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DOES VACCINATION PREVENT SMALLPOX ?

A LESSON TAUGHT FROM THE GLOUCESTER EPIDEMIC.

BY

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A LECTURE

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1759

THIS year is the centenary of the experiment on vaccination made by Dr. Edward Jenner, of Berkeley, Gloucestershire. On the 11th May, 1796, Dr. Jenner vaccinated a boy eight years old from a sore on the hand of a dairymaid, who was infected by her master's cows. On July 1st, 1796, the boy was inoculated with smallpox matter, taken from a pustule; but no disease followed. Several months after this the boy was again inoculated with smallpox matter, but no sensible effect was produced on his constitution. Here then was the commencement of humanized vaccination, a practice which has continued till our times, and has been, until recently, accepted as the best preservative against the ravages of smallpox. The early vaccinators could test all their vaccinations by subsequent smallpox inoculation, and thus the prevention by vaccination was clear to all experienced practitioners in the early years of this century.

The question before us this evening is whether vaccination prevents smallpox, and what can we learn from the account of the epidemic in Gloucester. Let us, then, see what the facts were. In an account of that epidemic, on March 21st, it was stated that the number of cases of smallpox had risen from 50 to 70, and then to 170 in one week. It was also stated that Gloucester was one of the towns in which the anti-vaccination agitation seemed to have produced the greatest success, and that, as in Leicester, a large proportion of children and young persons had remained unvaccinated. The law of compulsory vaccination had been allowed to fall into abeyance, since the authorities seemed to await the Report of the Royal Commission before enforcing it. When 495 cases had been chronicled, the deaths stood at 93, with only 100 complete recoveries. In the first ten weeks of the present year there were twenty-six deaths of children under ten years of age, all of whom were among the unvaccinated, whilst no vaccinated child had died.

Twenty years ago, the vaccination law was so well carried out in Gloucester that only about five per cent. of children escaped vaccination; but latterly as many as 80 per 100 children born were left unvaccinated. All modern physicians of experience know that vaccination in infancy only protects as a rule for a certain number of years, and that it is necessary to revaccinate at least once on arriving at maturity, and the fact that deaths occurred in the Gloucester and other epidemics among adults who had been vaccinated in infancy only points to the necessity of our imitating the Prussian medical authorities and revaccinating all children at the age of twelve years, a practice which, as I shall show, has extirpated smallpox from Germany.

Dr. Bond, Officer of Health of Gloucester, issued a statement (*British Medical Journal*, April 11th, 1896) of the result of the cases in the smallpox hospital of that city. From this it appears that up to March 27th, 365 persons had been admitted since June 1895 into the smallpox hospital, of whom 207 were unvaccinated; 158, chiefly adults, vaccinated; and only one re-vaccinated. There had been 81 deaths, and 70 of these deaths occurred among the unvaccinated, and 11 deaths among those who had been only vaccinated in infancy (chiefly adults); 33·8 per cent., or more than one-third of the vaccinated died of the disease, and seven per cent of those (chiefly adults) vaccinated only in infancy. Of the 70 unvaccinated deaths all but three were of children under ten years of age, two of the three were of the ages of eleven and fourteen, and the third unvaccinated death was of the age of 21. None of the deaths occurred in any vaccinated patient under the age of 27 years. It would appear from these facts that vaccination gives a degree of protection against death from smallpox for the earliest years of life which is for all practical purposes nearly certain, even when it does not altogether protect adults against an attack of the disease. The great majority, too, of the unvaccinated children who recovered had the disease very severely and will be badly disfigured through life. The ages of the vaccinated persons attacked at Gloucester were:—Under 10, 2; under 20, 42;



under 30, 50; under 40, 35; 40 and over, 29. The ages of the unvaccinated: Under 10, 179; under 20, 14; under 30, 9; under 40, 1; 40 and over, 4. This confirms, what all experienced persons assert, viz., that proper infantile vaccination, whilst giving almost certain protection during the first ten years of life, loses its effect gradually, though it gives some amount of protection throughout life, just as an attack of smallpox itself does. Dr. Bond added, what has been invariably noticed in all smallpox hospitals:—"Of all the medical men, trained nurses, and attendants, who have, after being revaccinated, been brought into frequent and close contact with the disease in this city since the commencement of the outbreak, no one has taken the infection."

