

Report of experiments made under direction of the Lords of the Council as to the vaccination of sheep, and as to the influence of such vaccination in preventing sheep-pox / by James F. Marson and Professor Simonds.

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Publication/Creation

London : Printed by George E. Eyre and William Spottiswoode, 1864.

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REPORT

OF EXPERIMENTS MADE UNDER DIRECTION OF
THE LORDS OF THE COUNCIL

AS TO

THE VACCINATION OF SHEEP,

AND AS TO

THE INFLUENCE OF SUCH VACCINATION IN
PREVENTING SHEEP-POX.

BY

JAMES F. MARSON, Esq., F.R.C.S.,
RESIDENT SURGEON OF THE SMALLPOX HOSPITAL,

AND

PROFESSOR SIMONDS,
OF THE ROYAL VETERINARY COLLEGE.

8th June 1864.

Presented to both Houses of Parliament by Command of Her Majesty.



LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1864.

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REPORT

ON THE

VACCINATION OF SHEEP.

IN the year 1842 an Act of Parliament was passed to allow the importation of foreign cattle and sheep into England upon the payment of 20s. per head for cattle, and 3s. per head for sheep; the importation of foreign cattle and sheep having previously been prohibited. As the numbers imported under this arrangement were found to be but comparatively small, the duty in 1846 was altogether removed. The immediate effect of this free importation was, that in one year the number of sheep sent in was more than four times as many as had been during the previous three years and eight months which directly succeeded the alteration of the law.

This otherwise beneficial measure received, however, a serious drawback in 1847, when some Saxony-Merino sheep exported from Hamburgh and Tönnig, the chief ports of the Elbe and the Eider, brought with them a disease which, from the close resemblance in its development, progress, and effects to the small-pox of man, has been called the small-pox of sheep. The disease being of an infectious nature subsequently spread among the English flocks, and caused serious losses to be sustained. It was confined, however, after its first introduction, for several weeks to the immediate neighbourhood of London; but by the purchase in Smithfield Market of other sheep in whose systems the disease was latent, the malady was early conveyed to many parts of the country, and chiefly into the eastern counties, through the medium of cattle dealers.

On this visitation the disease continued its ravages for about four years, when it entirely subsided.

After an interval of 12 years it again appeared, namely, in 1862, and on this occasion it was first noticed in Wiltshire, to a small part of which county it was nearly confined, although by the sale of some lambs it subsequently extended to the county of Berkshire. It did not continue, however, for more than four months, and chiefly in consequence of the energetic measures which were adopted by the Government for its extermination.

The introduction of the disease on the latter occasion could not be traced with certainty, but it was nevertheless ascertained that it had an existence in a portion of Lauenburg and the adjacent states, from which places we had then been for some time importing sheep.

As it was positively stated by several persons that the vaccination of sheep could be beneficially employed to arrest the progress, and also to lessen the fatality of the malady, we undertook, at the request of the Privy Council, the task of proving the correctness or incorrectness of these opinions, and for this purpose we were furnished with 200 sheep by the Government. The sheep consisted of 50 Kents, 50 Exmoors and "half-breds," and 100 Cheviots. We may here remark, that we found the latter were not quite so well suited for purposes of this kind as the others, in consequence of many of them having so much hair on the inner side of the thighs, the part generally selected for inoculation or vaccination, as being the least covered with wool or hair.

The sheep were at first branded on each side in consecutive numbers from 1 to 200, and for the better carrying out of the experiments they were divided into lots of 50. The numbers were entered in a book, and against each sheep a record was kept of the effects produced from time to time by the several experiments to which the animals were subjected.

On the 24th of October 1862 the vaccinations were commenced, and by the 14th of November the whole of the sheep had been vaccinated once over, six punctures being made in each case. Current vaccine lymph, obtained from three different sources was used, Jennerian, that in use at the Small-pox and Vaccination Hospital, and some which had been originally procured by Mr. Badcock a few years before from inoculating the cow with the virus of human small-pox. No essential difference, however, was observed in the local action produced by these respective lymphs, either on this or any subsequent vaccination of the animals.

In the course of a few weeks we had had ample opportunities of satisfying ourselves of the comparative insusceptibility of sheep to the vaccine disease; for on the first vaccination being completed, it was found that, out of the 200, effect had only been produced on seventy-one of the animals. This fact determined us to procure if possible some *primary* vaccine lymph from the cow, and for this purpose advertisements were inserted in the "*Veterinarian*."

A small supply was obtained from three individuals, which, however, on trial proved to be quite inert. It is right that we should state that we had great doubt as to whether any of this was true cow-pox lymph, arising from the circumstance that there is a greater difficulty in obtaining genuine lymph from the cow than is generally supposed, and chiefly from the very rare occurrence of late years of the disease among these animals, as also from their being subject to other eruptive diseases which are liable to be mistaken for the true cow-pox.

For the purpose also of endeavouring to obtain primary lymph, recourse was had to the inoculation of cows with the virus of human small-pox, a proceeding that has been occasionally resorted to with success. Seventy-two animals were inoculated between the beginning of November and the end of August of the following year, 50 of which were tried two or three times in succession. We

were enabled, however, to charge only a few points from the whole of these inoculations, and the material thus obtained, when used on sheep, was found to have no greater effect than that produced by current vaccine lymph.

We next resorted to the vaccination of some calves, with the view of obtaining, if possible, a supply of lymph on the so-called principle of retro-vaccination, namely, the passing of current vaccine lymph through a bovine animal. A scanty supply was thus procured, which, however, on trial was likewise found to be not more active than ordinary vaccine lymph. This point we shall have occasion hereafter to refer to again.

