But very lately we apprehended that a terrible war with them was " at hand, and that they would unite the whole of their remaining strength " against the whites. Every day brought accounts of new armaments, and of a " loudly expressed spirit of vengeance towards the whites, but the small-pox " cast them down, the brave as well as the feeble, and those who were once " seized by this infection never recovered. It is affirmed that several bands of

" warriors who were on their march to attack the fort, all perished by the way, " so that not one survived to convey the intelligence to their tribe. Thus, in " the course of a few weeks, their strength and their courage were broken, and " nothing was to be heard but the frightful wailings of death in their camp, " Every thought of war was dispelled, and the few that are left are as humble " as famished dogs. No language can picture the scene of desolation which the " country presents. In whatever direction we go, we see nothing but melancholy " wrecks of human life. The tents are still standing on every hill, but no rising " smoke announces the presence of human beings, and no sounds but the " croaking of the raven and the howling of the wolf interrupt the fearful silence. " The above accounts do not complete the terrible intelligence we receive. " There is scarcely a doubt that the pestilence will spread to the tribes in and " beyond the Rocky Mountains, as well as to the Indians in the direction of " Santa Fé and Mexico. It seems to be irrevocably written in the book of fate, " that the race of red men shall be wholly extirpated in the land in which they " ruled the undisputed masters till the rapacity of the whites brought to their " shores the murderous fire-arms, the enervating ardent spirits, and the all- " destructive pestilence of the small-pox. According to the most recent accounts, " the number of Indians who have been swept away by the small-pox, on the " western frontier of the United States, amounts to more than 60,000."

NOTE II.—VACCINIA AS A MODIFICATION OF SMALL-POX.

On the researches which have tended to prove the variolous origin of cow-pox, see Heim (who gives an account of Gassner's inquiry and of the local circumstances which nearly deprived him of credit in the matter) in Henke's Zeitschr., Ergänzungsheft xxx. p. 57; Thiele, loc. infra cit.; Ceely, in Transactions of the Provincial Medical and Surgical Association, vol. viii.; Badcock. Detail of Experiments proving the Identity of Cow-pox and Small-pox: Brighton, 1845; also Boston (U.S.) Daily Advertiser, April 14, 1852, where it is stated that Dr. Adams, of Waltham, and Dr. Putnam, of Boston, by a successful repetition of Mr. Ceely's experiments, have been able to "furnish the " city and neighbourhood with all the vaccine matter used there since that " period;" further, with respect to a different and probably less successful method of variolating the cow, Sunderland, in Hufeland's Journal, 1830. In the above quoted volume of the Trans. Provinc. Med. Surg. Ass. (p. 24) Dr. McMichael is referred to as having in 1828 informed the College of Physicians that in Egypt, on occasion of a failure in the ordinary supply of vaccine lymph, the variolous inoculation of cows was successfully practised, and " fine active vaccine virus produced."

Dr. Thiele's paper is published in the first part, for 1839, of Henke's Zeitschrift für die Staatsarzneikunde, with an editorial note, dated December 1838. At that time the vaccine contagion, which he had originated by small-pox inoculation of the cow, had passed through 75 successive human descents, and had been used for vaccinating more than 3,000 persons. I transcribe the paragraph in which Dr. Thiele states his conclusions; and I add to it a further remarkable passage, in which he describes what he believed to be effectual means—independent of the cow—for *artificially reducing small-pox virus* to a state in which its inoculation would produce on the human subject only the ordinary effects of vaccination :—

" 1. Die sogennante Vaccine ist nicht eine den Kühen e genthümliche, sondern " durch Uebertragung der Menschenpocken bei ihnen hervorgebrachte Krank- " heit; und der Mensch und nicht die Kuh, wie man bisher geglaubt, ist die " Quelle der Vaccine.

"2. Diese so gebildete Krankheit kann durch unmittelbare Uebertragung von "Kühen auf Menschen übergehen, bringt in ihnen eine identische leichte, vor "den natürlichen Blattern schützende, Krankheit hervor.

"3. Durch ein absichtliches methodisches Modificiren und Depotenziren, kann "man auch ohne Daswischenkunft der Kuh, Schutzblattern hervorbringen.

"4. Diese Schutzblatter hat alle bekannte Eigenschaften der Vaccine, nur in einem zum Wohle der Menschheit höheren Grade.

"5. Die vorstehenden, bis jetzt erlangten Resultate berechtigen zu der "Hoffnung, dass man zur Milderung der epidemisch-contagiösen Krankheiten "ein den Schutzblattern ähnliches Mittel wird finden können.