According to a notice in the *British Medical Journal*, of April 25th, upwards of 1,300 cases of smallpox have been notified in Gloucester up to that date. In the *Echo* of May 16th, it was mentioned that 1,766 cases of smallpox had occurred in Gloucester since the outbreak of the disease in 1895. "Few smallpox epidemics have of late years excited so much attention, no doubt, largely from the fact that Gloucester has constituted itself a centre of the anti-vaccination movement for nearly ten years, and is now dearly paying the inevitable penalty for its folly." Few epidemics have had such a marked effect in favour of vaccination. And yet the lessons taught by Gloucester are only a severe repetition of those taught over and over again in the past, at Leipzig, Warrington, Sheffield, Oldham, Birmingham, Montreal, and in fact in every recent outbreak of smallpox.

The Gloucester epidemic has had a marvellous effect in promoting vaccination throughout England. The Guardians of Gloucester Union have now issued notices urging parents and others to obtain the vaccination of their children *as the only means of promptly stamping out* the present epidemic of smallpox. The result of this, aided by the vigorous action of the Grand Jury, has been that, within a few weeks, upwards of 25,000 vaccinations and revaccinations, mostly with calf vaccine, have been performed in a population of about 42,000. The recalcitrant Board of Guardians have now enforced the Vaccination Acts, and given up waiting for the result of the Royal Commission.

Finally, the Grand Jury for the city of Gloucester, on April 17th, recommended:—

"1. That the Vaccination laws, as evidenced by the present outbreak of smallpox in the city, urgently require amendment, and that Her Majesty's Government be respectfully requested to take the matter into their most serious consideration with a view to their amendment.

"2. That not only vaccination but revaccination within a prescribed limit of age, is urgently needed.

"3. That the enforcement of the Vaccination laws be withdrawn from the Boards of Guardians and vested in the Local Government Board, Whitehall, or some other public department.

"4. That the Grand Jury thoroughly endorse the remarks of the Recorder in his charge to them, and strongly urge the immediate vaccination of all children and revaccination of adults as the only means of stamping out smallpox in the city."

Such is a brief account of the Gloucester epidemic, and the resolutions just cited of the Grand Jury clearly set forth what is needed; and if only the advice given was seriously acted upon throughout the country, we might, ere long, practically, like Germany, banish smallpox from our midst.

German Law of 1874.

The German Vaccination Law of 1874 (*Das Impfwesen in Preussen*, 1890), appointed that vaccination with preventive lymph should be used for:—(1) Every child before the close of the calendar year following the year of birth, if it has not been certified by a medical practitioner to have had natural

smallpox. (2) Every pupil of a public school or private school (except Sunday and evening schools), within the year, in which the pupil has passed through his twelfth year, unless he, or she, have within the past four years suffered from natural smallpox, or has been successfully vaccinated. According to the *British Medical Journal*, November 24th, 1894, p. 1212, this important law, which ordains in Germany not only primary vaccination of all infants, but also revaccination of all school children at the age of twelve, has almost abolished smallpox from the interior of Germany. The few deaths which now occur are mainly near the frontiers of the neighbouring states. Accordingly the main efforts of the anti-vaccinists have been directed towards an attempt to prove, or rather, to bolster up, by mere repeated assertion, their statement, that the law made no great difference in the vaccination of Germany since 1874, as compared with the vaccination before 1874. The beneficent action of the law cannot be gainsaid, so the law itself is minimized. An old law of 1835 in Prussia, against infectious diseases generally, and containing provisions against smallpox chiefly when occurring as an epidemic, is put forward as being identical in substance with the radically different law of 1874, and, in particular, as ordaining the revaccination of school children.

A comparison of the regulations of the Prussian Law of 1835 with the Law of 1874, shows that the assertion that the vaccinator relations of Prussia have not been essentially altered is quite unsupported. "It is established that, apart from the army, according to the decree of 1835, when no smallpox was present, no one was legally obliged to have himself or his children vaccinated. True, the regulations urgently recommended vaccination to everyone; and all sensible persons were expected to further it by example and precept, especially public officials. Compulsory vaccination was ordained when smallpox occurred, and at first only for the susceptible inhabitants of the particular houses affected.

After this, *on further extension of the disease*, compulsory vaccination was ordered (in the Act of 1835) for the remaining inhabitants of the place. When there was no smallpox about, there was no legal nor police punishment for the neglect of vaccination. Punishment awaited only those whose children were attacked by the smallpox, and were still unvaccinated without sufficient reason. The indirect compulsion existed in so far that admission into public offices, and the enjoyment of certain benefices, also reception into boarding houses connected with institutions for teaching were made dependent on the proof that vaccination or revaccination had taken place. This last regulation did not extend to schools generally, for schoolmasters, as a body, are merely told that they will *do well* to make sure that their pupils are vaccinated. As to revaccination, it was only recommended on account of the greater security this afforded.

