

**FURTHER OBSERVATIONS OF THE VARIOLÆ VACCINÆ OR COW POX.  
BY EDWARD JENNER, M.D. F.R.S. &c. 1799**

ALTHOUGH it has not been in my power to extend the inquiry into the causes and effects of the variolæ vaccinæ much beyond its original limits, yet, perceiving that it is beginning to excite a general spirit of investigation, I think it of importance, without delay, to communicate such facts as have since occurred, and to point out the fallacious sources from whence a disease imitative of the true variolæ vaccinæ might arise, with the view of preventing those who may inoculate from producing a spurious disease; and, further, to enforce the precaution suggested in the former treatise on the subject, of subduing the inoculated pustule as soon as it has sufficiently produced its influence on the constitution. From a want of due discrimination of the real existence of the disease, either in the brute or in the human subject, and also of that stage of it in which it is capable of producing the change in the animal economy which renders it unsusceptible of the contagion of the smallpox, unpleasant consequences might ensue, the source of which, perhaps, might not be suspected by one inexperienced in conducting such experiments.

My late publication contains a relation of most of the facts which had come under my own inspection at the time it was written, interspersed with some conjectural observations. Since then Dr. G. Pearson has established an inquiry into the validity of my principal assertion, the result of which cannot but be highly flattering to my feelings. It contains not a single case which I think can be called an exception to the fact I was so firmly impressed with—that the cow-pox protects the human body from the smallpox. I have myself received some further confirmations, which shall be subjoined. I have lately also been favoured with a letter from a gentleman of great respectability (Dr. Ingenhousz), informing me that, on making an inquiry into the subject in the county of Wilts, he discovered that a farmer near Calne had been infected with the smallpox after having had the cow-pox, and that the disease in each instance was so strongly characterized as to render the facts incontrovertible. The cow-pox, it seems, from the doctor's information, was communicated to the farmer from his cows at the time that they gave out an offensive stench from their udders.

Some other instances have likewise been represented to me of the appearance of the disease, apparently marked with its characteristic symptoms, and yet that the patients have afterwards had the smallpox. On these cases I shall, for the present, suspend any particular remarks, but hope that the general observations I have to offer in the sequel will prove of sufficient weight to render the idea of their ever having had existence, but as cases of spurious cow-pox, extremely doubtful.

Ere I proceed let me be permitted to observe that truth, in this and every other physiological inquiry that has occupied my attention, has ever been the object of my pursuit, and should it appear in the present instance that I have been led into error, fond as I may appear of the offspring of my labours, I had rather see it perish at once than exist and do a public injury.

I shall proceed to enumerate the sources, or what appear to me as such, of a spurious cow-pox.

Firstly: That arising from pustules on the nipples or udder of the cow; which pustules contain no specific virus.

Secondly: From matter (although originally possessing the specific virus) which has suffered a decomposition, either from putrefaction or from any other cause less obvious to the senses.

Thirdly: From matter taken from an ulcer in an advanced stage, which ulcer arose from a true cow-pock.

Fourthly: From matter produced on the human skin from contact with some peculiar morbid matter generated by a horse.

On these subjects I shall offer some comments: First, to what length pustulous diseases of the udder and nipples of the cow may extend it is not in my power to determine; but certain it is that these parts of the animal are subject to some variety of maladies of this nature; and as many of these eruptions (probably all of them) are capable of giving a disease to the human body, would it not be discreet for those engaged in this investigation to suspend controversy and cavil until they can ascertain with precision what is and what is not the genuine cow-pox?

For example: A farmer who is not conversant with any of these maladies, but who may have heard of the cow-pox in general terms, may acquaint a neighbouring surgeon that the distemper appears at his farm. The surgeon, eager to make an experiment, takes away matter, inoculates, produces a sore, uneasiness in the axilla, and perhaps some affection of the system. This is one way in which a fallacious idea of security both in the mind of the inoculator and the patient may arise; for a disease may thus have been propagated from a simple eruption only.

One of the first objects then of this pursuit, as I have observed, should be, to learn how to distinguish with accuracy between that peculiar pustule which is the true cow-pock, and that which is spurious. Until experience has determined this, we view our object through a mist. Let us, for instance, suppose that the smallpox and the chicken-pox were at the same time to spread among the inhabitants of a country which had never been visited by either of these distempers, and where they were quite unknown before: what confusion would arise! The resemblance between the symptoms of the eruptive fever and between the pustules in either case would be so striking that a patient who had gone through the chicken-pox to any extent would feel equally easy with regard to his future security from the smallpox as the person who had actually passed through that disease. Time and future observation would draw the line of distinction.

So I presume it will be with the cow-pox until it is more generally understood. All cavilling, therefore, on the mere report of those who tell us they have had this distemper, and are afterwards found susceptible of the smallpox, should be suspended. To illustrate this I beg leave to give the following history:

Sarah Merlin, of the parish of Eastington in this county, when about thirteen or fourteen years of age lived as a servant with farmer Clarke, who kept a dairy consisting of about eighteen cows at Stonehouse, a neighbouring village. The nipples and udders of three of the cows were extensively affected with large white blisters. These cows the girl milked daily, and at the time she assisted, with two others, in milking the rest of the herd. It soon appeared that the disease was communicated to the girl. The rest of the cows escaped the infection, although they were milked several days after the three above specified, had these eruptions on the nipples and udders, and even after the girl's hand became sore. The two others who were engaged in milking, although they milked the cows indiscriminately, received no injury. On the fingers of each of the girl's hands there appeared several large white blisters—she supposes about three or four on each finger. The hands and arms inflamed and swelled, but no constitutional indisposition followed. The sores were anointed with some domestic ointment and got well without ulcerating.

As this malady was called the cow-pox, and recorded as such in the mind of the patient, she became regardless of the smallpox; but, on being exposed to it some years afterwards she was infected, and had a full burthen.

Now, had any one conversant with the habits of the disease heard this history, they would have had no hesitation in pronouncing it a case of spurious cow-pox; considering its deviation in the numerous blisters which appeared on the girl's hands; their termination without ulceration; its not proving more generally contagious at the farm, either among the cattle or those employed in milking; and considering also that the patient felt no general indisposition, although there was so great a number of vesicles.