"* * Die Reduction der Menschenpocke zur Vaccine anlangend, so "muss die Lymphe aus Menschenpocken erst 10 Tage zwischen mit Wachs "verklebten Gläsern liegen, und dann mit warmer Kuhmilch verdünnt, gleich "der gewöhnlichen Vaccine geimpft werden; diese Impfung bildet an den "geimpften Stellen grosse Pocken, das die gewöhnliche Impfung begleitende "einmalige Fieber zeigt sich zweimal, zum erstenmale gegen den 3ten bis 4ten, "das zweitemal, und zwar heftiger, zwischen dem 11ten und 14ten Tage, die "peripherische Röthe ist stärker, und nicht blos an der geimpften Stelle, "sondern auch neben derselben entstehen zuweilen, jedoch immer nur ganz "kleine Pocken; die Narbe ist grösser und tiefer wie gewöhnlich, die Ränder "derselben zuweilen scharf. Zehn Generationen hindurch muss diess Verfahren "beobachtet werden, wodurch die Pocke nach und nach ganz der Vaccine "gleichkömmt; wenn das consecutive Fieber ausbleibt, dann kann man "Impfungen von Arm zu Arm ohne Verdünnung der Lymphe mit Kuhmilch "vornehmen."

Note III.—Relation of certain Current Contagia to Ages of Population.

The adjoining table expresses in four series of figures, arranged side by side, what may be considered, approximately at least, as the natural affinities of the four zymotic diseases named in it. The population under five years of age is of course always a minority of the entire population—in England at the last census somewhere about 13 per cent.; but that minority furnishes

Proportionate Distribution by Age of 1,000 Deaths in Geneva by Small-pox before the Discovery of Vaccination; and of the same Number of Deaths in England by Hooping Cough, Measles, and Scarlet Fever respectively, in the Year 1847.

Ages.	Small-pox.	Hooping Cough.	Measles.	Scarlet Fever.
0—1 - -	202½	404½	156½	63¼
1—2 - -	191½	275	340¾	145
2—3 - -	190	138½	201½	171¼
3—4 - -	132¼	77¾	117	153
4—5 - -	88¾	47¼	68	123½
0—5 - -	805	943	883¾	656
5—10 - -	155¾	52½	91¾	254½
10—15 - -	18½	2¼	13½	54¼
15—25 - -	13¾	½	4	12¾
Above 25 -	7	1½	7	22½
At all Ages -	1,000	1,000	1,000	1,000

the large majority of the deaths here referred to. Two thirds of all deaths by scarlet fever, four-fifths of all deaths by natural small-pox, a still larger proportion of all deaths by measles, and 943 of every 1,000 deaths by hooping cough belong to that fraction of the population. In a word, those are distinctively infantile diseases. And the obviousness of this fact represents three conditions:—first, that the susceptibility to those diseases develops itself very early in life; secondly, that the susceptibility, when once acted on by its corresponding exterior cause, becomes exhausted more or less absolutely for the remainder of life; thirdly, that the exterior cause or infection has been of sufficiently frequent recurrence among the population for those relations of susceptibility to show themselves. For the meaning of the diseases being infantile is, not that any insusceptibility to contract them is acquired in the mere act of growing up; but that—because the susceptibility developes itself at the commencement of life, and because the exterior influence which acts upon that susceptibility is seldom absent,—therefore all who have outlived the first years of childhood have commonly had each susceptibility exhausted by suffering the disease to which it relates. Hence, if all occurring cases of any such disease be classified according to the ages at which they happen, the resulting series of figures must necessarily have its maximum at that age where the special susceptibility is first fully developed. From this point it must undergo a more or less rapid and uninterrupted decline; the *uninterruptedness* being determined by the fact that at each succeeding age there will be fewer and fewer susceptible persons, the *rapidity* being graduated by the frequency or constancy with which the exterior cause is in operation. The infection of measles was carried to the Faroe islands in the year 1846 after an absence of sixty-five years; and it was then observed that (with exception of persons who had been touched in the former epidemic) nearly the whole population suffered. According to the very interesting history published by Dr. Panum (Virchow's Archiv. i. 492) there were—among 7,782 inhabitants of the islands—more than 6,000 attacks of measles. If these had been classified in the manner of which I speak, the maximum number corresponding to the age when the susceptibility is first fully developed, would probably have stood, as in the adjoining death-table, at the second year of life; but as all subsequent ages of that population up to sixty-five years represented a still susceptible class, the series of figures for these periods of life would have declined very slowly; probably, indeed, only at the same rate as the mass of living population declines from age to age. In the adjoining table, it deserves notice that deaths from hooping cough, and (in a trifling degree) those from small pox, are proportionately most abundant in the first year of life; deaths from measles in the second; and deaths from scarlet fever in the third. I have no reason to believe that a similar classification of *attacks* of those diseases respectively would (if one could obtain it) differ so materially from that classification of *deaths* as to reverse any important conclusion which may be drawn from the latter; and if not, there would seem to be evidence that the several specific susceptibilities to those respective diseases develop themselves, not simultaneously, but in succession. I would not insist much on the trifling difference between 202½, 191½, and 190 in the small-pox column; for although they show that the susceptibility to small-pox is largely developed in the first year of life, yet they leave it quite possible that the full susceptibility—if it could be tested by *attacks* instead of *deaths*—might be found rather in the second and third years of life than in the first. But a very early development of full susceptibility to hooping-cough, and a later development of susceptibility to scarlet fever, are strikingly suggested in the table. It deserves notice, however, that an analysis of deaths from the same diseases in *London* during the seven

years 1848–54, though showing generally the same distribution among different ages, presents a remarkable exception in the case of hooping-cough; the deaths from this disease in the first biennium of life being divided nearly equally between the two years; not, as above, in the proportion of $404\frac{1}{2}$ to 275, but (with a slight preponderance for the second year) in the proportion of $319\frac{1}{4}$ to $323\frac{1}{2}$.