It is clear from this that, in the nine old provinces of Prussia no direct compulsion to vaccination existed before the Imperial Vaccination Law of 1874. Only when smallpox broke out in any locality were compulsory measures resorted to. There was no direct compulsion in ordinary times even as to primary vaccination, and a general obligation of all children to be vaccinated did not exist in the nine old provinces of Prussia before 1874. It was the want of this compulsion which led to the law of 1874.

As to the Army, the law of 1874 made no difference to it as regards vaccination. The revaccination of all recruits was already compulsory (section 57), since 1834 at least. But a striking change in the smallpox mortality of the army followed the law of 1874, the mortality being actually abolished. From 1895 onwards no death from smallpox occurred in the Prussian army, except in 1884-5; and in that case the man had been twice vaccinated on joining the army without result. This virtual abolition of smallpox from the army of Germany is due to the fact that the surrounding community, the general population, was far less susceptible to smallpox after

1874; and it furnished a strong argument for the compulsory vaccination and revaccination of all.

Some of the anti-vaccination writers object that all vaccination statistics are supplied by one side, and that the medical men at Gloucester had not allowed for the influence on infectious diseases of the sanitary condition of their city, for that all parts of Gloucester did not suffer alike. I can hardly think that any one will question the accuracy of the statistics printed by medical officers of health, unless with some evidence to go upon. As to sanitation, that does not influence the incidence of diseases such as scarlet fever, measles, or smallpox. However filthy a community may be, these contagions will never, in modern times, be generated from bad drainage or filth. The germ of contagion is a *sine quâ non* for their appearance in any locality. Thus the natives of the Fiji Islands, although, of course, like all savages, filthy in their homes in the extreme, never had suffered from measles until a few years ago one of their chiefs contracted that contagion in Sydney, N.S.W., and introduced it to his countrymen, when no less than 40,000 took the disease forthwith. And smallpox did not exist in Greece or Rome when these nations were in their splendour; but was introduced into Europe about the year of the birth of Mahomet. Dr. Bond, of Gloucester, has explained that the southern side of Gloucester suffered most, because the smallpox hospital was almost in the centre of the district. Contagion, and contagion alone, is the cause of this terrible malady, which is the most hideous and fatal of all European plagues, when vaccination is neglected.

To show how perfectly the Imperial Vaccination Law of 1874 has protected Germany from the ravages of smallpox, in comparison with other European States, which have no such stringent compulsory vaccination laws, let me cite a few figures from a table drawn up by my friend Dr. Jacques Bertillon, of Paris, for the year 1886. In that year there was no smallpox death recorded in Berlin, Hamburg, Leipzig, Magdeburg, Stuttgart, or any of the large German cities. In Austria, however, which had no compulsory vaccination law, Buda-pest had 358 deaths per 100,000 inhabitants; Prague, 59; and Vienna 27 per 100,000 inhabitants. France, also without vaccination laws, had that year 573 deaths per 100,000 inhabitants in Marseilles from smallpox; 110 in Paris; and 41 in Lille. Great Britain and Ireland, where vaccination in childhood is obligatory, had only a few cases—such as 5 per 100,000 in Liverpool. Italy, where no compulsory law like that of Germany was then carried out, showed Rome with 128 deaths; Milan with 64; and Turin with 12 per 100,000 inhabitants. On the other hand, Holland, with universal vaccination, gave no cases of smallpox in 1886; and well-vaccinated Sweden, Norway and Denmark were also exempt from this plague.

It is curious to compare the smallpox mortality of Prussia and Austria from 1874 up to 1881, during which time the compulsory law of vaccination and revaccination was carried out in Germany, whilst there was no compulsory law in Austria.

In 1875, 1876, 1877, 1878, 1879, 1880 and 1881, the deaths from smallpox per 100,000 inhabitants in Germany were 3·60, 3·14, 0·34, 0·71, 1·26, 2·6 and 3·62; whereas in these years the deaths per 100,000 inhabitants in Austria were 57·73, 39·28, 16·94, 5·57, 50·88, 64·27 and 78·80. Before 1875 these two countries had similar smallpox deaths; but after vaccination and revaccination were made compulsory in Germany, smallpox at once disappeared; whilst it kept on as usual in Austria. I may mention that at present calf-lymph alone is used in German cities, and humanized lymph is scarcely used any longer. This is a custom which we could easily follow, when revaccination at or about the age of ten years prevails in this country, as I trust it will according to the able recommendation of the Grand Jury of Gloucestershire. To finish up the great proof furnished by the German Law of 1874, I add the following figures from a paper read by Dr. E. J. Edwards to the Epidemiological Society, December 9th, 1885:—

DEATHS FROM SMALLPOX PER 100,000 OF POPULATION IN YEARS 1874 TO 1883.