This is perhaps the most deceptive form in which an eruptive disease can be communicated from the cow, and it certainly requires some attention in discriminating it. The most perfect criterion by which the judgment may be guided is perhaps that adopted by those who attend infected cattle. These white blisters on the nipples, they say, never eat into the fleshy parts like those which are commonly of a bluish cast, and which constitute the true cow-pox, but that they affect the skin only, quickly end in scabs, and are not nearly so infectious.

That which appeared to me as one cause of spurious eruptions, I have already remarked in the former treatise, namely, the transition that the cow makes in the spring from a poor to a nutritious diet, and from the udder's becoming at this time more vascular than usual for the supply of milk. But there is another source of inflammation and pustules which I believe is not uncommon in all the dairy counties in the west of England. A cow intended to be exposed for sale, having naturally a small udder, is previously for a day or two neither milked artificially nor is her calf suffered to have access to her. Thus the milk is preternaturally accumulated, and the udder and nipples become greatly distended. The consequences frequently are inflammation and eruptions which mature.

Whether a disease generated in this way has the power of affecting the constitution in any peculiar manner I cannot presume positively to determine. It has been conjectured to have been a cause of the true cow-pox, though my inquiries have not led me to adopt this supposition in any one instance; on the contrary, I have known the milkers affected by it, but always found that an affection thus induced left the system as susceptible of the smallpox as before.

What is advanced in my second position I consider also of very great importance, and I could wish it to be strongly impressed on the minds of all who may be disposed to conclude hastily on my observations, whether engaged in their investigation by experiments or not. To place this in its clearest point of view (as the similarity between the action of the smallpox and the cow-pox matter is so obvious) it will be necessary to consider what we sometimes observe to take place in inoculation for the smallpox when imperfect variolous matter is made use of. The concise history on this subject that was brought forward respecting what I had observed in this neighbourhood<sup>1</sup> I perceive, by a reference since made to the Memoirs of the Medical Society of London, may be considered as no more than a corroboration of the facts very clearly detailed by Mr. Kite.<sup>2</sup> To this copious evidence I have to add still more in the following communications from Mr. Earle, surgeon, of Frampton-upon-Severn, in this county, which I deem the more valuable, as he has with much candour permitted me to make them public:

“SIR:

“I have read with satisfaction your late publication on the Variolæ Vaccinæ, and being, among many other curious circumstances, particularly struck with that relating to the inefficacy of smallpox matter in a particular state, I think it proper to lay before you the following facts which came within my own knowledge, and which certainly tend to strengthen the opinions advanced in pages 56 and 57 of your treatise.

“In March, 1784, a general inoculation took place at Arlingham in this county. I inoculated several patients with active variolous matter, all of whom had the disease in a favourable way; but the matter being all used, and not being able to procure any more in the state I wished, I was under the necessity of taking it from a pustule which, experience has since proved, was advanced too far to answer the purpose I intended. Of five persons inoculated with this last matter, four took the smallpox afterwards in the natural way, one of whom died, three recovered, and the other, being cautioned by me to avoid as much as possible the chance of catching it, escaped from the disease through life. He died of another disorder about two years ago.

“Although one of these cases ended unfortunate, yet I cannot suppose that any medical man will think me careless or inattentive in their management; for I conceive the appearances were such as might have induced any one to suppose that the persons were perfectly safe from future infection. Inflammation in every case took place in the arm, and fever came on with a considerable degree of pain in the axilla. In some of their arms the inflammation and suppuration were more violent than is commonly observed when perfect matter is made use of; in one there was an ulcer which cast off several large sloughs. About the ninth day eruptions appeared, which died away earlier than common without maturation. From these circumstances I should suppose that no medical practitioner would scarcely have entertained a doubt but that these patients had been infected with a true smallpox; yet I must confess that some small degree of doubt presented itself to me at the speedy disappearance of the eruptions; and in order, as far as I could, to ascertain their safety, I sent one of them to a much older practitioner than myself. This gentleman, on hearing the circumstances of the case, pronounced the patient perfectly secure from future infection.

“The following facts are also a striking proof of the truth of your observations on this subject:

“In the year 1789 I inoculated three children of Mr. Coaley, of Hurst farm in this county. The arms inflamed properly, fever and pain in the axillæ came on precisely the same as in the former cases, and in ten days eruptions appeared, which disappeared in the course of two days. I must observe that the matter here made use of was procured for me by a friend; but no doubt it was in an improper state; for, from the similarity of these cases to those

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<sup>1</sup> Inquiry into the Causes and Effects of the Variolæ Vaccinæ, p. 56 of the original article.

<sup>2</sup> See an account of some anomalous appearances subsequent to the inoculation of the smallpox, by Charles Kite, Surgeon, of Gravesend, in the Memoirs of the Medical Society of London, vol. iv, p. 114.

which happened at Arlingham five years before, I was somewhat alarmed for their safety, and desired to inoculate them again: which being permitted, I was particularly careful to procure matter in its most perfect state. All the children took the smallpox from this second inoculation, and all had a very full burthen. These facts I conceive strikingly corroborate your opinion relative to the different states of matter; for in both instances that I have mentioned it was capable of producing something strongly resembling the true smallpox, although it afterwards proved not to be so.

“As I think the communication of these cases is a duty I owe to the public, you are at liberty to make what use you please of this letter.

I remain, &c.,

“John Earle.

“FRAMPTON-UPON SEVERN, GLOUCESTERSHIRE, November 10, 1798.

“P. S. I think it necessary to observe that I can pronounce, with the greatest certainty, that the matter with which the Arlingham patients were inoculated was taken from a true smallpox pustule. I took it myself from a subject that had a very full burthen.”

Certain then it is that variolous matter may undergo such a change from the putrefactive process, as well as from some of the more obscure and latent processes of nature, as will render it incapable of giving the smallpox in such a manner as to secure the human constitution from future infection, although we see at the same time it is capable of exciting a disease which bears so strong a resemblance to it as to produce inflammation and matter in the incised skin (frequently, indeed, more violent than when it produces its effects perfectly), swelling of the axillary glands, general indisposition, and eruptions. So strongly persuaded was the gentleman, whose practice I have mentioned in page 51 of the late treatise, that he could produce a mild smallpox by his mode of managing the matter, that he spoke of it as a useful discovery until convinced of his error by the fatal consequence which ensued.