Note IV.—Degeneration of Vaccine Lymph.

In support of the doctrine that the vaccine contagium has a natural tendency to degenerate in transmission, reference has been made to what commonly occurs in the *clavélisation* of sheep. In order to procure a mitigation of ovine small-pox, recourse has been had to the same sort of proceeding as used to be followed on the human subject; and the contagion of the disease has been artificially conveyed from sheep to sheep by inoculation with *claveau* or lymph, derived in the first instance from an animal having the natural disease. Monsieur Hurtrel d'Arboval, in his Dictionary of Veterinary Medicine (vol. i. p. 445) gives the following account of what ensues:—"Il est une observation bien digne " de remarque, c'est que le claveau perd de son activité et de sa propriété par la " succession de son inoculation. Vierden a observé qu'à la cinquième clavélisa- " tion, il ne produit pas qu'un bouton unique, et Boudouin fixe à la douzième " ou quinzième clavélisation successive le dernier degré de l'affaiblissement du " claveau. Passé ce terme, on ne remarque plus de veritable clavelée, ou " du moins on en voit trèsrarement. Il est donc nécessaire de renouveler de " temps en temps le claveau, en le reprenant sur des bêtes atteints naturellement " de la clavelée." Mr. Ceely however (to whom I owe my knowledge of this remarkable passage) does not receive, without reserve, the alleged degeneration of small-pox contagion in the sheep. He expresses to Mr. Simonds (see the latter's work on Variol. Ovin., p. 123) his doubt whether it may not have arisen in the absence of "care and selection in the transmission." But "if it be true, " when great pains are taken to repeat inoculations with lymph in a proper " state, viz., clear and limpid, it is a very remarkable and highly interesting fact, " and well worthy the attention of the members of the medical and veterinary " professions. . . . . I cannot help suspecting that the difficulty consists in " obtaining the virus before it is too late, for there certainly is a difficulty."

Whatever question there may be whether the contagium is naturally prone to degenerate, there can be no question as to the great frequency with which definite causes of degeneration operate on it. It is alleged, that, without any fault of the vaccinator, certain subjects act deterioratingly on the contagion which they transmit; that lymph taken from them is necessarily an inefficient lymph; that such subjects must occur in every line of succession; that thus at the end of any long series of vaccinations, effected from arm to arm *without selection of subject*, degeneration will certainly have been produced. Still more frequent danger to the efficiency of successive contagions arises of course in acts of personal carelessness, to which reference is hereafter made, especially in taking lymph from vesicles too advanced in their processes (when in fact it has degenerated), or from vesicles that have been disturbed in their course by mechanical or other irritation, or by accidentally concurrent diseases (especially skin diseases) in the subject. I cannot say to what extent the various modified stocks of contagion thus originated are capable of perpetuating their degenerative types: but whatever the extent may be, to that extent the results would tend to diffuse themselves in proportion to the number of vaccinations. Whether slow progressive degeneration of the vaccine contagion in its successive human transmission be or be not proved as inevitable, 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, when 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 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 where 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. This danger would of course be greatly increased if (as has been suggested) the subdivision were carried further by arranging for public vaccination under a kind of general contract with the entire medical profession.

The following are quotations from authorities named at p. 229, as having drawn attention to the differences of efficiency between older and younger stocks of lymph:—

M. Bousquet (sur le Cow-pox) découvert à Passy le 22 Mars 1836) gives an elaborate account, illustrated with coloured plates, of the differences of operation which he observed between the current lymph of 1836 and that of a new source. One important difference was in power of *taking*:—"Sur un nombre égal de " vaccinés avec l'ancien et le nouveau virus, le premier a donné 628 boutons et " le second 776; différence 148, en faveur du dernier. Et remarquez que je ne " fais souvent que deux piqûres avec le nouveau vaccin, tandis que j'en fais " toujours trois avec l'ancien." This at p. 24; and, as regards some other differences, at p. 20—"On voit que le nouveau vaccin marche tout à la fois plus vite " et plus lentement que l'ancien; plus vite en ce qu'il donne plus tôt signe de " vie; plus lentement, en ce qu'il prolonge sa carrière beaucoup plus loin." M. Bousquet adds, that in vesicles produced by the new contagion, the lymph remained effective much later than in vesicles of the former source, and that the lymph was more effective for re-vaccination.

Dr. Gregory (Med. Gaz. xxi., p. 860) drawing a distinction in 1838, between two qualities of lymph, says, of that which he had abandoned, that—"For three " or four years past he had noticed a diminution of its intensity; eight or ten " incisions produced not more irritation than the three to which I was accus- " tomed fifteen years ago. In March last, Mr. Marson, the Resident Surgeon, " employed lymph from a different source. The new lymph was found to be far " more intense and active than the old lymph. . . These facts have convinced " me that vaccine lymph, by passing through the bodies of many persons, loses, " in process of time, some essential portion of its activity."