	1875	1876	1877	1878	1879	1880	1881	1882	1883
Berlin	5.1	1.8	0.4	0.7	0.7	0.8	4.7	0.4	0.3
Hamburg	0.0	1.8	1.2	0.2	0.0	0.0	0.0	0.4	0.3
Breslau	0.0	0.0	0.7	1.5	0.3	0.7	1.1	3.2	8.3
Munich	0.0	0.5	0.0	0.9	0.0	0.0	1.9	2.9	0.0
Dresden.....	2.5	0.5	0.9	0.0	1.8	3.6	2.6	1.3	0.8
London	1.3	20	70	38	12	12	61	11	3.4
Paris	13	20	6.8	4.4	45	108	49	29	20
Vienna	113	169	84	75	46	73	123	108	9.6
Petersburg ...	—	—	—	144	142	21	28	77	46
Prague	—	11	78	395	86	84	290	64	224

This is a most striking example of the way in which vaccination, followed by re-vaccination in school years, prevents death from a virulent fever. I do not contend that such prevention of smallpox lowers the general mortality; for that depends mainly on the supply of food and the birth-rate; but smallpox, at least, may be got rid of by vaccination it is clear. As to the Prussian and Austrian armies. In 1874 the death-rate in the German army was 0.33 against 67 in the Austrian; in 1875, 0.00 in the German to 21.5 in the Austrian; in 1876, 0.00 in the former, to 10.4 in the latter; in 1877, 0.00 in the former to 25.5 in the latter; and in 1878, 0.00 in the former to 15.4 in the latter. The German army is therefore entirely free from smallpox at present, and has been so since 1875, with, perhaps, one or two exceptions.

Is vaccination attended by danger to health? Vaccination is, in medical parlance, a disease; but it is not practically a disease. The assertion that vaccination produces disease was carefully examined by a Committee of the House of Commons in 1871. It was then testified ("Facts about Vaccination" by Sir Lyon Playfair, Parliament, 19th June, 1893), that among 151,316 revaccinations of soldiers, not even one can be observed of syphilis; and since 1852 up to 1870 about 17 millions of infants have been vaccinated in England and Wales; and yet it was extremely doubtful whether half-a-dozen cases of propagation of syphilis had occurred. Some cases of erysipelas had occurred, but very rarely had they proved fatal. I have seen one fatal case in London, and was called by my friend, Dr. Wm. Hardwicke, late Coroner for Middlesex, to give evidence upon it, as a genuine case of generalized vaccinia. Such extraordinary cases constitute no argument against vaccination. Who would forbid the use of chloroform or ether because in rarest cases patients have died from inhalation of such gases. Who would give up drinking water because bad water occasionally gives typhoid fever, or diarrhoea or cholera? The Committee of the House of Commons of 1871, after hearing all the evidence tendered against vaccination as the producer of disease, came to the conclusion that "there need be no apprehension that vaccination will injure health or communicate disease."

The late respected member for Leicester, Mr. P. A. Taylor, with whom I carried on a friendly discussion in the *Echo* some years ago, was on that Commission, and only made a slight alteration in that resolution of the Committee; but his own resolution was simply this: "That some few cases of disease have been communicated by vaccination, but the danger is so infinitesimal in respect to proportion that, subject to the conditions mentioned above, the Committee do not hesitate to express their conviction of the practically safe character of the operation." The German Commission on Vaccination found that in 1882 returns were asked from all the army surgeons of that country; and these returns showed that, out of 1,200,000 revaccinations, decided indisposition occurred only in 78; and that only one man had died of blood poisoning. The temperature may rise

to 104° Fahr. on the 5th, 6th or 7th day, but this is only for a few hours, and there are whole series of cases where no such disturbance is seen. To call, then, vaccination a disease would be misleading. The German Commission, therefore, concluded that vaccination itself was not attended with danger, which was due to accidental complications. Dr. Koch remarked, with truth, that very few fatal cases of syphilis had been spread by vaccination; and, practically speaking, the only other danger is erysipelas; any cases of blood poisoning are due to erysipelas. Of course, calf vaccine is free from syphilis, and as it is, or ought to be, now procurable in England by all, that danger is illusory. There is absolutely no need to exclaim against vaccination as a cause of disease. It is practically harmless.