After this ought we to be in the smallest degree surprised to find, among a great number of individuals who, by living in dairies, have been casually exposed to the cow-pox virus when in a state analogous to that of the smallpox above described, some who may have had the disease so imperfectly as not to render them secure from variolous attacks? For the matter, when burst from the pustules on the nipples of the cow, by being exposed, from its lodgment there, to the heat of an inflamed surface, and from being at the same time in a situation to be occasionally moistened with milk, is often likely to be in a state conducive to putrefaction; and thus, under some modification of decomposition, it must, of course, sometimes find access to the hand of the milker in such a way as to infect him. What confusion should we have were there no other mode of inoculating the smallpox than such as would happen from handling the diseased skin of a person labouring under that distemper in some of its advanced and loathsome stages! It must be observed that every case of cow-pox in the human species, whether communicated by design or otherwise, is to be considered as a case of inoculation. And here I may be allowed to make an observation on the case of the farmer communicated to me by Dr. Ingenhousz. That he was exposed to the matter when it had undergone the putrefactive change is highly probable from the doctor's observing that the sick cows at the farm gave out an offensive stench from their udders. However, I must remark that it is unusual for cattle to suffer to such an extent, when disordered with the cow-pox, as to make a bystander sensible of any ill smell. I have often stood among a herd which had the distemper without being conscious of its presence from any particular effluvia. Indeed, in this neighbourhood it commonly receives an early check from escharotic applications of the cow leech. It has been conceived to be contagious without contact; but this idea cannot be well founded because the cattle in one meadow do not infect those in another (although there may be no other partition than a hedge) unless they be handled or milked by those who bring the infectious matter with them; and of course, the smallest particle imaginable, when applied to a part susceptible of its influence, may produce the effect. Among the human species it appears to be very clear that the disease is produced by contact only. All my attempts, at least, to communicate it by effluvia have hitherto proved ineffectual.

As well as the perfect change from that state in which variolous matter is capable of producing full and decisive effects on the constitution, to that wherein its specific properties are entirely lost, it may reasonably be supposed that

it is capable of undergoing a variety of intermediate changes. The following singular occurrences in ten cases of inoculation, obligingly communicated to me by Mr. Trye, Senior Surgeon to the Infirmary at Gloucester, seem to indicate that the variolous matter, previously to its being taken from the patient for the intended purpose, was beginning to part with some of its original properties, or, in other words, that it had suffered a partial decomposition. Mr. Trye says: "I inoculated ten children with matter taken at one time and from the same subject. I observed no peculiarity in any of them previously to their inoculation, nor did anything remarkable appear in their arms till after the decline of the disease. Two infants of three months old had erysipelas about the incisions, in one of them extending from the shoulders to the fingers' ends. Another infant had abscesses in the cellular substance in the neighbourhood of the incisions, and five or six of the rest had axillary abscesses. The matter was taken from the distinct smallpox late in its progress, and when some pustules had been dried. It was received upon glass and slowly dried by the fire. All the children had pustules which matured, so that I suppose them all secure from future infection; at least, as secure as any others whom I have ever inoculated. My practice never afforded a sore arm before."

In regard to my former observation on the improper and dangerous mode of preserving variolous matter, I shall here remark that it seems not to have been clearly understood. Finding that it has been confounded with the more eligible modes of preservation, I will explain myself further. When the matter is taken from a fit pustule and properly prepared for preservation, it may certainly be kept without losing its specific properties a great length of time; for instance, when it is previously dried in the open air on some compact body, as a quill or a piece of glass, and afterwards secured in a small vial.<sup>3</sup> But when kept several days in a state of moisture, and during that time exposed to a warm temperature, I do not think it can be relied upon as capable of giving a perfect disease, although, as I have before observed, the progress of the symptoms arising from the action of the imperfect matter bear so strong a resemblance to the smallpox when excited completely.

Thirdly. That the first formed virus, or what constitutes the true cow-pox pustule, invariably possesses the power I have ascribed to it, namely, that of affecting the constitution with a specific disease, is a truth that no subsequent occurrence has yet led me to doubt. But as I am now endeavouring to guard the public as much as possible against erroneous conclusions, I shall observe that when this pustule has degenerated into an ulcer (to which state it is often disposed to pass unless timely checked), I suspect that matter possessing very different properties may sooner or later be produced; and although it may have passed that stage wherein the specific properties of the matter secreted are no longer present in it, yet when applied to a sore (as in the casual way) it might dispose that sore to ulcerate, and from its irritation the system would probably become affected; and thus, by assuming some of its strongest characters, it would imitate the genuine cow-pox.

From the preceding observations on the matter of smallpox when decomposed it must, I conceive, be admitted that cow-pox matter in the state now described may produce a disease, the effects of which may be felt both locally and generally, yet that the disease thus induced may not be effectual in obviating the future effects of variolous contagion. In the case of Mary Miller, related by Mr. Kite in the volume above alluded to, it appears that the inflammation and suppuration of the inoculated arm were more than usually severe, although the system underwent no specific change from the action of the virus; which appears from the patient's sickening seven weeks afterwards with the natural smallpox, which went through its course. Some of the cases communicated by Mr. Earle tend further to confirm this fact, as the matter there manifestly produced ulceration on the inoculated part to a considerable extent.

Fourthly. Whether the cow-pox is a spontaneous disease in the cow, or is to be attributed to matter conveyed to the animal, as I have conceived, from the horse, is a question which, though I shall not attempt now fully to discuss, yet I shall digress so far as to adduce some further observations, and to give my reasons more at large taking up an opinion that to some had appeared fanciful. The aggregate of these observations, though not amounting to positive proof, forms presumptive evidence of so forcible a kind that I imagine it might, on any other person, have made the same impression it did on me, without fixing the imputation of credulity.

<sup>3</sup> Thus prepared, the cow-pox virus was found perfectly active, and possessing all its specific properties, at the end of three months.