Mr. Estlin, in reference to one quality of lymph (Med. Gaz. xxii., p. 997) says—" The alterations in the vaccine infection which have appeared to me most marked " are the smallness of the vesicle and its attendant areola; its rapid course; the

" absence of constitutional disturbance ; the small quantity of lymph yielded by " the vesicle ; and especially the diminished activity of its infecting power." And subsequently (Med. Gaz. xxiv., p. 153) in reference to a different supply, which he had recently derived from its source, he observes—" Having watched " the virus through 29 subjects successively (nearly one every week since the " matter was derived from the cow), I have now no hesitation in stating, that " I consider it a valuable supply of virus, more energetic in its local and consti- " tutional effects, and more inclined to produce vesicles resembling what cow- " pox was many years ago, than that employed by the National Vaccine Esta- " blishment." Mr. Estlin soon after published (op. cit. p. 208) important testimony from the Vaccine Institution of Glasgow, stating that in 43 trials made with this lymph there had not been a single failure, whereas in the last preceding 43 vaccinations made with a former lymph there had been failure in 10 cases, and spurious or imperfect vesicles in 9 others; that at this Institution, in the course of the preceding $3\frac{1}{3}$ years, there had " at four different periods occurred an entire " degeneration of the lymph, and a consequent complete failure of the vaccina- " tion ;" and that, at the very time when the new supply reached them such a failure was being illustrated in the fact that "all the children vaccinated upon " the day week preceding, presented, instead of true vesicles, raw surfaces re- " sembling spots that had been vesicated and then denuded of their cuticle."

Professor Hering, of Stuttgart, (über Kuhpocken an Kühen, p. 166) writes— " Die von originärer Kuhpockenlymphe bei Kindern entstehenden Pusteln sind " meist durch Grösse, stärkere locale Entzündung, heftigeres Fieber und " langsameren Verlauf ausgezeichnet. In selteneren Fällen kommt aber auch " das Gegentheil vor. Die stärkere Einwirkung auf den menschlichen Körper " ist oft noch in der zweiten und dritten Impf-Generation bemerklich. Die " Impfung mit solch erneuertem Stoffe schägt seltener fehl als mit dem seit " langer Zeit nicht mehr aufgefrischen. Ein frieselähnliches Exanthem begleitet " manchmal die Impfung mit originärer Lymphe." In the little volume referred to there is an unusual amount of information on the subject; for, during the ten years 1827–37, genuine cow-pox had been observed in Wirtemberg on 69 different occasions; and its contagion had been successfully transferred to the human subject at least 170 times out of about 210 trials.

M. Fiard, communicating to the Académie des Sciences in 1844 the results of an experimental comparison which he had just instituted between the action of lymph then newly derived from the cow and the action of other lymph which was of eight years' descent, uses these words:—" Jusqu'au huitième jour (comme " cela a lieu pour la varioloïde et la variole) la différence est nulle; mais à " dater du neuvième jour, la dessiccation des pustules de l'ancien vaccin com- " mence; elle est complète du treizième au quatorzième jour. Le nouveau, au " contraire, poursuit sa marche et son développement plus lentement, et la " dessiccation n'est complète que du seizième au dix-septième jour. C'est donc, " entre ces deux vaccins, une différence de trois ou quatre jours. Le vaccin de " Jenner, après un séjour de trente-neuf ans sur l'homme, comparé en 1836 à " celui de 1836, était tombé au point que sa dessiccation avait lieu le douzième " jour, tandis que celui de 1836, comme celui de 1844, n'arrivait à la dessicca- " tion complète que le dix-septième jour. Il y avait donc une différence de " cinq jours. Celui de 1836, aujourd'hui, après huit ans de séjour sur l'homme, " comparé à celui de 1844, dont la dessiccation n'est complète que le dix- " septième jour, arrive à cette dessiccation du treizième au quatorzième jour; " c'est donc trois ou quatre jours qu'il a perdu sous le rapport de la durée " éruptive. Or, d'après ce qui précède, il est évident que le vaccin de 1836, en

" huit ans, a subi aujourd'hui une atténuation. Donc il faut le remplacer par " le nouveau, puis se mettre en mesure pour opérer le renouvellement tous les " cinq ou six ans."—Comptes Rendus des Séances de l'Acad., 1844, p. 749.

Dr. Steinbrenner (op. cit. p. 252) in describing the results of his own comparative experiments, says :—" On pourrait presque dire que les pustules de vaccine " ancienne sont aux pustules de vaccine régénérée ce que les pustules de " varioloide sont aux pustules de variole. En effet, comme dans la varioloide, " les pustules du vaccin ancien sont moins développées, se dessèchent plus " rapidement, l'affection générale qui les accompagne est plus légère, elles " laissent des cicatrices bien moins profondes," &c.