History of Vaccination and of Smallpox.

Smallpox belongs to a class of germs producing eruptive fevers, which have the curious property that one attack of the disease protects the person passing through it from further attacks of the disease. On the whole, it is, perhaps, the most frightful of all human diseases, when allowed free scope among unvaccinated races or individuals. In the ninth century Isaac Judæus wrote of the fever of variola "which attacks almost all." In the sixteenth century "Mercurialis" (*Br. M. J.*, May 23rd, 1899, p. 1261) took it for granted that everyone must have smallpox at least once in his life. In 1788, Dr. Black (*loco citato*) said, "Very few of the human species escape the smallpox, especially in populous cities and towns wherein there is always lasting variolous fuel. A mere handful of the progeny of the metropolis can be supposed to have escaped an infection with which they are constantly enveloped." Bichat ("Anatomie Pathologique") says that "usually all men experience it." People used in London to advertise for servants who had got over smallpox, e.g. "Wanted, a man between 20 and 30 years of age; he must be of the Church of England, and had the smallpox in the natural way" (October 1st, 1774). During last century everyone expected to have the smallpox; and sooner or later nearly all got it. The German proverb of the eighteenth century, "Von Pocken und Liebe bleiben nur Wenige frei," expresses this fact well. At the commencement of this century probably half a million deaths from smallpox occurred in Europe of that day. Bernonilli, a famous man of science, believed that 600,000 persons died of the disease annually; and De la Condamin estimated that it destroyed, maimed, or disfigured a fourth part of mankind. Sweden, from 1774 to 1801, had smallpox statistics; and the average annual mortality 2,050 per 1,000,000. In 1779 it was 7,200. A queen of Sweden died of it in 1741, Queen Mary died of it 1694, and Macaulay, in speaking of that event says:—"That disease, over which science has achieved a succession of glorious and beneficial victories was then the most terrible of all the ministers of death. The havoc of the plague had been far more rapid; but plague had visited our shores only once or twice within living memory, and the smallpox was always present, filling the churchyards with corpses, tormenting with constant fears all whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover.

A Dauphin of France died of smallpox in 1711, and in 1774 Louis XV. died of a second attack of the disease. It has been calculated that the death rate from smallpox in England during the last half of the eighteenth century would, if applied to the present population, be equivalent to 70,000 deaths a year. In addition to Queen Mary's untimely death has to be added that of the Duke of Gloucester and an aunt, who died of it at Whitehall in 1660. William III. had been severely attacked by the disease in his youth, and his father and mother both died of it. In Austria, Joseph I., in the middle of the

eighteenth century, besides two Empresses and six Archdukes and Archduchesses, an Elector of Saxony and an Elector of Bavaria died of it in that century. Two-thirds of the blind in an institution mentioned by Sir Gilbert Blane had lost their sight from attacks of smallpox.

Sir John Simon, writing in 1857, mentioned that when smallpox was introduced into Mexico by the Spaniards, in a short time it killed three and a half millions of people, "sweeping over the land like fire over the prairies, smiting down prince and peasant." In 1563 whole races were killed by the disease, and it killed more than 100,000 Indians in the province of Quito. Catling, writing in 1841, says:—"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 had fallen victims to the smallpox." In 1707 (*Br. M. Jour.*, May 23rd, 1896, p. 1263), the disease killed 18,000 out of a population of 50,000 in Iceland.

Smallpox has raged in former centuries in the fiercest way in Hindostan, Thibet and China. In 1767 (*British Medical Journal*, loc. cit.) it was said "the disease proves universally of the most malignant kind, from which few, either of the Europeans or natives, escaped." In unfortunate China, smallpox acts as one of the commonest checks (positive) to population. "Smallpox kills the children in some districts so that," as remarked by a writer (*British Medical Journal*, loc. cit.), "there is no need for a mother to sacrifice her superfluous children, for she has none."

Inoculation Period.

It appears that inoculation of smallpox was practised in Hindostan by the Brahmins, and that it was also in common use in Persia and Arabia, whence it came naturally to Turkey. In China, also, the practice seems to have prevailed for centuries of introducing dried smallpox matter into the nostrils. Lady Montague introduced it into England in 1717, when her infant daughter was inoculated for smallpox. In 1722 the Princess of Wales had her two daughters inoculated: and in 1746 a hospital for inoculation of the poor was erected in London. In 1754 the Royal College of Physicians thought it to be "very salutary to the human race." A very successful inoculator, Dr. Dimsdale, was in 1768 summoned to Russia to inoculate the Empress Catherine and her son. Another inoculator, Daniel Smith, boasted of performing 20,000 inoculations without any death that could "fairly" be attributed to the operation. After vaccination was introduced, inoculation died out, and was rendered illegal in 1840; but it might even now be of service in case of a smallpox outbreak on ship board.