Firstly: I conceived this was the source, from observing that where the cow-pox had appeared among the dairies here (unless it could be traced to the introduction of an infected cow or servant) it had been preceded at the farm by a horse diseased in the manner already described, which horse had been attended by some of the milkers.

Secondly: From its being a popular opinion throughout this great dairy country, and from its being insisted on by those who here attend sick cattle.

Thirdly: From the total absence of the disease in Ireland and Scotland, where the men-servants are not employed in the dairies.<sup>4</sup>

Fourthly: From having observed that morbid matter generated by the horse frequently communicates, in a casual way, a disease to the human subject so like the cow-pox that, in many cases, it would be difficult to make the distinction between one and the other.<sup>5</sup>

Fifthly: From being induced to suppose, from experiments, that some of those who had been thus affected from the horse resisted the smallpox.

Sixthly: From the progress and general appearance of the pustule on the arm of the boy whom I inoculated with matter taken from the hand of a man infected by a horse; and from the similarity to the cow-pox of general constitutional symptoms which followed.<sup>6</sup>

I fear it would be trespassing too far to adduce the general testimony of our farmers in support of this opinion: yet I beg leave to introduce an extract of a letter on this subject from the Rev. Mr. Moore, of Chalford Hill, in this county:

“In the month of November, 1797, my horse had diseased heels, which was certainly what is termed the grease; and at a short subsequent period my cow was also affected with what a neighbouring farmer (who was conversant with the complaints of cattle) pronounced to be the cow-pox, which he at the same time observed my servant would be infected with: and this proved to be the case; for he had eruptions on his hands, face, and many parts of the body, the pustules appearing large, and not much like the smallpox, for which he had been inoculated a year and a half before, and had then a very heavy burthen. The pustules on the face might arise from contact with his hands, as he had a habit of rubbing his forehead, where the sores were the largest and the thickest.

“The boy associated with the farmer’s sons during the continuance of the disease, neither of whom had had the smallpox, but they felt no ill effects whatever. He was not much indisposed, as the disease did not prevent him from following his occupations as usual. No other person attended the horse or milked the cow but the lad above mentioned. I am firmly of opinion that the disease in the heels of the horse, which was a virulent grease, was the origin of the servant’s and the cow’s malady.”

But to return to the more immediate object of this proposition.

From the similarity of symptoms, both constitutional and local, between the cow-pox and the disease received from morbid matter generated by a horse, the common people in this neighbourhood, when infected with this disease, through a strange perversion of terms, frequently call it the cow-pox. Let us suppose, then, such a malady to appear among some of the servants at a farm, and at the same time that the cow-pox were to break out among the cattle; and let us suppose, too, that some of the servants were infected in this way, and that others received the infection from the cows. It would be recorded at the farm, and among the servants themselves wherever they might afterwards be dispersed, that they had all had the cow-pox. But it is clear that an individual thus infected from the horse would

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<sup>4</sup> This information was communicated to me from the first authorities.

<sup>5</sup> The sound skin does not appear to be susceptible of this virus when inserted into it, but, when previously diseased from little accidents, its effects are often conspicuous.

<sup>6</sup> This case (on which I laid no inconsiderable stress in my late treatise, as presumptive evidence of the fact adduced) seems to have been either mistaken or overlooked by those who have commented upon it. (See Case XVIII, p. 157.) The boy, unfortunately, died of a fever at a parish workhouse before I had an opportunity of observing what effects would have been produced by the matter of smallpox.

neither be for a certainty secure himself, nor would he impart security to others were they inoculated by virus thus generated. He still would be in danger of taking the smallpox. Yet were this to happen before the nature of the cowpox be more maturely considered by the public my evidence on the subject might be depreciated unjustly. For an exemplification of what is here advanced relative to the nature of the infection when received directly from the horse see Inquiry into the Causes and Effects of the Variolæ Vaccinæ, pp. 27, 28, 29, 30, and p. 35; and by way of further example, I beg leave to subjoin the following intelligence received from Mr. Fewster, Surgeon, of Thornbury, in this county, a gentleman perfectly well acquainted with the appearances of the cow-pox on the human subject:

“William Morris, aged thirty-two, servant to Mr. Cox of Almondsbury, in this county, applied to me the 2d of April, 1798. He told me that, four days before, he found a stiffness and swelling in both his hands, which were so painful it was with difficulty he continued his work; that he had been seized with pain in his head, small of the back, and limbs, and with frequent chilly fits succeeded by fever. On examination I found him still affected with these symptoms, and that there was a great prostration of strength. Many parts of his hands on the inside were chapped, and on the middle joint of the thumb of the right hand there was a small phagedenic ulcer, about the size of a large pea, discharging an ichorous fluid. On the middle finger of the same hand there was another ulcer of a similar kind. These sores were of a circular form, and he described their first appearance as being somewhat like blisters arising from a burn. He complained of excessive pain, which extended up his arm into the axilla. These symptoms and appearances of the sores were so exactly like the cow-pox that I pronounced he had taken the distemper from milking cows. He assured me he had not milked a cow for more than half a year, and that his master’s cows had nothing the matter with them. I then asked him if his master had a greasy horse, which he answered in the affirmative, and further said that he had constantly dressed him twice a day for the last three weeks or more, and remarked that the smell of his hands was much like that of the horse’s heels. On the 5th of April I again saw him, and found him still complaining of pain in both hands, nor were his febrile symptoms at all relieved. The ulcers had now spread to the size of a seven-shilling gold coin, and another ulcer, which I had not noticed before, appeared on the first joint of the forefinger of the left hand, equally painful with that on the right. I ordered him to bathe his hands in warm bran and water, applied escharotics to the ulcers, and wrapped his hands up in a soft cataplasm. The next day he was much relieved, and in something more than a fortnight got well. He lost his nails from the thumb and fingers that were ulcerated.”

The sudden disappearance of the symptoms in this case after the application of the escharotics to the sores is worthy of observation; it seems to show that they were kept up by the irritation of the ulcers.

