ON THE EXISTING STATE OF OUR KNOWLEDGE OF VACCINATION AND REVACCINATION, AS PREVENTIVE OF SMALL-POX.

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THE preventive influence of Vaccination, questioned even at the period of its discovery, and especially from the year 1804 onwards, has acquired additional claims to the most careful and dispassionate consideration, from the increased prevalence of epidemic Small-pox of late years. A re-examination of the subject, therefore, would appear peculiarly appropriate, not only with the object of attempting to satisfy the natural anxiety of the public, but also with the hope of contributing to a greater unanimity of professional opinion on the questions—*How far does the artificial Cow-pock actually secure the constitution against a subsequent attack of casual Small-pox?* and, *Whether it is possible, by any means, to confer an additional degree of security?*

To the examination of a subject, manifestly of the greatest practical importance, not only intrinsically, but as occurring to us almost daily in our professional life, I shall therefore address myself with all the deliberate attention and impartiality which the difficulty of the investigation properly demands.

1. CASUAL SMALL-POX—ITS HORRORS—PROPORTIONAL ATTACKS, AND MORTALITY—LEADING TO THE PRACTICE OF VARIOLOUS INOCULATION. HISTORY OF INOCULATION—ITS PHENOMENA, AND EFFECTS IN ABATING THE RAVAGES OF SMALL-POX—REPLACED BY VACCINATION, OR THE ARTIFICIAL PRODUCTION OF COW-POCK.

Casual Small-pox. It has been disputed by writers of the highest authority in medicine, whether Small-pox was known to the ancients; the affirmative of the question having been maintained, by Rhazes, Salmasius, Willan, Baron, and others; whilst, on the opposite side, are found the names of Friend, Mead, and Good,—no mean authorities on such a subject. But there is too little of practical utility in the question, to induce us to take part in its discussion. Rhazes, who wrote in the ninth century, appears to have been the first to treat distinctly of the disease, although the occurrence of both Small-pox and measles as early as the year 572 (the era of the birth of Mohammed), is expressly mentioned in an Arabic manuscript,¹ preserved in the University of Leyden; but, whether that document be certainly genuine, or not, at all events, from the allusions made by Rhazes to the opinions of Ahron, and others of his predecessors, we cannot err in dating the appearance of Small-pox anterior to the period of the Hegira, as it frequently broke out, during the seventh century, in the wild, fanatic legions led forth by the great prophet of Mecca, to propagate the doctrines of the Koran by the edge of the sword. Thenceforward, at all events, Small-pox has proved one of the most destructive of human maladies, whether appearing in its sporadic form, or in those terrible epidemic irruptions, in which it has smitten its victims as fatally, as numerous, and scarce

¹ Hamilton's History of Medicine, vol. i.

less suddenly, than the destroying angel who passed of old over the doomed hosts of the Assyrian camp.

A few illustrations of what we have asserted will suffice. When introduced into Mexico, not long after the discoveries of Columbus, this fearful pestilence cut off, within a brief period, not less than three millions of the unfortunate natives; and it is well known, that whole tribes of the Red men of Western America, who, from this and other causes, are fast disappearing from the footfalls of their fathers, have been swept away by the same malady. In England, 40,000 individuals are said to have perished annually; and two millions, on one occasion, in Russia in a single year. Haygarth attributed to this cause one half of all the deaths taking place in children under ten years of age; and, of all persons attacked by Small-pox, one-fourth, or at least one-fifth, are believed to perish; whilst, according to the experience of Dr. George Gregory, the mortality is even greater than this. At the Small-pox Hospital, for the last half century, the fatal cases have ranged from eighteen to forty-one in the hundred; averaging, on the whole, about thirty per cent.¹ Nor is this all, for one attack of the malady, even in its severest form, does not invariably protect the survivor from a second, as is clearly shown by ample experience. The extent of this consecutive liability, however, has been variously estimated by different authorities: thus, the proportion of secondary attacks of Small-pox, to the primary, is computed, by La Condamine as 1 in 50,000; Heberden, as 1 in 10,000; other authorities, as 1 in 8,000; Eichorn, as 1 in 250; and Mohl, in his description of the Copenhagen epidemic, asserts that every sixth person who suffered from the disease, had it for the second time.

The calculations just quoted are evidently too widely discrepant to do more than establish, generally, the fact, that the disease may occur a second time; and, on some occasions, as in the Danish physician's experience, in a high proportion; but they shew conclusively, at the same time, that we have no data for determining any law as to the frequency of the occurrence. The general proposition, however, of the liability to a second attack, was known as early as the times of Rhazes and Avicenna; and probably there are few practitioners who are not, from their own experience, cognizant of it; but, at all events, Baron, in his life of Jenner, alludes to no less than one hundred and thirty different writers, who have given examples of this occurrence. Were it necessary to strengthen the evidence on this point, we might refer to the reports of Heim and the Wirtemberg physicians, showing, that of 297 persons who bore evident marks of the Small-pox, Vaccination failed in only 126 cases, succeeding perfectly in 95, and affecting the remaining 76 in a modified form. Indeed, the entire statistics of the authorities referred to, show that more than a half of all the individuals operated on, after Small-pox so severe as to leave their persons marked by scars, had again become liable to the disease. In coming to this conclusion, they assume, perhaps correctly, that susceptibility of the contagion of Cow-pock indicates an equal liability to that of Small-pox: this, however, is a debateable question, to which we shall return hereafter. But not only is the possibility of the recurrence of Small-pox, in the