It is an interesting and instructive fact that, in the days of small-pox inoculation, questions very similar to these were raised. Jenner (op. cit. Edit. 3, p. 52) speaks of inoculations " with inefficacious variolous matter " which gave no permanent security, though the immediate results were to all appearance sufficient. In one striking set of cases (p. 80) a surgeon had inoculated " from a " pustule which, experience had since proved, was advanced too far to answer " the purpose intended." The local results which followed, and the eruptions which appeared about the ninth day (but " died away earlier than common " without maturation ") were such as induced the operator—and, he says, might have induced any one—" to suppose that the persons were perfectly safe from " future infection." But of the five, who were thus inoculated, " four took the " small-pox afterwards in the natural way; one of whom died, three recovered, " and the other, being cautious to avoid as much as possible the chance of " catching it, escaped from the disease through [the remaining twelve years " of] life."

Note V.—Renewed Attacks on Vaccination.

The following are the terms in which M. Verdé de Lisle (de la Dégénérescence Physique et Morale de l'Espèce Humaine déterminé par le Vaccin ; Paris, 1855) opens his case against vaccination :—" L'espèce humaine dégénère ; aux " puissantes races des siècles passés a succédé une génération petite, maigre, " chétive, chauve, myope, dont le caractère est triste, l'imagination sèche, l'esprit " pauvre . . Remontons enfin à l'origine : la cause unique de ce désastre " multiple, c'est la vaccine . Voyez cette génération inerte, rachitique, frappée " en naissant d'impuissance et de vieillesse. Prenez-la dès le collége, froide, en " proie à une paresse triste . pauvres enfants, qui n'admettent que la malice " paisible, pour qui l'espièglerie est trop gaie, l'exercise trop fatiguant . . " Suivez-les . ils n'ont jamais dansé . . Rappelez-vous nos pères, la forte " race de l'empire? aujourd'hui les compagnies d'hommes de cinq pieds six " pouces appartiennent à l'histoire . . Après Voltaire, après Beaumarchais . " le triste spectacle d'une foule de petits personnages qui ne peuvent élever leur " présomption plus haut que la collaboration et la critique . . L'Angleterre . " n'a même plus ni un Sheridan, ni un Dryden quelconque; son éloquence " parlementaire s'arrête à la pléïade contemporaine de Lord Palmerston. " L'Allemagne . s'est arrêtée à Jean Paul . . En musique, à défaut des " Gluck, des Mozart . des Boieldieu . le métier nous donne les nombreux " arrangeurs. En peinture, après les Rubens, les Van-Dick . il nous faut " tomber sans transition de la puissance de Géricault à la patience de Meisonnier. " . . On prétend être sérieux; tout simplement on est grave et ennuyé. . " A un mal, ils en ajoutent un autre; ils compliquent le premier empoissonne- " ment, ils fument pour avoir l'air de penser . . Les exemptions du service " militaire . ont pris des proportions de plus en plus considérables. . .

" A quoi bon l'air? Les pores de la peau sont oblitérés, les poumons sont " tuberculisés. . A quoi bon la nourriture saine? à quoi bon préserver " l'economie des miasmes pestilentiels?" etc. It requires no medical knowledge to gauge the capacity of this fiction. Its nonsense is only to be equalled in burlesque literature; and perhaps the nearest parallel is presented in a familiar line of the *Rejected Addresses*, where the indignant author of "A Loyal " Effusion" intimated that Napoleon Buonaparte had "filled the butcher's shops " with large blue flies." The physical degeneration of man is, indeed, an old cry. Every age in its turn has looked back wistfully on some imagined possession of the golden past—some strength, or stature, or nobility which belonged exclusively to its good old times. Not two of Homer's contemporaries (οἷοι νῦν βροτοί εἰσι) could move such stones as Ajax and Æneas had hurled; and the same tendency to believe in a gradual degeneration of mankind has, from then till now, been expressed in inumerable forms. That "the world is in " its dotage," is a doctrine which, a century ago, was sufficiently current and sufficiently ridiculous to be used for the purposes of the humourist. The reader of the Vicar of Wakefield remembers it in the mouth of Ephraim Jenkinson as representing just that sort of gabble which could be used for the stock-speech of a sham philosopher; and Dr. Primrose might well, on the second occasion, think he had " heard all this before."

Note VI.—Comparison of English Death Rates from all causes in Pre-vaccination and Post-vaccination Times.

The nearest approach to an exact pre-vaccination death rate for England is the very limited one which we have in the Tontines of 1774–8 and 1790; but this (besides being insecure from the smallness of its material) is made almost inapplicable for my present purpose by the fact that the nominees in these Tontines were *selected*—chiefly of course with reference to their chances of comfort and longevity; and to compare our *average* death-rates with the death-rates of a population so selected, would be to defeat the objects of comparison. Mr. Finlaison has kindly obliged me with his calculation of the Tontine death-rates, and I have embodied them in the subjoined table side by side with certain other death-rates for the same periods of life. For special comparison with the Tontine death-rates, I have inserted the death-rates of two populations of the present time, where circumstances operated in some respect

Annual Death Rate per 10,000 living at Ages and in Populations as below.