The general symptoms which I have already described of the cow-pox, when communicated in a casual way to any great extent, will, I am convinced, from the many cases I have seen, be found accurate; but from the very slight indisposition which ensues in cases of inoculation, where the pustule, after affecting the constitution, quickly runs into a scab spontaneously, or is artificially suppressed by some proper application, I am induced to believe that the violence of the symptoms may be ascribed to the inflammation and irritation of the ulcers (when ulceration takes place to any extent, as in the casual cow-pox), and that the constitutional symptoms which appear during the presence of the sore, while it assumes the character of a pustule only, are felt but in a very trifling degree. This mild affection of the system happens when the disease makes but a slight local impression on those who have been accidentally infected by cows; and, as far as I have seen, it has uniformly happened among those who have been inoculated, when a pustule only and no great degree of inflammation or any ulceration has taken place from the inoculation. The following cases will strengthen this opinion.

The cow-pox appeared at a farm in the village of Stonehouse, in this county, about Michaelmas last, and continued gradually to pass from one cow to another till the end of November. On the twenty-sixth of that month some ichorous matter was taken from a cow and dried upon a quill. On the 2d of December some of it was inserted into a scratch, made so superficial that no blood appeared, on the arms of Susan Phipps, a child seven years old. The common inflammatory appearances took place in consequence, and advanced till the fifth day, when they had so much subsided that I did not conceive anything further would ensue.

6th: Appearances stationary.

7th: The inflammation began to advance.

8th: A vesication, perceptible on the edges, forming, as in the inoculated smallpox, an appearance not unlike a grain of wheat, with the cleft, or indentation in the centre.

9th: Pain in the axilla.

10th: A little headache; pulse, 110; tongue not discoloured; countenance in health.

11th, 12th: No perceptible illness; pulse about 100.

13th: The pustule was now surrounded by an efflorescence, interspersed with very minute confluent pustules to the extent of about an inch. Some of these pustules advanced in size and matured. So exact was the resemblance of the arm at this stage to the general appearance of the inoculated smallpox that Mr. D., a neighbouring surgeon, who took some matter from it, and who had never seen the cow-pox before, declared he could not perceive any difference.<sup>7</sup> The child's arm now shewed a disposition to scab, and remained nearly stationary for two or three days, when it began to run into an ulcerous state, and then commenced a febrile indisposition accompanied with an increase of axillary tumour. The ulcer continued spreading near a week, during which time the child continued ill, when it increased to a size nearly as large as a shilling. It began now to discharge pus; granulations sprang up, and it healed. This child had before been of a remarkably sickly constitution, but is now in very high health.

Mary Hearn, twelve years of age, was inoculated with matter taken from the arm of Susan Phipps.

6th day: A pustule beginning to appear, slight pain in the axilla.

7th: A distinct vesicle formed.

8th: The vesicle increasing; edges very red; no deviation in its appearance at this time from the inoculated smallpox.

9th: No indisposition; pustule advancing.

10th: The patient felt this evening a slight febrile attack.

11th: Free from indisposition.

12th, 13th: The same.

14th: An efflorescence of a faint red colour extending several inches round the arm. The pustule, beginning to shew a disposition to spread, was dressed with an ointment composed of hydrarg. nit. rub. and ung. ceræ. The efflorescence itself was covered with a plaster of ung. hydr. fort. In six hours it was examined, when it was found that the efflorescence had totally disappeared.

The application of the ointment with the hydr. nit. rub. was made use of for three days, when, the state of the pustule remaining stationary, it was exchanged for the ung. hydr. nit. This appeared to have a more active effect than the former, and in two or three days the virus seemed to be subdued, when a simple dressing was made use of; but the sore again shewing a disposition to inflame, the ung. hydr. nit. was again applied, and soon answered the intended purpose effectually. The girl, after the tenth day, when, as has been observed, she became a little ill, shewed not the least symptom of indisposition. She was afterwards exposed to the action of variolous matter, and completely resisted it. Susan Phipps also went through a similar trial. Conceiving these cases to be important, I have given them in detail: first, to urge the precaution of using such means as may stop the progress of the pustule; and, secondly, to point out (what appears to be the fact) that the most material indisposition, or at least that which is felt most sensibly, does not arise primarily from the first action of the virus on the constitution, but that it often comes on, if

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<sup>7</sup> That the cow-pox was a supposed guardian of the constitution from the action of the smallpox has been a prevalent idea for a long time past; but the similarity in the constitutional effects between one disease and the other could never have been so accurately observed had not the inoculation of the cow-pox placed it in a new and stronger point of view. This practice, too, has shewn us, what before lay concealed, the rise and progress of the pustule formed by the insertion of the virus, which places in a most conspicuous light its striking resemblance to the pustule formed from the inoculated smallpox.



the pustule is left to chance, as a secondary disease. This leads me to conjecture, what experiment must finally determine, that they who have had the smallpox are not afterwards susceptible of the primary action of the cow-pox virus; for seeing that the simple virus itself, when it has not passed beyond the boundary of a vesicle, excites in the system so little commotion, is it not probable the trifling illness thus induced may be lost in that which so quickly, and oftentimes so severely, follows in the casual cow-pox from the presence of corroding ulcers? This consideration induces me to suppose that I may have been mistaken in my former observation on this subject.

In this respect, as well as many others, a parallel may be drawn between this disease and the smallpox. In the latter, the patient first feels the effect of what is called the absorption of the virus. The symptoms then often nearly retire, when a fresh attack commences, different from the first, and the illness keeps pace with the progress of the pustules through their different stages of maturation, ulceration, etc.