Statistics per Million.

The average death-rate per million from smallpox in large cities was over 3,000, and in the nation over 2,000; in some years it rose to 5,000 or 6,000. In Sweden 1774-1801 the mean rate was 2,045 per million; 1802-16, 480; 1817-94 (compulsory vaccination) 155. In England, last century, the rate was 2,000. During 12 years, 1838-53, 417; next 18 years, 154; and since 1872, 53 per million inhabitants. During the last ten years the mortality from smallpox in Prussia averaged only 7 per million inhabitants living; in Austria (1847-1882) the mortality was 580; in Belgium, 441 (between 1875-84). In neither of these countries is there compulsion as yet. Italy has followed Germany since 1888; and, hence, the smallpox mortality has fallen (1890-94) to 110 per million.

Sanitation.

It cannot possibly be improved sanitation that has caused the remarkable changes in the mean death-rates above given; for more than one reason. Compare Prussia with Austria. There is a sudden and striking change in the

smallpox death-rate of Prussia in the period succeeding the law of 1874. Now Austria shows no such change, although sanitation has been studied in that country. And the reduction of smallpox mortality has not yet affected all ages alike, whereas improved sanitation has done so. It is erroneous, too, to speak of a natural decline of smallpox. Spain and Russia, where there is still very little vaccination, are still much attacked. Thus, in 1889, in Spain, the following provinces were thus affected with smallpox deaths per million:—Almeria, 3,080; Murcia, 2,670; Coruna, 1,230; Malaga, 1,340; Cadiz, 1,330; Cordova, 1,400; whilst the rate for Germany for the same year was four. "Is it not sentimental to talk about personal liberty where the health and lives of our neighbours are concerned in our condition as to susceptibility to smallpox, in a country of rate-paid compulsory education?"

Marson's Evidence.

Dr. Marson said that in thirty-five years he had never had a nurse in the smallpox hospital, nor a servant with smallpox, as he vaccinated them when they came to the smallpox hospital. Out of a total of 110 attendants at Homerton, all but two were revaccinated, and these two took the smallpox.

The lessons to be learnt from the history of English vaccination are, that even the best vaccination in infancy is not protective for the whole of life. Thus, in Bavaria, in 1871, 30,742 persons took smallpox, 26,429 of whom had been vaccinated. In Sheffield, over 200 vaccinated persons died. In the last century, survivors from smallpox in childhood were protected; now they are not so, without revaccination. Hence compulsory revaccination is necessary. German statistics teach that a successful revaccination during school-age renders a person safe for life against smallpox, with rare exceptions (for even a previous attack of smallpox is not perfectly preventive). In modern Germany, smallpox epidemics are things of the past, and most of the sporadic cases seen are met with on the boundaries of the empire. Italy has imitated Germany since 1890; but England has not yet been a properly vaccinated country. We require compulsory revaccination of all children about the age of ten years and then we shall be free from all fears of smallpox epidemics. In Italy the Consolidated Vaccination Regulations of 1891 make revaccination compulsory after the age of eight years.

Jenner formed the idea that vaccination gave life-long immunity; for among milkers there were many instances which supported that view. The inoculations in these cases however occurred in adults, not in infants; and therefore resembled revaccinations. No such change takes place in the tissues of the protected individual as takes place after infantile vaccination. Perhaps, in the presence of a smallpox epidemic, a third vaccination might be necessary in some severe virulent attacks.

Jenner's early experiments, were made with lymph direct from the animal, what we now call animal vaccination. He worked carefully and diligently at the nature and results of this direct vaccination, before taking to the practice of human vaccination from one person to the others. Cowpox used to be common in Gloucestershire, a dairy country, and he pointed out the great importance of discriminating between various eruptions on the udders of cows. He always considered cowpox and smallpox as modifications of the same disease; and that in employing vaccine lymph he only made use of a mild form of the disease. The name *variola vaccinae* shows that this was his idea. He does not, however, ever have appeared to have inoculated cows with variola; this has been reserved for others, such as Sonderland, 1830; Thiele, 1830; Ceely, 1839; Badcock, 1840; Voigt, 1882; Fischer, 1890; Hime, 1892, and others. Dr. Hime (*British Medical Journal*, May 23rd, 1896, p. 1,281) inoculated a calf with variola in 1892, and vaccinated a second calf, producing a fine specimen of cowpox. From calf 2 he vaccinated a child, and the vaccine was passed through several generations of children, always