Ages and Sex.	Tontines of 1774–8.	Tontine of 1790.	Friendly Societies of Great Britain.	Sixty-three Healthy Districts of England, 1849–53.	England and Wales (Reg. Gen.) 1845–54.
Males:					
15–25 - -	111·467	118·634	61·9	69·1	83·3
25–35 - -	117·302	118·683	75·5	81·8	101·5
35–45 - -	139·351	130·520	93·9	92·8	130·9
Females:					
15–25 - -	83·149	84·268	66·5	76·5	86·3
25–35 - -	101·254	85·299	75·1	89·4	108·3
35–45 - -	114·416	99·283	92·8	99·8	129·3
Mean:					
15–25 - -	97·308	101·451	64·2	72·8	84·8
25–35 - -	109·278	101·991	75·3	85·7	104·9
35–45 - -	126·883	114·901	93·4	96·4	130·1

equivalently to the selection which I have described. I have taken, first, the *death-rates of the provident classes* from materials given by Mr. Neison in his recent "Contributions to Vital Statistics"; and secondly, the *death-rates of the population of the* 63 *healthiest registration districts of England and Wales*, as estimated by Dr. Farr. These populations—the former in respect of somewhat easier circumstances and better-regulated lives, the latter in respect of advantages of residence—may be considered as select populations, fairly comparable with Tontinists. I have also inserted in the table the general (unselected) death-rates of England and Wales, as given by the Registrar General for the years 1845–54. I must, however, confess that the standard of comparison appears to me radically defective. The great difference between the death-rates of the two sexes of Tontinists shows, I think, one of two things: either that the population-basis of these calculations has been too small for a trustworthy result, and that some fallacy affects the death-rate of one sex or the other; or else that circumstances, unknown to the present age, did really at the periods referred to make that large difference between the death-rates of the sexes. In either case it would be unsafe to draw conclusions from the comparison; and therefore it is that the table is set here rather than inserted in the text. In the last part of the table is set the mean rate for the two sexes in respect of each of the five populations compared, and in this of course the discrepancy is concealed. But I am not prepared to say that any trustworthy conclusion may be drawn from it.

Note VII.—Indifference of Typhoid Fever to difference between Variolated and Vaccinated Persons.

In the Report for 1852 of the Vaccination Board of the Department of the Rhone, Dr. Roy, of Lyons, writes as follows:—"Une jeune fille varioleuse " avec taches ecchymotiques entrée au mois d'Octobre dans notre service, suc- " comba dans les vingt-quatre heures qui suivirent son entrée. Trois jours après " deux malades convalescentes de fièvre typhoïde sont prises de variole: une " d'elles a succombé. Nous avons observé deux cas de fièvre typhoïde chez des " ouvrières qui portaient des cicatrices nombreuses de variole antérieure."

And again, the Report for 1853 of the same Board, besides other references, quotes these cases from Dr. Piérou:—" Dans une maison, les six personnes qui " l'habitaient ont eu, en 1853, la fièvre typhoïde; sur ce nombre, deux avaient " eu antérieurement une variole confluente, ce qui n'empêcha pas la fièvre " typhoïde d'être aussi grave que chez les personnes vaccinées. Un homme de " 48 ans, soignant son fils vacciné, atteint de fièvre typhoïde, et portant lui-même " des traces de variole confluente antérieure, a eu la même fièvre que son fils; " tandis que sa femme, bien vaccinée, en fut exempte, quoiqu'elle eût soigné son " fils et son mari, passant les nuits près d'eux pendant près de deux mois. Enfin, " M. Piérou cite encore deux femmes avec cicatrices varioliques nombreuses " atteintes plus tard de la fièvre typhoïde."

Subjoined to the latter Report is a paper, which had recently been communicated to the Académie de Medecine of Lyons, by Dr. Teissier, Physician of the Hôtel Dieu; telling that among 170 cases of typhoid fever which, during the past eighteen months, had been under his treatment, there were 30 where the patient bore marks of previous small-pox; and adding that within the same period he had seen more than 20 illustrations of small-pox attacking persons who had previously had typhoid fever; two of whom were at that moment still in his ward, having been seized with the former disease when just convalescing from the latter.

The Paris Academy, in its Report for 1852, speaks of interminable facts of the same sort, specifying only a few of them:—"M. Barth a vue, dans son service

" à l'hôpital Beaujon, quatre cas de fièvre typhoïde sur des sujets non vaccinés, " et marqués de la petite vérole. Un seul est mort; c'était justement le plus " marqué. Et l'inverse, il a vu encore plus souvent la petite vérole après la " fièvre typhoïde . . . . . M. le Docteur Lasnon a raconté qu'appelé dans " le cours d'une épidemie, pour voir quatre enfans de la même famille, il eut la " douleur de voir périr les deux garçons, âgés de 25 à 26 ans; les deux sœurs " s'en tirèrent, mais elles ne se relevèrent de la petite vérole que pour mourir " plus tard de la fièvre typhoïde . . . . Un honorable académicien a trouvé " dans un seul rapport dix-sept cas de fièvre typhoïde, dont neuf sur des sujets " qui avaient eu la variole naturelle."

In the Gazette Médicale de Paris, 1854 (p. 530) Dr. Thore writes a paper, in which, besides quoting similar cases from several other authorities, he details from his own experience, as follows: first, 8 cases of typhoid fever, sometimes of great severity, following small-pox in non-vaccinated persons aged from 19 to 51; and secondly, 6 cases of small-pox, modified and unmodified, following typhoid fever in vaccinated and non-vaccinated persons aged from 9 to 20. Dr. Thore appropriately quotes Stoll's information about fever in Vienna in the last century, to the effect that, during a period of 12 years, about two-fifths of all Vienna deaths were produced by it, and that it proved fatal to nearly one-seventh of all whom it attacked.