¹ Cyclopædia of Practical Medicine. Art. "Small-pox", p. 742.

same individual perfectly established, but equally so the fact, that the secondary attack may be extremely severe, and even fatal. A well-known instance of this unfortunate result occurred in the person of Louis XV of France; and at least one fatal case has happened within our own observation. The experience of Macintosh supplied twelve instances of secondary attacks; and he adds, "all my cases of secondary Small-pox, with the exception of two, have been remarkably severe, whereas, I have not seen a severe case after Vaccination." And when to the fearful mortality just described, are added not only the virulently contagious nature of the disease, but the long catalogue of melancholy results which follow in its train, including tubercular consumption, various forms of scrofula, hideous disfiguration of the countenance, and blindness, it may readily be believed that any feasible plan of mitigating its horrors was calculated to excite intense interest; and this plan was found in the practice of variolous inoculation.

Variolous Inoculation. The artificial production of Small-pox by Inoculation, is a practice alleged to have existed amongst the Chinese and the inhabitants of Hindostan from remote ages, and to have been also long known to the people of various countries of Europe; but its power of ameliorating the virulence of the casual disease was first formally announced in a communication made to the Royal Society of Edinburgh, early in the eighteenth century. About the same period, the observations of Pylarini, Venetian consul at Smyrna, and a notice of the letter of Dr. Timoni, on Inoculation, written from Constantinople, were published in the *Philosophical Transactions*. Further attention was drawn to the subject by the writings of Mr. Kennedy, but without any practical effect, until the pen and personal influence of Lady Mary Wortley Montague seriously attracted the notice of the public. The practice of Inoculation, thereafter, gradually made its way in England, although violently opposed by many eminent members of the medical profession, and denounced from the pulpit as the offspring of atheism, and a diabolical invention of Satan. Subsequently, however, to the year 1730, it fell into almost total disuse in these kingdoms; and was actually prohibited by law in France. In 1754, a declaration was made by the London College of Physicians in favour of the practice, but without any decided effect, until its successful results in the hands of the Brothers Sutton rendered it generally popular for some time. In 1746, the Small-pox and Inoculation Hospital of London was founded, for the purpose of extending the benefits of the discovery to the poor; and the results, in that establishment, were favourable. In the following year, Inoculation was powerfully supported by the influential pen of Mead;¹ and Baron Dimsdale² followed the Suttons with much success. His plan of operating, which has not been improved on, was generally adopted for the next twenty years, and with increasing popularity, until Jenner, in 1798, announced to the world his great discovery of Vaccination. Since that period, the general practice of Variolous Inoculation has fallen into disuse.

With reference to the individual, the advantage of Inoculation, however, was fully established. It abridged, by several days, the incubative stage of the disease: it lessened the quantity of the eruption; and so

¹ De Variolis et Morbillis.

² Present Method of Inoculation for Small-pox.

greatly abated the malignancy of the symptoms, that the deaths in the Inoculation Hospital only amounted to three in one thousand cases, whilst the mortality from the casual disease at that time, and even now, according to Gregory, amounted to *three* in every ten persons attacked by the malady. The following phenomena, usually occurring after Variolous Inoculation, may be contrasted with the unameliorated horrors of the casual disease.

Inoculated Small-pox. About the third or fourth day, a slight redness, and a trifling degree of induration, perceptible to the finger, may be observed at the point of operation. On the fifth day the redness is more vivid; and on the sixth, the cuticle is generally elevated by the effusion of serum, a central depression being observable at the same time. On the seventh day, irritation of the superficial lymphatic vessels occurs, the arm in the vicinity of the puncture becomes painful, and the general symptoms of fever are developed. The eruption, whether local or general, commences to decline from the twelfth to the fifteenth day, after the date of the operation; the pustule being replaced by a scab, which falls off in a week or ten days more, leaving behind it an indelible cicatrix.

The question then arises, why a practice, so manifestly beneficial, came to be almost completely abandoned, at all events, by the medical profession? Several circumstances contributed to this result. It was found, on examination, that the malady produced by Inoculation, although mild in the majority of cases, was not invariably so; for many persons, after the operation, passed through a very severe form of Small-pox; and no inconsiderable number died of the disease thus artificially produced. Like casual Small-pox also, the engrafted malady was found to excite in the system various consecutive disorders, and, especially, to arouse into activity any lurking scrofulous taint. These were serious risks for the practitioner to incur by his own act; and as it was impossible to foresee, in any given case, what might happen, the objection to the production of a disease artificially, which in the common course of events might, probably, never occur at all, became very strong; for, even at the worst, it appeared that a vast majority of the people, without any precautions whatever, escaped altogether an attack of casual Small-pox. Another objection, and, as regards the public, a very weighty one, was the unquestionable tendency of Inoculation, without careful seclusion and proper precautions, to promote the diffusion of contagion. It may be true, as Adams,¹ Watkinson, and Schwenke, have attempted to shew, that the danger has been over-rated; but the sources of infection were so much multiplied by the practice, as Dr. Gregory justly remarks, that the casual Small-pox, which formerly visited country places at long and uncertain intervals, was now to be met with in all parts, at all times; 45,000 persons being annually cut off by its virulence.²

Experience also taught, that Inoculation, however confidently asserted to prevent a second attack of the malady, had, by no means, invariably this effect; on the contrary, many writers affirm that secondary attacks

¹ Inquiry into the Laws, etc., of Epidemic Diseases.