Although the application I have mentioned in the case of Mary Hearn proved sufficient to check the progress of ulceration and prevent any secondary symptoms, yet, after the pustule has duly exerted its influence, I should prefer the destroying it quickly and effectually to any other mode. The term caustic to a tender ear (and I conceive none feel more interested in this inquiry than the anxious guardians of a nursery) may sound harsh and unpleasing, but every solicitude that may arise on this account will no longer exist when it is understood that the pustule, in a state fit to be acted upon, is then quite superficial, and that it does not occupy the space of a silver penny.<sup>8</sup>

As a proof of the efficacy of this practice, even before the virus has fully exerted itself on the system, I shall lay before my reader the following history:

By a reference to the treatise on the Variolæ Vaccinæ it will be seen that, in the month of April, 1798, four children were inoculated with the matter of cow-pox, and that in two of these cases the virus on the arm was destroyed soon after it had produced a perceptible sickening. Mary James, aged seven years, one of the children alluded to, was inoculated in the month of December following with fresh variolous matter, and at the same time was exposed to the effluvia of a patient affected with the smallpox. The appearance and progress of the infected arm was, in every respect, similar to that which we generally observe when variolous matter has been inserted into the skin of a person who has not previously undergone either the cow-pox or the smallpox. On the eighth day, conceiving there was infection in it, she was removed from her residence among those who had not had the smallpox. I was now anxiously waiting the result, conceiving, from the state of the girl's arm, she would fall sick about this time. On visiting her on the evening of the following day (the ninth) all I could learn from the woman who attended her was that she felt somewhat hotter than usual during the night, but was not restless; and that in the morning there was the faint appearance of a rash about her wrists. This went off in a few hours, and was not at all perceptible to me on my visit in the evening. Not a single eruption appeared, the skin having been repeatedly and carefully examined. The inoculated arm continued to make the usual progress to the end, through all the stages of inflammation, maturation, and scabbing.

On the eighth day matter was taken from the arm of this girl (Mary James) and inserted into the arms of her mother and brother (neither of whom had had either the smallpox or the cow-pox), the former about fifty years of age, the latter six.

On the eighth day after the insertion the boy felt indisposed, and continued unwell two days, when a measles-like rash appeared on his hands and wrists, and was thinly scattered over his arms. The day following his body was marbled over with an appearance somewhat similar, but he did not complain, nor did he appear indisposed. A few pustules now appeared, the greater part of which went away without maturing.

On the ninth day the mother began to complain. She was a little chilly and had a headache for two days, but no pustule appeared on the skin, nor had she any appearance of a rash.

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<sup>8</sup> I mention escharotics for stopping the progress of the pustule because I am acquainted with their efficacy; probably more simple means might answer the purpose quite as well, such as might be found among the mineral and vegetable astringents.

The family was attended by an elderly woman as a nurse, who in her infancy had been exposed to the contagion of the smallpox, but had resisted it. This woman was now infected, but had the disease in the slightest manner, a very few eruptions appearing, two or three of which only matured.

From a solitary instance like that adduced of Mary James, whose constitution appears to have resisted the action of the variolous virus, after the influence of the cow-pox virus had been so soon arrested in its progress, no positive conclusion can be fairly drawn; nor from the history of the three other patients who were subsequently infected, but, nevertheless, the facts collectively may be deemed interesting.

That one mild variety of the smallpox has appeared I have already plainly shewn;<sup>9</sup> and by the means now mentioned we probably have it in our power to produce at will another.

At the time when the pustule was destroyed in the arm of Mary James I was informed she had been indisposed about twelve hours; but I am now assured by those who were with her that the space of time was much less. Be that as it may, in cases of cow-pox inoculation I would not recommend any application to subdue the action of the pustule until convincing proofs had appeared of the patient's having felt its effects at least twelve hours. No harm, indeed, could ensue were a longer period to elapse before the application was made use of. In short, it should be suffered to have as full an effect as it could, consistently with the state of the arm.

As the cases of inoculation multiply, I am more and more convinced of the extreme mildness of the symptoms arising merely from the primary action of the virus on the constitution, and that those symptoms which, as in the accidental cow-pox, affect the patient with severity, are entirely secondary, excited by the irritating processes of inflammation and ulceration; and it appears to me that this singular virus possesses an irritating quality of a peculiar kind, but as a single cow-pox pustule is all that is necessary to render the variolous virus ineffectual, and as we possess the means of allaying the irritation, should any arise, it becomes of little or no consequence.

It appears then, as far as an inference can be drawn from the present progress of cow-pox inoculation, that it is an accidental circumstance only which can render this a violent disease, and a circumstance of that nature which, fortunately, it is in the power of almost everyone to avoid. I allude to the communication of the disease from cows. In this case, should the hands of the milker be affected with little accidental sores to any extent, every sore would become the nidus of infection and feel the influence of the virus; and the degree of violence in the constitutional symptoms would be in proportion to the number and to the state of these local affections. Hence it follows that a person, either by accident or design, might be so filled with these wounds from contact with the virus that the constitution might sink under the pressure.

Seeing that we possess the means of rendering the action of the sores mild, which, when left to chance, are capable of producing violent effects; and seeing, too, that these sores bear a resemblance to the smallpox, especially the confluent, should it not encourage the hope that some topical application might be used with advantage to counteract the fatal tendency of that disease, when it appears in this terrific form? At what stage or stages of the disease this may be done with the most promising expectation of success I will not pretend now to determine. I only throw out this idea as the basis of further reasoning and experiment.

I have often been foiled in my endeavours to communicate the cow-pox by inoculation. An inflammation will sometimes succeed the scratch or puncture, and in a few days disappear without producing any further effect. Sometimes it will even produce an ichorous fluid, and yet the system will not be affected.<sup>10</sup> The same thing, we know, happens with the smallpox virus.

Four or five servants were inoculated at a farm contiguous to this place, last summer, with matter just taken from an infected cow. A little inflammation appeared on all their arms, but died away without producing a pustule; yet all these servants caught the disease within a month afterwards from milking the infected cows, and some of them had

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<sup>9</sup> See Inquiry into the Causes and Effects of the Variolæ Vaccinæ, p. 54 (of original article).

<sup>10</sup> At this period of the inquiry I had not discovered the importance of inoculating with virus newly formed in the pustule. The reader will find this explained as he proceeds.

it severely. At present no other mode than that commonly practiced for inoculating the smallpox has been used for giving the cow-pox; but it is probable this might be varied with advantage. We should imitate the casual communication more clearly were we first, by making the smallest superficial incision or puncture on the skin, to produce a little scab, and then, removing it, to touch the abraded part with the virus. A small portion of a thread imbrued in the virus (as in the old method of inoculating the smallpox) and laid upon the slightly incised skin might probably prove a successful way of giving the disease; or the cutis might be exposed in a minute point by an atom of blistering plaster, and the virus brought in contact with it. In the cases just alluded to, where I did not succeed in giving the disease constitutionally, the experiment was made with matter taken in a purulent state from a pustule on the nipple of a cow.