producing the same typical results. Voigt has used no other vaccine at Hamburg, from January 1st, 1882, up to the present year, 1896. In 1895 he had the opportunity of testing the efficacy of the primary vaccinations done with his variola-vaccine in 1882, by the regular compulsory revaccination of the children done that year. Only 60·2 per cent. of those vaccinations were successful; showing the power of the original lymph. In no other German town were such good results obtained. The variola-vaccine of Ceely, Badcock, Voigt and Fischer has been employed to vaccinate hundreds of thousands of persons with the best results; and has never yet caused smallpox.

The disease called grease on the horse is communicable to the bovine species; and cowpox produces it in the horse, according to Dr. Bouley of Alfort (*La Vaccine sur le Cheval*, 1862) (*Recueil de Med. Vet.*). The disease is now called the "horsepox."

Animal vaccination is destined to take the place of humanized in the near future. It was first used in Italy by Dr. Galbiati, and came to France in 1864. Dr. Warlomont started an establishment in Brussels in 1865, and the Belgian Government took up the practice. In Germany, the use of calf-vaccine for public vaccinations has become general; and all public vaccinations, as well as almost the whole of private vaccinations, are done from that source. The German Royal Commission of 1884 recommended that, as "Vaccination with animal lymph has been recently so perfected, as almost to equal vaccination by human lymph, the latter is to be superseded by animal lymph."

Mr. Shirley Murphy (Twelfth Report of Local Government Board) says:—"Animal lymph takes with as much certainty as humanized lymph, and produces similar local and constitutional effects." Holland and some of the American States provide animal vaccine for public vaccination, but England has been the last country to utilize it. The disadvantage of humanized lymph lies in the possibility of conveying syphilis, and the fact that mothers do not like lymph to be taken from the arms of their infants. Animal vaccine, too, can be had in unlimited quantity if needed. Some authors (Martin, etc.), allege that humanized vaccine tends to degenerate. Whole nations have for many years been vaccinated and revaccinated with calf lymph with success, judged by every standard. In Germany not only are all children vaccinated with calf lymph in infancy, and revaccinated in their twelfth year, but all recruits (some 300,000 yearly), are vaccinated for the third time on joining the army. In 1893 (HIME, *British Medical Journal*, May 23rd, p. 1283), there was 1,518,793 infants legally liable to be vaccinated in the German empire. Of these 1,326,754 or 96·35 per cent. were vaccinated; 1,321,348 with animal lymph, and only 5,406 with other vaccine. Of these primary vaccinations, 96·35 per cent. were successful. Of 1,143,947 children who were liable to revaccination (in their twelfth year, 1,107,025 were actually revaccinated or 96·77 per cent. of the total revaccinations: 91·71 were successful. Of the children revaccinated, 1,099,860 or 99·35 per cent. were done with calf vaccine, and only 7,165 with other vaccine. Hence the completely successful practice of Germany, which we ought speedily to imitate, consists in vaccinating in infancy, revaccination at the age of twelve, and all with animal vaccine. It is no longer possible to urge that calf vaccine is inefficient, or that there is any difficulty in using it. The wonderful immunity from smallpox in Germany shows its efficiency. In many parts of the empire there were 100 per cent. successes with primary vaccination. The immunity enjoyed by the German soldier during the war of 1870 was most striking. There were not 300 deaths from smallpox among the German soldiers, whilst the French lost 23,400 from the disease.

It should be remembered that in Jenner's time, test inoculations of persons who had been accidentally and intentionally vaccinated with animal lymph showed the patients in numerous cases to be immune. The animal

vaccine is taken from the calf on the fifth day after vaccination. On the Continent calf vaccine stations are closed when the weather is sultry. In winter the stables must be heated artificially. The mixture of calf lymph with pure glycerine has the effect of rendering it less liable to set up inflammation, by the inoculation of ordinary moulds and fungi in company with the virus of vaccinia. The result of the great experience now acquired on this subject is that the direct use of vaccine from calf to arm is almost entirely abandoned. The glycerine pulp is the best form of calf vaccine. It is the one exclusively employed in Germany, and for our army and navy. This form is put up in sterilized, air-tight tubes. Calf vaccine is also dried on ivory points by a few persons, but cannot be as pure. Four insertions, well apart, should be used, with a blunt lancet or needle, only to scarify the epidermis.