² Cyclopædia of Practical Medicine. Article, "Small-pox."

were more frequent after the artificial, than the casual disease. This last statement has been controverted by the high authority of Dimsdale; but, at all events, as has been more recently shewn by Baron, death occurred in the proportion of one in every fifty of the inoculated.

Inoculation was prohibited, by Royal authority, in France in 1763; but the death-blow to the practice was not given, as already intimated, until the promulgation of Jenner's discovery, about a quarter of a century later.

II. VACCINATION, HISTORY OF—SYMPTOMS AND OBJECTS—ARGUMENTS IN FAVOUR OF ITS PROTECTIVE INFLUENCE—OBJECTIONS—HOW FAR, AND IN WHAT MANNER, IT HAS BEEN SHEWN TO FAIL.

History. After a lengthened investigation of the subject, Jenner first announced, in 1798, in his well-known *Enquiry into the Causes and Effects of the Variolæ Vaccinæ*, that the Cow-pock, having passed through the human system, after being transferred from the teats or udder of the cow, by the process of Inoculation, ever after guards individuals, so operated on, from the contagion of casual Small-pox; and that, by the universal adoption of Vaccination, this dreadful disease might not only be divested of its all terrors, but be finally extinguished from the list of human maladies. Residing at Berkeley, in Gloucestershire, in one of the great dairy districts of England, his attention was first turned to the subject by a knowledge of the popular belief, which he found prevalent, that Cow-pock, when casually transferred to the hands of the milkers, subsequently protected all persons so affected from an attack of Small-pox. And to the establishment of this doctrine, by accumulated observations and arguments, as tending to confer incalculable benefits on the human race, he devoted a great part of the remainder of his long, honourable, and useful life. Jenner did not, however, escape the common fate of great discoverers; for although the majority of the medical profession eagerly and gratefully adopted his views, yet, by a few, the value of his announcement was depreciated, his motives questioned, and even his character maligned. Time, however, has done justice alike to him and his traducers; and even if it could be shewn, unequivocally, that his views were partially erroneous, enough would still remain to entitle him to the undying gratitude of the human race, whilst his ardent desire for the good of his kind, and his patient and Christian bearing under the detraction of his enemies, as well as the untiring industry, the deep sagacity, and profound reasoning, which he displayed in the defence of what he conceived to be true, will for all time to come confer celebrity on his name. “Τό ὄνομα ὄνκωρ’ ὀλώλει.”

In 1799, Vaccination was introduced into America by Dr. Waterhouse; and, in the same year, a testimonial of confidence in the discovery of Jenner was signed by a large number of the most eminent physicians and surgeons of London, including the distinguished names of Cline, Cooper, Baillie, and Abernethy.

In 1800, the practice was adopted in France. Amongst the warmest of its advocates on the Continent, we may enumerate Sacco of Milan, and De Carro of Vienna, by the exertions of the latter of whom, Vaccination reached Bombay, and was thence diffused all over India. As early as 1801, six thousand persons had been successfully vaccinated in Great Britain alone, In the year 1802, a remuneration of £10,000

was voted to Jenner by the British parliament, and a further sum of £20,000 in 1807, sixteen years before his death, which took place in 1823, when he had reached the advanced age of seventy-four years.

In 1838, a Committee of the House of Commons made a report on the Vaccine Board, and on the practice of Vaccination generally, which contained the latest information on the subject, up to the period in which it was drawn up. More recently, the question has been ably discussed in Dr. Baron's *Life of Jenner*, and in the Report of the Committee, appointed by the British Association, to investigate the subject in 1839. Within the last few years, a short Act of Parliament was passed, commonly called the Vaccination Act, with the praiseworthy object of promoting the more general diffusion of Cow-pock, by providing remuneration, to be made out of the poor-rates, for each successful operation. In Norway and some of the other continental kingdoms, Vaccine Inoculation is enjoined by law, and the practice is more or less prevalent throughout every country in the world.

Effects. The doctrines of Jenner have been maintained, since his death up to the present hour, by many distinguished writers, not the least celebrated of whom is Dr. Baron, his able biographer, who was principally concerned in drawing up the Report already alluded to, as emanating from the British Association. The views there advocated will briefly appear, from the following abstract of the petition, founded on the report, and directed to be presented to Parliament: "Your petitioners have learned by the concurrent testimony of a very large proportion of their members, that Cow-Small-Pox, if duly and carefully communicated, has an enduring influence in protecting the constitution; they admit that this protection is not in all cases complete, but they have unquestionable proof of its being capable, if generally and properly employed, of mitigating, controlling, and they might almost say of extinguishing, Small-Pox in any district."