Is pure pus, though contained in a smallpox pustule, ever capable of producing the smallpox perfectly? I suspect it is not. Let us consider that it is always preceded by the limpid fluid, which, in constitutions susceptible of variolous contagion, is always infectious; and though, on opening a pustule, its contents may appear perfectly purulent, yet a given quantity of the limpid fluid may, at the same time, be blended with it, though it would be imperceptible to the only test of our senses, the eye. The presence, then, of this fluid, or its mechanical diffusion through pus, may at all times render active what is apparently mere pus, while its total absence (as in stale pustules) may be attended with the imperfect effects we have seen.

It would be digressing too widely to go far into the doctrine of secretion, but as it will not be quite extraneous, I shall just observe that I consider both the pus and the limpid fluid of the pustule as secretions, but that the organs established by nature to perform the office of secreting these fluids may differ essentially in their mechanical structure. What but a difference in the organization of glandular bodies constitutes the difference in the qualities of the fluids secreted? From some peculiar derangement in the structure or, in other words, some deviation in the natural action of a gland destined to create a mild, innoxious fluid, a poison of the most deadly nature may be created. For example: That gland, which in its sound state secretes pure saliva, may, from being thrown into diseased action, produce a poison of the most destructive quality. Nature appears to have no more difficulty in forming minute glands among the vascular parts of the body than she has in forming blood vessels, and millions of these can be called into existence, when inflammation is excited, in a few hours.<sup>11</sup>

In the present early stage of the inquiry (for early it certainly must be deemed), before we know for an absolute certainty how soon the virus of the cow-pox may suffer a change in its specific properties, after it has quitted the limpid state it possesses when forming a pustule, it would be prudent for those who have been inoculated with it to submit to variolous inoculation. No injury or inconvenience can accrue from this; and were the same method practiced among those who, from inoculation, have felt the smallpox in an unsatisfactory manner at any period of their lives, it might appear that I had not been too officious in offering a cautionary hint in recommending a second inoculation with matter in its most perfect state.

And here let me suppose, for argument's sake (not from conviction), that one person in an hundred after having had the cow-pox should be found susceptible of the smallpox, would this invalidate the utility of the practice? For, waiving all other considerations, who will deny that the inoculated smallpox, although abstractedly it may be considered as harmless, does not involve in itself something that in numberless instances proves baneful to the human frame.

That in delicate constitutions it sometimes excites scrofula is a fact that must generally be subscribed to, as it is so obvious to common observation. This consideration is important.

As the effects of the smallpox inoculation on those who have had the cow-pox will be watched with the most scrupulous eye by those who prosecute this inquiry, it may be proper to bring to their recollection some facts relative to the smallpox, which I must consider here as of consequence, but which hitherto seem not to have made a due impression.

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<sup>11</sup> Mr. Home, in his excellent dissertation on pus and mucus, justifies this assertion.

It should be remembered that the constitution cannot, by previous infection, be rendered totally unsusceptible of the variolous poison; neither the casual nor the inoculated smallpox, whether it produces the disease in a mild or in a violent way, can perfectly extinguish the susceptibility. The skin, we know, is ever ready to exhibit, though often in a very limited degree, the effects of the poison when inserted there; and how frequently do we see, among nurses, when much exposed to the contagion, eruptions, and these sometimes preceded by sensible illness! Yet should anything like an eruption appear, or the smallest degree of indisposition, upon the insertion of the variolous matter on those who have gone through the cow-pox, my assertions respecting the peculiarities of the disease might be unjustly discredited.

I know a gentleman who, many years ago, was inoculated for the smallpox, but having no pustules, or scarcely any constitutional affection that was perceptible, he was dissatisfied, and has since been repeatedly inoculated. A vesicle has always been produced in the arm in consequence, with axillary swelling and a slight indisposition; this is by no means a rare occurrence. It is probable that fluid thus excited upon the skin would always produce the smallpox.

On the arm of a person who had gone through the cow-pox many years before I once produced a vesication by the insertion of variolous matter, and, with a little of the fluid, inoculated a young woman who had a mild, but very efficacious, smallpox in consequence, although no constitutional effect was produced on the patient from whom the matter was taken. The following communication from Mr. Fewster affords a still clearer elucidation of this fact. Mr. Fewster says: “On the 3d of April, 1797, I inoculated Master H——, aged fourteen months, for the smallpox. At the usual time he sickened, had a plentiful eruption, particularly on his face, and got well. His nursemaid, aged twenty-four, had many years before gone through the smallpox, in the natural way, which was evident from her being much pitted with it. She had used the child to sleep on her left arm, with her left cheek in contact with his face, and during his inoculation he had mostly slept in that manner. About a week after the child got well she (the nurse) desired me to look at her face, which she said was very painful. There was a plentiful eruption on the left cheek, but not on any other part of the body, which went on to maturation.

“On enquiry I found that three days before the appearance of the eruption she was taken with slight chilly fits, pain in her head and limbs, and some fever. On the appearance of the eruption these pains went off, and now, the second day of the eruption, she complains of a little sore throat. Whether the above symptoms are the effects of the smallpox or a recent cold I do not know. On the fifth day of the eruption I charged a lancet from two of the pustules, and on the next day I inoculated two children, one two years, the other four months old, with the matter. At the same time I inoculated the mother and eldest sister with variolous matter taken from Master H——. On the fifth day of their inoculation all their arms were inflamed alike; and on the eighth day the eldest of those inoculated from the nurse sickened, and the youngest on the eleventh. They had both a plentiful eruption, from which I inoculated several others, who had the disease very favourably. The mother and the other child sickened about the same time, and likewise had a plentiful eruption.

“Soon after, a man in the village sickened with the smallpox and had a confluent kind. To be convinced that the children had had the disease effectually I took them to his house and inoculated them in both arms with matter taken from him, but without effect.”

These are not brought forward as uncommon occurrences, but as exemplifications of the human system’s susceptibility of the variolous contagion, although it has been previously sensible of its action.