There is no possibility of communicating anthrax from the calf, as the animal is seen for days before it is vaccinated from. As to tuberculosis, that is almost unheard of in the young calf. In some places the calf is killed after vaccination and examined before sending out the vaccine from it. And the tubercle bacillus, as tested by inoculation of animals, does not exist in the vaccine even of animals with generalized tuberculosis. In Germany the use of calf lymph has increased yearly, and is now nearly universal, but tuberculosis has greatly diminished in that country.

Absence of Dangerous Sequelæ.

Dr. Hime, of Bradford (*British Medical Journal*, May 23rd, 1896), says that: "Serious sequelæ after vaccination with animal vaccine, I have never seen. Of course, if obvious precautions are neglected, if dirt be inoculated along with vaccine, if the wound be kept foul and be irritated by friction, bad results may arise; such results are not due to animal vaccine as such, but to dirt and other preventable causes."

Popularity of Animal Vaccine.

Public vaccinators are now finding that their stations are neglected, if they use humanized lymph. Calf vaccination is far more popular at Halifax, Bradford and Gloucestershire. The poor man can be vaccinated with calf lymph in London, but not if he reside far away from London. Our soldiers and sailors are vaccinated by calf vaccine. Why should the citizens be treated with humanized? The great objection to vaccination, with the general public, lies in the use of humanized vaccine, and Government would do well to remove this difficulty.

Dr. Hime's History.

In Kilmarlock in the years 1728-64, 16 per cent. of all deaths were from smallpox. In Glasgow, just before the end of last century, one-fourth of all deaths were caused by smallpox; and the deaths were almost confined to the young, so that scarcely anyone can have escaped the contagion. In Edinburgh, from 1744 to 1763, it was 10 per cent., and in London, taking the whole of the eighteenth century, smallpox caused 8.4 per cent. of all deaths. Nowadays, so few people have seen cases of smallpox that they do not realize the horrors of the disease; and in Germany this is still more true. Situated as they are in the midst of a vaccinated kingdom, places like Leicester, Gloucester, Keighley and Dewsbury, have for long been sheltered behind the Jennerian shield; but as protection becomes more and more incomplete, by means of continued neglect, the risk to the vaccinated becomes all the greater. Sir John Simon wrote: "At the anti-vaccination meetings of which we now occasionally read where some pragmatistical quack pretends to be making mincemeat of Jenner, how small would become the voice of the orator, and

how abruptly would the meeting dissolve itself, if but for a moment the leash were away with which Jenner's genius holds back the pestilence, and smallpox could start into form before the meeting as our grandfathers saw it a century ago." As Dr. Hime truly says: It is the duty of the medical profession to protect the public in this matter. In particular, the little children must be protected against follies with which they have no concern.

In a *soiree* at Berlin on May 15th, 1896, * Dr. Gerhardt said that in our time the disease had almost died out in Prussia. From 1890 to 1894, there had been only thirty-five to thirty-six deaths from smallpox per year, and these had been nearly all introduced cases. As to the anti-vaccinationists, in spite of themselves they had helped to improve the methods of vaccination, by drawing attention to the possible danger of human lymph, and thus giving an impetus to calf lymph vaccination. On the conclusion of Dr. Gerhardt's address, Dr. Krüse, member of the German Reichstag, of the Prussian Diet, spoke of the undermining work carried on by anti-vaccinists. He said that as the danger from smallpox epidemics decreased, the anti-vaccinationists became bold, and petitions from them kept pouring unto the Reichstag. Their chief supporters in the House were the Social Democrats and the Anti-semites, and as there were few medical men in the house, the Imperial Board of Health was the chief stay.

At the congress of Internal Medicine held in Wiesbaden in May, Professor von Leyden said that "the two chief improvements that had been made since Jenner's time were the appreciation of the value of re-vaccination and the use of animal vaccine. For the latter improvement the antivaccinists had principally to be thanked. There were a good many of them in Germany. In 1877 the number of petitions against vaccination was only twenty-one: in 1891, it was 2,951 with 90,000 signatures mostly of uneducated or half-educated lay persons. There were few medical men in the anti-vaccinist camp in Germany. Since 1884 there had been a Commission in the Imperial Health Bureau and in the State Vaccine Institute charged with the supervision of the preparation of vaccine from the calf, its preservation, and gratuitous distribution. Owing to this system and to compulsory re-vaccination, Germany showed the best vaccination results of any country in the world."

* *British Medical Journal*, May 23rd, 1896.