Many observers, however, both on the Continent and these countries,—and the number has been increasing for some years,—only partially subscribe to the doctrine of Jenner, contending that Vaccination, although it may impart the protective influence to an unascertained proportion of those submitted to the operation, by no means does so to all; and that even where imparted, it is liable to wear out, and leave the system again susceptible of the contagion of casual Small-Pox. A few maintain that the Cow-pock, in its most perfect form, confers neither permanent nor temporary protection. In addition to the grand object of destroying the liability to Small-Pox, or at least mitigating its severity by Vaccination, the practice has been advocated, by ascribing to it several subsidiary advantages, the chief of which is the comparative safety of the operation as compared with Variolous Inoculation, both to the individual and the community, from the tendency of the latter to multiply the sources of contagion, and consequently to extend the ravages of the disease.

Minor benefits derivable from the artificial production of Cow-pock, are alleged to be, an occasional tendency to ameliorate the process of dentition, and occasionally to effect a cure of various cutaneous dis-

eases. These collateral benefits of Vaccination we shall dispose of first, and thus leave the space clear, for the discussion of the grand question of protective influence.

It is asserted by Heim that the process of dentition is, in many cases, accelerated by the development of the Cow-pock, and Capuron admits, that it is, at least, not rendered more troublesome. Jenner, and several other writers, bear testimony to various chronic affections of the skin having been rendered milder, and even actually removed by Vaccination. Amongst the diseases specified, are scabies, herpes, porrigo, and impetigo; and Valentin adds ophthalmia, and scrofula; nor does there seem to be any valid objection against trying the effects of Vaccination in such cases, provided we do not allow the lymph, resulting from the operation, to be made use of for the transmission of the Cow-pock to others. We do not, however, advise our readers to hope for any very striking success from this practice, as it will be found, in the majority of instances, as unsuccessful in arresting the progress of any severe cutaneous diseases, as it turned out, in the hands of Dr. M'Cormac, when experimenting on its effects, in a case of whooping-cough.¹

Other advantages possessed by Vaccination are the absence of that tendency to produce, in any case, a number of confluent pustules with their consequent deformity, and to rouse into activity, the germs of scrofula and other constitutional diseases, which is well known to mark the course of Small-pox, whether arising casually, or dependent on inoculation. We are aware that it is alleged, that even Vaccination may produce a deterioration of the blood, and give rise, also, to a variety of cutaneous affections. This alleged deterioration of the blood, however, is a mere hypothesis, and, as such, deserving of no further remark. That boils, pustules, certain cutaneous eruptions, and smart inflammation, may now and then follow the Cow-pock, although rarely, where the health of the patient is in a satisfactory state, we are assured from personal experience; but even here a comparison of the operation, with that for variolous inoculation, is in favour of the former, for such diseases are much more frequently observed after Small-pox, and, as pertinently observed by the late lamented Professor Burns, whose memory is deservedly held in the highest respect, no new cutaneous affection has followed the introduction of Vaccination. But, even at worst, when compared with the great advantages of Vaccination, this objection would scarcely be worthy of notice, except with the view of correcting a vulgar error, viz., that the cutaneous affections alluded to, depend on impurity of the virus employed. Manifestly, in the majority of cases, this is not so—but the result is dependent on the state of the constitution at the time of the operation; for the same lymph will produce the effects in question in one child, and not in another, as I have, over and over again, had the opportunity of observing.

The tendency of Vaccination to diminish the prevalence of Small-pox, by rendering less numerous the sources of infection, is so self-evident, that we need not dilate on it here, although, as regards the community, it is a matter of very great importance.

¹ *Methodus Medendi.*

And, even in point of safety, the operation for Cow-pock has an immense advantage over variolous inoculation, for, to say nothing of the comparative mildness of the symptoms of the former, it is not to be overlooked, that a considerable mortality arose from the artificial Small-pox, even after the most careful preliminary preparation for the operation. The average number of deaths from this cause, at the Inoculation Hospital, is stated to have been three in one thousand cases, and the mortality consequent on Vaccination is certainly very much less than this, although little or no medical treatment, either preparatory, or during the progress of the disease, is either practised, or, indeed, considered necessary. Many practitioners, of considerable experience in this branch of practice, have never seen a single case of Cow-pock terminate fatally in the human subject; still, the possibility of such an occurrence has been sufficiently determined. In Germany, according to Heim, of 208,922 children submitted to the operation, 70 died; and at Baden, 79 deaths occurred out of 98,198 cases. The proportion of one fatal case therefore in rather more than 2,000 individuals is not large, even if it could be unequivocally shown, that all the recorded deaths were necessarily dependent on this cause, and the results might therefore be advantageously contrasted with the mortality arising from variolous inoculation. But in these kingdoms, we are able to infer with certainty, after extended inquiry, that the fatality is infinitely less; and in my own personal experience, extending to a thousand cases in one year, I have never seen the operation terminating in death, even in a single case, and Dr. Baron has only seen one. Nothing further need therefore be advanced as to the superiority of Vaccination in point of safety.