Happy is it for mankind that the appearance of the smallpox a second time on the same person, beyond a trivial extent, is so extremely rare that it is looked upon as a phænomenon! Indeed, since the publication of Dr. Heberden’s paper on the Varicellæ, or chickenpox, the idea of such an occurrence, in deference to authority so truly respectable, has been generally relinquished. This I conceive has been without just reason; for after we have seen, among many others, so strong a case as that recorded by Mr. Edward Withers, Surgeon, of Newbury, Berks, in the fourth volume of the Memoirs of the Medical Society of London (from which I take the following extracts), no one, I think, will again doubt the fact:

“Mr. Richard Langford, a farmer of West Shefford, in this county (Berks), about fifty years of age, when about a month old had the smallpox at a time when three others of the family had the same disease, one of whom, a servant

man, died of it. Mr. Langford's countenance was strongly indicative of the malignity of the distemper, his face being so remarkably pitted and seamed as to attract the notice of all who saw him, so that no one could entertain a doubt of his having had that disease in a most inveterate manner."

Mr. Withers proceeds to state that Mr. Langford was seized a second time, had a bad confluent smallpox, and died on the twenty-first day from the seizure; and that four of the family, as also a sister of the patient's, to whom the disease was conveyed by her son's visiting his uncle, falling down with the smallpox, fully satisfied the country with regard to the nature of the disease, which nothing short of this would have done. The sister died.

"This case was thought so extraordinary a one as to induce the rector of the parish to record the particulars in the parish register."

It is singular that in most cases of this kind the disease in the first instance has been confluent; so that the extent of the ulceration on the skin (as in the cow-pox) is not the process in nature which affords security to the constitution.

As the subject of the smallpox is so interwoven with that which is the more immediate object of my present concern, it must plead my excuse for so often introducing it. At present it must be considered as a distemper not well understood. The inquiry I have instituted into the nature of the cow-pox will probably promote its more perfect investigation.

The inquiry of Dr. Pearson into the history of the cow-pox having produced so great a number of attestations in favour of my assertion that it proves a protection to the human body from the smallpox, I have not been assiduous in seeking for more; but as some of my friends have been so good as to communicate the following, I shall conclude these observations with their insertion.

Extract of a letter from Mr. Drake, Surgeon, at Stroud, in this county, and late Surgeon to the North Gloucester Regiment of Militia:

"In the spring of the year 1796 I inoculated men, women, and children to the amount of about seventy. Many of the men did not receive the infection, although inoculated at least three times and kept in the same room with those who actually underwent the disease during the whole time occupied by them in passing through it. Being anxious they should, in future, be secure against it, I was very particular in my inquiries to find out whether they ever had previously had it, or at any time been in the neighbourhood of people labouring under it. But, after all, the only satisfactory information I could obtain was that they had had the cow-pox. As I was then ignorant of such a disease affecting the human subject, I flattered myself what they imagined to be the cow-pox was in reality the smallpox in a very slight degree. I mentioned the circumstance in the presence of the officers, at the time expressing my doubts if it were not smallpox, and was not a little surprised when I was told by the Colonel that he had frequently heard you mention the cow-pox as a disease endemial to Gloucestershire, and that if a person were ever affected by it, you supposed him afterwards secure from the smallpox. This excited my curiosity, and when I visited Gloucestershire I was very inquisitive concerning the subject, and from the information I have since received, both from your publication and from conversation with medical men of the greatest accuracy in their observations, I am fully convinced that what the men supposed to be cow-pox was actually so, and I can safely affirm that they effectually resisted the smallpox."

Mr. Fry, Surgeon, at Dursley in this county, favours me with the following communication:

"During the spring of the year 1797 I inoculated fourteen hundred and seventy-five patients, of all ages, from a fortnight old to seventy years; amongst whom there were many who had previously gone through the cow-pox. The exact number I cannot state; but if I say there were nearly thirty, I am certainly within the number. There was not a single instance of the variolous matter producing any constitutional effect on these people, nor any greater degree of local inflammation than it would have done in the arm of a person who had before gone through the smallpox, notwithstanding it was invariably inserted four, five, and sometimes six different times, to satisfy the minds of the patients. In the common course of inoculation previous to the general one scarcely a year passed without my meeting with one or two instances of persons who had gone through the cow-pox, resisting the action of the variolous contagion. I may fairly say that the number of people I have seen inoculated with the smallpox who, at



former periods, had gone through the cow-pox, are not less than forty; and in no one instance have I known a patient receive the smallpox, notwithstanding they invariably continued to associate with other inoculated patients during the progress of the disease, and many of them purposely exposed themselves to the contagion of the natural smallpox; whence I am fully convinced that a person who had fairly had the cow-pox is no longer capable of being acted upon by the variolous matter.

“I also inoculated a very considerable number of those who had had a disease which ran through the neighbourhood a few years ago, and was called by the common people the swine-pox, not one of whom received the smallpox.”<sup>12</sup>

“There were about half a dozen instances of people who never had either the cow- or swine-pox, yet did not receive the smallpox, the system not being in the least deranged, or the arms inflamed, although they were repeatedly inoculated, and associated with others who were labouring under the disease; one of them was the son of a farrier.”

Mr. Tierny, Assistant Surgeon of the South Gloucester Regiment of Militia, has obliged me with the following information:

“That in the summer of the year of 1798 he inoculated a great number of the men belonging to the regiment, and that among them he found eleven who, from having lived in dairies, had gone through the cow-pox. That all of them resisted the smallpox except one, but that on making the most rigid and scrupulous enquiry at the farm in Gloucestershire, where the man said he lived when he had the disease, and among those with whom, at the same time, he declared he had associated, and particularly of a person in the parish, whom he said had dressed his fingers, it most clearly appeared that he aimed at an imposition, and that he never had been affected with the cow-pox.”<sup>13</sup>

Mr. Tierny remarks that the arms of many who were inoculated after having had the cow-pox inflamed very quickly, and that in several a little ichorous fluid was formed.

Mr. Cline, who in July last was so obliging at my request as to try the efficacy of the cow-pox virus, was kind enough to give me a letter on the result of it, from which the following is an extract:

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<sup>12</sup> This was that mild variety of the smallpox which I have noticed in the late Treatise on the Cow-Pox (p. 233).

<sup>13</sup> The public cannot be too much upon their guard respecting persons of this description.