Professor Forget, of Strasburg, had published in 1852 (Gaz. des Hôpit. p. 79) an important memoir, discussing the question on general pathological grounds, and giving cases in support of his opinion. He institutes an extended comparison of the two diseases, as to their respective anatomical affinities and the nature of their morbid processes, and the symptoms (especially the relation of the fever to the local changes) of each. He argues that "l'apparence pustuleuse de la " dothinentérie est exceptionelle et ne constitue qu'une forme assez rare;" and he concludes, " (1) que la comparaison entre les deux maladies n'est pas soutenable; (2) que l'enterite folliculeuse ne préserve pas de la variole; et (3) que " l'une pouvant succéder immédiatement à l'autre et vice versâ, c'est le comble " de l'inconsequence que d'établie entre ces deux affections un esolidarite que " rien ne justifie."

A careful description by M. Blot, communicated to the Société de Biologie (Gaz. Méd. 1854, p. 731), illustrates this further point; that when, rarely enough, small-pox does develop pustules along the intestinal canal, these differ essentially in their distribution and character from that affection of a specific glandular structure, which is characteristic of typhoid fever. It is remarkable, too, that in M. Blot's case not even M. Carnot could have regarded the intestinal pustules as *la variole détournée par la vaccine:* for never had patient been less vaccinated; the intestines were those of a *fœtus;* the mother herself, not vaccinated, had had modified small-pox; and the intra-uterine child had thus contracted small-pox, died, and been expelled. In addition to an abundant variolous eruption on the skin there were great numbers of pustules in the stomach, and all along the small intestine at every part of its circumference.

In *Canstatt's Jahresbericht* for 1851 I read of a paper by Dr. Debourge (published in the Brussels *Journal de Médecine*, Nov. 1851) answering M. Carnot with the following illustration:—A village in M. Debourge's neighbourhood had been visited by typhoid fever so severely, that almost the whole population—especially that part which was between 20 and 40 years of age—had suffered. Four years afterwards, small-pox prevailed there (nearly the whole population being unvaccinated) and attacked and killed indiscriminately those who had, and those who had not, suffered from the typhoid infection.

NOTE VIII.—EARLY WORKING OF THE COMPULSORY VACCINATION ACT.

The annexed Table (for the particulars in which I am indebted to Mr. Tomkins, Inspector of Vaccinations to the National Vaccine Establishment) illustrates that disobedience to the secondary provisions of the law has also increased, and—to judge from this sample—has prevailed in a large majority of even those cases in which vaccination has been duly performed. The Act of Parliament requires that vaccinated children shall on the eighth day be taken back for inspection as to the success of the vaccination, and shall receive a certificate of its success. Mr. Tomkins shows that, of 407 cases vaccinated by him in the last 6⅓ months, only 97 were brought back for inspection, and only 3 received certificates. The Registrar's Notice, which enjoins that " this paper must be shown to the medical practitioner when the child is taken " to him for inspection after vaccination," was presented in only 58 of the 97 cases.

Proceedings at the Central Station of the National Vaccine Establishment.	Vaccinations performed by the Inspector.	Cases brought back for Inspection on the 8th Day.	Cases brought with their corresponding Registrar's Notices.	Certificates of Successful Vaccination given to Applicants.
Sept. 1853—Sept. 1854 -	1,192	289	265	86
Sept. 1854—Sept. 1855 -	1,502	219	179	29
Sept. 1855—Sept. 1856 -	943	256	195	24
Sept. 1856—April 1857 -	407	97	58	3

On the whole three years the infantine vaccinations of England and Wales have amounted to nearly three-fifths of the births. The annexed table, giving an account of such vaccinations in the different parishes of the metropolis, may illustrate how very unequally different places contribute to the general proportion. In the parish of St. Matthew, Bethnal Green, for every hundred births during the three years 1854–6, there have been 81 infantine vaccinations by the public vaccinator. In the parish of St. Luke's there have been only 28. Without local inquiry, it is not possible to decide how much of the apparent insufficiency of infantine vaccination in certain districts is really what it seems; but there are many differences in the table for which I am unable to account otherwise than by supposing that there are corresponding differences of merit in the local arrangements for public vaccination.

INFANTINE VACCINATIONS performed in the METROPOLIS during the TRIENNIAL PERIOD 1854-6.