Protective Influence of Vaccination. The great practical question—*Whether, and how far, does Vaccination protect from a Subsequent Attack of Casual Small-pox?* now remains for discussion. And first, with reference to the groundless assumption, that Vaccination affords no protection whatever, we believe it to be so directly contravened by the most conclusive testimony, and by well-established facts, that no other reply seems necessary, but to adopt the language of Capuron—“Experience and observation constitute an answer to their foolish and absurd declamations.” The evidence in favour of the protective and modifying influence of Vaccination may be arranged as follows.

a. *Popular experience, as to the immunity enjoyed by those who have casually contracted Cow-pock from the cow, horse, or camel.*

The discovery of Jenner, as before stated, arose out of the popular belief, prevalent in the dairy counties of England, that the casual transfer of a peculiar form of disease from the udder of the cow to the hands of the persons engaged in milking, defended such persons, ever after, from the liability to Small-pox; and it was only after a long and patient investigation of this point, that that eminently sagacious physician came to the conclusion, that the popular belief was founded in truth. His researches have, therefore, tended to lighten, greatly, the labours of subsequent investigators, by clearly pointing out the precise characters of the pock, which alone can impart the desired impunity, and which it is therefore necessary carefully to discriminate from a variety of diseases having a general resemblance to the genuine malady, but conferring no exemption from a subsequent attack of Small-pox. Jenner,

however, erred in supposing the casual variolæ vaccinae to be, invariably, a purely local disease, whereas it is frequently a constitutional febrile affection, generally mild, and accompanied by an eruption; but occasionally severe, and even fatal. Thus, at Moorshedabad, the pustules appeared all over the body, about the fifth or sixth day after the animal became indisposed, with fever and much distress, and went on to ulceration, the hair falling off wherever a pustule had run its course. The mouth and fauces (which, being one mass of ulceration, impeding mastication), were the principal seats of the disease, which proved fatal, apparently from inanition, in the proportion of from fifteen to twenty per cent.

According to Ceely,—to whose minute and correct history of the symptoms, collated, however, with various other accounts, we are principally indebted for the following description,—the casual Cow-pock appears most generally in the spring, and in a sporadic form. The disease is, however, occasionally epizootic; but Mr. Ceely has not been able to trace it to the equine vesicle, and he adds, that in England, fever is rarely observed. The first perceptible symptoms are heat, tenderness and induration of the udder, followed, about the fifth day after exposure, by small papulæ, affecting also the teats. In cows with white skins, circumscribed indurations appear about the sixth and seventh days, of a reddish colour, as large as a pea, and circular, ovoid, or lozenge-shaped, with a central depression, in which is visible a small dirty yellowish-white discoloration, surrounding a still darker dot or line. The indurations are often interspersed with minute red papulæ, of a darker colour, rather acuminate, and frequently abraded at the summits. Some of the tumours have a slender amber-coloured, yellowish-brown, or black central crust, and are less prominent than those without the crusts. On the eighth and ninth days, the central depression, frequently of a blueish tint, becomes more apparent, as well as the elevation of the margin, which is solid, uniform, tense, and shining, of a glistening pearly, or silvery hue. An areola of a pale rose, or light damask-colour, a line or two in width, is frequently apparent round the base. In others, the central crust has increased, and is yellow, brown, or black; some appear a little pustular in their centres. A few small conoidal vesicles, some of them with a slight depression on the apex, appear to have subsequently arisen on the teats, but in general, the majority of the tumours on these parts are more or less abraded, and lymph is seen exuding from their centres, the cuticle being loose, or partly detached, whilst brown and black incrustations, and other alterations from the natural characteristic appearance, are manifest. About the tenth and eleventh days, the disease usually reaches its acme, when the tumours are often eight or ten lines in diameter, the centres and central edges of the intumescent margin are of a deep blue or slate-colour, and the areola, under which the integuments are deeply indurated, generally of a pale rose-colour, is seldom more than four or five lines in extent. The lymph, now abundant, raises the cuticle, and forms a globular or conoidal vesicle, or freely flows out from its rupture. From this period the induration subsides, and the incrustation and desiccation proceed, until the crusts spontaneously separate, from the twentieth to the twenty-third days, leaving shallow, smooth, oval, or circular

cicatrices, of a pale rose, white, or yellow colour. When the process is disturbed, we may observe on the teats, large black, solid crusts, often more than an inch or two in length, or they appear abraded, ulcerated, and bleeding.¹

It has been affirmed by Reckleben and Thar in Germany, as well as by some observers in this country, that milch-cows are alone subject to Cow-pock, but Heim has shewn that this is not consonant with fact. The truth is, that milch-cows, from causes that must be obvious, are certainly more liable to the disease than young cattle, which are less exposed to inoculation by the hands of the milker; but the latter are by no means entirely exempt.

The lymph from the genuine vaccine vesicle just described, when accidentally transferred to any abraded surface on the milker's hand, and absorbed, reproduces the disease usually termed casual Cow-pock in man, which is marked by an eruption of inflamed spots, the tendency of which is to terminate in suppuration. The pustules are bluish, and circular, with elevated edges; and the consecutive phenomena include swellings in the axilla, fever, headache, vomiting, and, occasionally, delirium. These symptoms decline in three or four days; but the sores are painful, and very frequently heal with difficulty.

Bastard forms of Cow-pock, on the hands of the milkers, arising from spurious varieties of the disease in the cow, are of frequent occurrence, and, from their incapability of imparting any protection to the system, have proved a frequent source of error. The most usual forms of the spurious disease are described in another part of this paper; by contrasting which, with the above minute description of the genuine disease, they may be readily distinguished from each other.

But, rigidly speaking, this popular belief in the general immunity, conferred by casual Cow-pock, cannot be admitted as a conclusive argument, until it shall have been determined, by a sufficient body of statistical information, to be certainly true. This, hitherto, in our opinion, is by no means the case; but, at the same time, the proposition has been rendered so probable, by the investigations of Jenner, and others since his time, as to entitle it justly to the place of a strong corroborative argument, in favour of the efficacy of Vaccination. It is not, however, to be looked for, as a result of further examination of the subject, that the protection, which Cow-pock is capable of conferring, shall be invariably present in all cases. This was an error into which Jenner fell; for the immunity, arising even from casual and inoculated Small-pox, is liable to numerous exceptions; and no other result can reasonably be expected in the case of Cow-pock.

Having thus portrayed the casual disease, as it displays itself, both in the cow, and in man, we shall now minutely describe the symptoms, which follow the transference of genuine lymph to the human subject. This is a part of the subject of great importance; because all our reasoning, as to the protective influence, has reference to the genuine character of the disease; and the truest test of this is the complete and regular process of the vesicle, with its attendant symptoms, throughout its entire course.

¹ British and Foreign Medical and Surgical Review, No. xx, p. 465.

b. Symptoms of inoculated Cow-pock. After the insertion of the genuine virus, the puncture ceases to be apparent for a few days, which may be termed the period of abeyance; but it has been observed by Gregory to assume a vesicular form, under the microscope, within eight-and-forty hours. On the third, or fourth day, an inflamed speck becomes visible to the naked eye, which gradually increases in size, and forms a small, slightly prominent tumour, presenting in its centre a dark point, formed by the commencing secretion of the lymph. This point gradually increases in size, and becomes a small transparent vesicle, either of a dull white colour, something like a pearl, or, occasionally, yellowish, with a circular, or sometimes an oval base, especially if the operation has been performed with a longitudinal scratch. The margin is well defined, being rounded, turgid, red, and shining; the centre is umbilicated, or dips instead of being polarized; and this form remains until the eighth, or ninth day, when the vesicle sometimes becomes more elevated in the centre than at the circumference. Frequently there is scarcely any perceptible fever; but more usually, about the eighth day, a degree of constitutional disturbance takes place, which is indicated by slight headache, and lassitude, and possibly by shivering, loss of appetite, heat of skin, increase of pulse, disordered bowels, pain of the arm-pit, and occasional enlargement of the axillary glands. These febrile symptoms may be present for a day, or two, but they almost invariably then subside, leaving no trace behind. About the eighth day, a little sooner or later, the vesicle is surrounded with a circular, inflamed halo, or erythematous areola, marked by intense itching, redness, and slight swelling of the surrounding membrane, and varying, in diameter, from one to two inches, in different cases. The areola is, occasionally, the site of a number of small vesicles. This local inflammation is the pathognomonic proof of the system being affected with the disease. About the ninth, or tenth day, the vesicle acquires its greatest magnitude, and is equal in diameter to the third or fourth part of an inch, and about the size of a split pea. About the eleventh day, all the symptoms decline; the hue of the areola becomes gradually fainter, and, in a day or two, as it begins to fade imperceptibly away, it leaves two or three concentric rings, of a bluish light grey. It is scarcely distinguishable on the thirteenth day after the operation; at which time the vesicle hardens into a dark brown, circular scab; the fluid for two or three days previously having begun to dry up, first at the centre, and to assume something of a purulent consistence. This, if not rubbed off, or interfered with, falls off towards the twentieth to twenty-fourth day, leaving the skin perfectly whole, but marked by a permanent cicatrix, about the third, or half of an inch in diameter, which is marked by a number of pits, corresponding to the cells of which the vesicle had been composed. Each puncture produces but a single, multilocular vesicle, the little cells of which communicate with each other, and secrete a perfectly transparent, colourless lymph, not however, as stated by Good, during the entire progress of the disease. For, although Cow-pock is considered rather a vesicular, than a pustular malady, the vesicle becomes turbid towards the close, and actually secretes genuine pus. Such is the usual progress of the genuine Cow-pock. It may, however, present various deviations from the regular

course, which may be looked on as immaterial, and which are, therefore, to be carefully distinguished from such aberrations as would interfere with the due impregnation of the system. In the former class we may enumerate the following peculiarities: more or less violent inflammation, sometimes even extending to the trunk of the body, is occasionally observed, terminating in a profusely discharging ulcer, instead of the characteristic scab; but this, though requiring local applications, and at times even general remedies, of a cooling nature, does not, in the opinion of Gregory, militate against the protecting influence of the vaccine operation: my own experience is to the same effect. The same physician describes a papular eruption, appearing about the tenth day, occasionally spreading from the extremities to the trunk, and most usually occurring where numerous vesicles have been raised on the arm, indicating, as he alleges, a full effect upon the system. The lichen, here described, is by no means unfrequent, but it may follow spurious, as well as genuine Vaccination, and cannot therefore be looked on as any certain test of the efficacy of the operation.