PARISHES.	Births.	Vaccinations under 1 Year of Age.		
		Successful.	Total Number.	Total Number per 100 Births.
St. Matthew, Bethnal Green - -	10,944	7,909	8,880	81·1
St. Luke, Chelsea - - - -	5,670	3,250	3,427	60·4
Clerkenwell - - - - -	6,642	3,215	3,216	48·4
Fulham - - - - -	3,119	1,866	1,883	60·4
St. George (East) - - - -	5,585	2,448	2,462	44·1

INFANTINE VACCINATIONS performed in the METROPOLIS during the TRIENNIAL PERIOD 1854-6—*continued.*

PARISHES.	Births.	Vaccinations under 1 Year of Age.		
		Successful.	Total Number.	Total Number per 100 Births.
St. George (Hanover Square)	6,195	3,031	3,311	53·4
St. Giles and St. George (Bloomsbury)	5,357	1,870	1,891	35·3
Hackney	6,347	2,935	3,002	47·3
Hampstead	987	344	393	40·1
Holborn	4,223	2,381	2,446	57·9
St. Mary, Islington	12,209	6,422	6,626	54·3
St. James, Westminster	2,816	1,278	1,492	53·0
Kensington	5,053	2,032	2,079	41·1
City of London	3,611	1,141	1,152	31·9
East London	4,517	2,403	2,447	54·2
West London	2,457	1,552	1,561	63·5
St. Luke, Middlesex	7,457	2,059	2,035	28·0
St. Margaret and St. John, Westminster	6,618	4,125	4,356	65·8
St. Martin-in-the-Fields	2,001	1,435	1,479	73·9
Marylebone	13,620	6,543	6,578	48·3
Paddington	5,015	1,885	1,933	38·5
St. Pancras	18,200	8,243	8,407	46·2
Poplar	7,570	4,337	4,381	57·9
Shoreditch	14,045	8,355	8,618	61·4
Stepney	13,188	5,699	5,730	43·4
Strand	7,412	2,584	2,637	35·6
Whitechapel	8,301	5,926	6,113	73·6
Bermondsey	6,152	2,764	2,805	45·6
Camberwell	5,995	3,043	3,271	54·6
St. George, Southwark	5,750	2,881	3,078	53·5
Lambeth	15,813	6,037	6,217	39·3
St. Mary, Newington	7,844	3,252	3,388	43·2
St. Olave	1,717	866	866	50·4
Rotherhithe	1,754	836	836	47·7
St. Saviour	3,762	2,803	2,803	74·5
Wandsworth and Clapham	5,358	2,359	2,420	45·2
Greenwich	11,464	6,041	6,278	54·8
Lewisham	4,361	1,655	1,753	40·2

NOTE IX.—MENTION OF SOME ADDITIONAL SOURCES OF INFORMATION.

Since the date of this letter, I have received a valuable communication (Die Kuhpocke und ihre Bedeutung; eine Beantwortung der von der K. grossbritt. Gesandtschaft vorgelegten Fragen; von Dr. Raimund Melzer, k.k. Director des Bezirkskrankenhauses auf der Wieden in Wien) from Dr. MELZER, of Vienna; which, if it had reached me earlier, I should have laid under considerable contribution. Dr. Melzer treats the entire subject with much skill; but the especial interest of his paper consists in a comparison which he draws (with the support of some volumes of documentary evidence) between Carniola and Carinthia, in respect of their prevailing diseases. He affirms (in a sense directly opposed to M. Carnot's doctrine) that Carinthia, where vaccination has

been greatly resisted, suffers so much from scrofula, typhoid fevers, and other contagious diseases, as to be unable to furnish the army with its proper contingent of recruits; while Carniola, where vaccination has always been received with the greatest favour, not only furnishes its own contingent, but makes up for the deficiencies of the other province. Also I received, unfortunately too late to be translated for my Appendix, a treatise (Die Kuhpockenimpfung; eine Beantwortung der vom General Board of Health aufgestellten Fragen, von Dr. Carl Friedinger, prov. Impfarzt im k.k. Kubp. impf. Hauptinstitut, und prov. Hauswundarzt der k.k. Findel-Anstalt in Wien) on the entire subject by Dr. FRIEDINGER, of the same city, whose opportunities of observation in the great Foundling establishment of Vienna give peculiar value to his statements. I need the less regret the absence of this communication from my Appendix, as Dr. Friedinger has taken part in furnishing the very important paper (p. 154) which is contributed by the Society of Surgeons of Vienna; and his views are no doubt embodied therein with those of his distinguished colleagues. I have also to thank Dr. BERTIN, of Nancy, for a paper of much merit (Essai historique et critique sur les attaques dirigées contre la Vaccine) published by him last year in refutation of M. Carnot and his followers. I have read with pleasure and instruction many other works than those which I have expressly quoted in my Letter; and among such I may name a very sensible little book written thirty years ago by Mr. GREENHOW, of Newcastle, and some papers by Dr Alexander KNOX, "On the existing state of our knowledge of Vaccination and "Re-vaccination," published in the *London Journal of Medicine*, Nos. XXIII and XXIV. I observe that I have not specially quoted Dr. EIMER's very excellent work (Die Blatternkrankheit in pathologischer und sanitätspolizeilicher Beziehung; Leipzig, 1853) and therefore it is incumbent on me to acknowledge that I have often referred to it with advantage. Dr. STEINBRENNER'S work (Traité sur la Vaccine; ouvrage couronné par l'Académie Royal des Sciences en 1845; Paris, 1846) I have indeed quoted; but hardly in proportion to the indirect assistance I have derived from its learned, but unmethodical, treatment of the subject.—MAY 20th, 1857.