The occurrence of vesicles, except on the points punctured, is very rare; but if present, they may be considered as a proof of the energetic operation of the virus on the system. In certain cases, these supernumerary vesicles have been attributed, by Cazenave and Schedel, to transference of the matter by the nails, after scratching; but this appears to be a very questionable cause, and, at any rate, the effects may occur quite independently of it.

The phenomena of Vaccination in the adult are the same as in the child, with a few unimportant variations, which have been correctly described by Gregory. Thus the vesicles are thinner, and consequently, more easily ruptured, the lymph generally presents a yellowish tinge, and the areola is more extensive, the axillary glands more frequently become swollen, and the consecutive fever is greater, with less tendency to secondary lichen, than in children. But such slight anomalies neither interfere with the protective power, nor the contagious properties of the lymph, although, for reasons which will appear hereafter, we should avoid selecting it for transmission of the disease.

c. The Identity of Cow-pock and Small-pox an argument in favour of the protective influence of Vaccination.

It was maintained by Jenner, on theoretical grounds, that the diseases in question were identical, the Small-pox being merely a malignant variety of the Cow-pock; but it is of importance to show, that the correctness of his opinion, in part at least, has been established by evidence, both sufficient in point of amount, and satisfactorily attested, to gain the assent of all those who are not unreasonably and pertinaciously sceptical. In asserting the identity of the variolæ vaccinae and Small-pox, Jenner has found supporters in Wedekind, Henry,¹ Baron, and many others. But no actual experiment in favour of their opinion, however rational, was adducible, until Dr. Sonderland, of Bremen, communicated the disease to a cow, by enveloping her in a woollen bed-cover removed from a patient, who had died of Small-pox;² and fine vaccine lymph was procured in Egypt in the same way. As the ex-

On the Laws of Contagion.

² Petition of Provincial Medical Association.

periment, however, was not followed by like results in the hands of Gregory, Numann, and Macpherson, the statement of Dr. Sonderland became unjustly discredited, until Gassner, Fomin, and Dr. Basil Thiele, of Kasan, succeeded in producing the genuine vaccine disease in the cow, by inoculation with Small-pox matter. Finally, the question must be looked on as settled by the unexceptionable experiments of Mr. Ceely, of Aylesbury;¹ for, the virus of human Small-pox having been communicated by inoculation to the cow, a pock was the result, resembling in all essential particulars the Cow-pock, and which, like the original vaccine disease, afforded a lymph with which some hundreds of persons have been successfully vaccinated, and the efficiency of which has been subsequently tested, both by inoculation of the persons vaccinated, and by their exposure to the contagion of the casual disease. Nor is there anything very remarkable in Retro-vaccination, or the artificial communication of Small-pox to the cow; for M. Viborg had previously succeed in producing the disease in dogs, apes, and swine, in the same manner.² In the dog, the vesicle, although evidently smaller, runs the same course as in man. In Lombardy, and in Persia, it has been observed in the sheep as well as the cow, and also in South America by Humboldt and others.³ The camel too, is susceptible of the disease, as we learn from the communication of Dr. Winchester, in the *Indian Journal of Medicine*, quoted in the nineteenth number of the *British and Foreign Medical and Surgical Review*.

It appears that, in the province of Lus, the camel milkers are subject to a malady termed "*Photo-Shootur*," the Small-pox of the camel, that complaint being designated by the term *Phota*, in the district in question. This is a pustular disease, affecting the hands and arms of the milkers, which is derived from a similar affection on the udder of the camel, closely resembling that on the udder of the cow. No one is ever known to die from this disease; and it is remarked by the natives that those who have been subject to this camel-pock are invariably free from Small-pox, which occasionally prevails as an endemic in that district. It is generally known, that Jenner attributed the sole origin of the disease in the cow, to a complaint affecting the heels of horses, which he erroneously supposed to be the grease, but which has subsequently been ascertained to be a peculiar vesicular disorder affecting not only the heels, but the limbs and body of that animal, and capable of communicating the Cow-pock either to the cow, or directly to man, as fully shown by Loy, Sacco, and De Carro. Of this equine form of the disease, or *pferdemauke*, Professor Hering adduces two instances exhibiting all the characters of perfect identity with the vaccine malady. But this is not the only source of the complaint affecting the cow, for it is well ascertained, as stated by Griva, that it has been observed to occur in that animal spontaneously in Switzerland, the north of Italy, Rome, Germany, Wirtemberg, Holland, France, and Ireland. Dr. M'Cormac suggests, that the disorder in the horse may have been

¹ See Mr. Ceely's Experiments; *British and Foreign Med. Rev.*, No. xvi, p. 614, et seq., and vol. xiii, p. 781; also, *Med.-Chir. Rev.*, Jan. 1834.

² *Med. and Phys. Journ.*, Sep. 1802.

³ *Baron's Life of Jenner*, vol. i, p. 239.

derived from the cow, but it would be extremely difficult, if not impossible, to determine whether the disease originated in man, or in the horse, or the cow; and, at any rate, it is sufficient to know the fact, that it may now occur independently in each, and that it is mutually communicable from the one to the other. In giving an impartial view of the subject, however, we should not omit to state the arguments which have been advanced against the identity of the diseases we have been considering, although such objections must now go for nothing, since the establishment of the point at issue by authentic experiments. The first of the objections in question to which we shall allude, is the comparative mildness of the vaccine disease; but the force of this argument, if it have any force, is obviated by knowing that the variolæ vaccinæ have prevailed, as in the year 1825, in as severe and fatal a form, as the Small-pox in man. It must be admitted, however,—indeed it is on this that the value of Jenner's discovery entirely depends,—that, in general, the character of the malady has been rendered infinitely milder, by its transmission through the cow. Another point of difference well established between the two forms of the disease is, the atmospheric transmissibility of the contagion arising either from the casual or inoculated Small-pox, whereas it is not known that the Cow-pock can be conveyed, except by direct contact. It has also been asserted, that the vesicles arising from the vaccine lymph are invariably confined to the points of puncture; and, as a general rule, this must be admitted to be true. But, from whatever cause arising, this is not invariably the case. Thus it sometimes occurs, that Vaccination is performed on individuals exposed to the variolous contagion, and, in such cases, an eruption, more or less abundant, may appear on various parts of the body. Cazenave and Schedel explain this, by saying that the eruption is only Small-pox modified by the process of Vaccination. But it has been further alleged by some physicians, that they have employed the lymph taken from this supposed Cow-pock eruption, and produced therewith genuine vaccine vesicles; in commenting on which, the authors in question observe, that in such cases, the operators have either grossly deceived themselves, or that the malady thus developed has truly the appearance of Cow-pock. Admitting this, they inquire, what becomes of the distinction between Cow-pock and Small-pox?¹

By the German physicians, a secondary eruption has been observed to accompany the vaccine process, presenting variously the appearance of a spotted rash, or a papuliform, vesicular, or even pustular disease; occurring usually between the eighth and fourteenth days, and remaining for two or three days, or even for a week. In some cases, the eruption assumes the appearance of chicken-pox; and in others, partially, or even entirely, resembles the genuine Cow-pock, and appears on various parts of the body.

Still, such appearances as these last are extremely rare, as I have not observed more than two, out of some thousand cases, in which the pock was not limited to the point of insertion. At one time, Dr. Geo. Gregory was directly opposed to the doctrine of the two varieties of pock being identical, inasmuch as no direct experiments had proved

¹ *Maladies de la Peau*, p. 79.

that Cow-pock can be communicated from man back to the cow;¹ but his statement is not in accordance with the experiments of M. Fiard.² At the same time, on the grounds that diseases which mutually produce each other, are clearly referable to the same source, he admitted the identity of Cow-pock and swine-pox; but, in the same train of argument, he denied that Cow-pock and Small-pox were identical, as the former never produced the latter in the human system; and Small-pox, however mild, never approaches to the character of Cow-pock. The inconsequential character of this mode of reasoning is apparent, but need not be insisted on, as Dr. Gregory has since admitted, that late observations have established the identity of the two diseases; and it is difficult to see how any other inference could be arrived at, after the conclusive experiments of Ceely, unless we are prepared to assert that one malady is capable of producing, by inoculation, another of a totally different nature.

This identity unquestionably supplies a powerful argument in favour of the efficacy of Vaccination; for those who believed that Small-pox and Cow-pock were essentially distinct diseases, might very justly object to the belief in the impunity alleged to be conferred by the latter, that there was no known instance of any one malady having the effect of destroying the liability to another. But the fact, as now established, both obviates the objection, and explains what was previously very mysterious; so much so, that a conviction of the non-identity of the two diseases would go far to shake, *in toto*, our belief in the real efficacy of Vaccination. Cow-pock, therefore, being determined to be essentially the same disease as Small-pox, which is confessedly one of that class of maladies in which a first attack destroys the liability to a second, the inference appears unavoidable, that Cow-pock should confer a like immunity; but the extent of that immunity can only be determined by the result of experience. Reasoning from analogy, and the observed effects in other diseases, we should be led to the conclusion, that the amount of the protection imparted by an attack of Small-pox, whether in its severe and casual, or in the mild and modified form of Cow-pock, would be the same; for we find that the constitution is equally protected from a second attack of scarlatina or measles, whether the primary disease may have been of the most malignant, or the mildest nature. But, as already stated, this is a question which can only be satisfactorily determined by extensive and accurate observation.

(*To be continued.*)

¹ Medical Gazette, vol. i, p. 781-2.

² La Lancette Franç., 1835. Report of M. Gérardin on Vaccine, 1833. British and Foreign Medical and Surgical Review, No. iii.