Finding such unsatisfactory results from these experiments, we determined to *ovinate* the cow, with a view of procuring, if possible, a lymph which would produce more decided action on the sheep on being returned to this animal, in a similar manner that the virus of human small-pox, after being passed through the cow, has been returned to man. For this purpose six cows were ovinated with lymph taken from a natural case of sheep-pox, eight punctures being made in the *perineum* or on the *labia pudendi* of each cow. No special results followed, but some of the same lymph, used at the same time on sheep, took readily. The experiments were repeated on these cows shortly afterwards with a like result. Within a few weeks of this time five other cows, a heifer, and a steer, were ovinated after the same manner from a natural case of sheep-pox, sets of scratches being used as well as punctures on the teats and other parts; but still no sufficient effect was produced to enable us to obtain lymph. These experiments, so far as they go, show the correctness of that which has been stated by several of the continental writers respecting the insusceptibility of the cow to take the sheep-pox, and they also confirm the experiments which were instituted by ourselves in 1848 to determine this same question.

Although scarcely anticipating any greater success, we nevertheless resolved to give trial to the vaccination of pigs, and also to the inoculation of them with the virus of human small-pox; these animals being omnivorous, and therefore, like man, living on a mixed animal and vegetable diet. Pigs varying in age from a few weeks to a year old were chosen for the purpose. The vaccinations, although several times repeated, produced no effect, and the inoculations but very slight; no vesication following from either.

We were thus thrown back upon current vaccine lymph for the completion of the experiments, and after a short interval the sheep not affected by any of the previous vaccinations were vaccinated again, but without any material alteration in the results being obtained. Fifty-six sheep were next selected for a repetition of the experiments, care being taken that some of them should be animals on which a former vaccination had had effect. Only 12 of the 56 sheep showed any result from the operation; and it is worthy of note that no less than eight of these, or two-thirds, had been affected before. Another 50 were selected and vaccinated, and 29 of them took the disease; 17 of which, or nearly two-

thirds again, had been influenced by a previous vaccination. The second action of the vaccine virus was found to be fully equal to the first, by which it appeared to be in no way influenced.

The fact of sheep being susceptible to the action of the vaccine virus a second and even a third time, as we proved by oft repeated experiments, is of itself sufficient to show the inutility of the vaccination of sheep. For if the first vaccination affected the system so as to be protective, the animal would not be susceptible to a second action of the same virus, until after a lapse of probably some years, instead of being acted upon by it a second time, almost immediately.

A slight difference only was observed in the action of the Jennerian, and Small-pox and Vaccination Hospital lymph, the two which were principally employed; 33 per cent. only of the whole of the vaccinations with Jennerian, and 38 per cent. of those done with the Small-pox and Vaccination Hospital lymph showing results.

The vaccine disease in the sheep, even when developed to its fullest extent, is very unlike the same disease in the human subject. In the sheep it is but seldom anything more than the production of a small papule, which occasionally results in the formation of a minute vesicle, or more commonly a pustule, which is sometimes, although very rarely, surrounded with a slight areola. Generally, however, neither vesication nor pustulation follows, but a small scab is produced, which soon falls from the site of the puncture, leaving no trace behind. The disease passes quickly and irregularly through its several stages, so as to have ended by the eighth or ninth day, or not unfrequently even before this time. Lymph is but rarely obtainable, and never but in the smallest quantity, and this on the fifth or sixth day succeeding the vaccination. The effects are only local, and the animal's health never impaired. In man, on the contrary, vaccination can nearly always be made to take effect, a vesicle being formed on the eighth day, affording regularly lymph for the vaccination of others, which is always, or nearly always, followed by areola, the vesicles being never so small as those observed in sheep, excepting in what are called abortive or spurious cases, which, however, in well-conducted vaccinations, are of very rare occurrence.

Our observations, therefore, fully confirm the remarks of Mr. Ceely, of Aylesbury, who says, "That imperfect development " and premature decline, with little or no areola, is the rule" in the vaccination of sheep.

Besides the 200 ewes, two rams were vaccinated. In one ram, effects rather greater than those usually observed were produced in four of the punctures, and in two of them in the other ram. Both these animals were subsequently ovinated and contracted the sheep-pox, passing regularly through its several stages. Both recovered. Six lambs were also selected for vaccination, four of which were operated on with Small-pox Hospital lymph, and too with primary lymph. The Small-pox Hospital lymph took effect in all four animals, but the primary lymph failed in each case. The six lambs were also ovinated with success, and all re-

covered. No difference in the course of the disease produced by the ovinations being observed between those in which the vaccination took effect and those in which it failed.

Besides the preceding instances of ovination after successful vaccination, 25 sheep, which had also been successfully vaccinated, were ovinated, and contracted the disease. Two of these animals died; and it is especially worthy of comment that both of them had shown effect *twice* from vaccination, thus proving the non-protective power of even a double effective vaccination.

Sixteen sheep which had been vaccinated with success were exposed to the sheep-pox and took it naturally; and out of this number no less than eleven died, thus proving that the severity of the disease was in no way mitigated by the vaccination.

Our experience of the vaccination of sheep therefore agrees with that of Hurtrel D'Arboval, who gives the following details.

"1,523 sheep," he says, "were subjected to the operation of vaccination, and of these, 1,341 contracted the vaccine disease, and 182 were not affected. Out of the 1,341 sheep, 429 were subsequently exposed to sheep-pox, either by direct ovination or by being placed among infected animals, and 308 of them were attacked with the malady." Hurtrel D'Arboval infers that the escape of the remaining 121 sheep was probably to be attributed to either their non-susceptibility or to some defects in conducting the experiments; and he concludes that "vaccination cannot be substituted for ovination."*

There is an impression, nevertheless, on the minds of some persons in France, as well as in England, with which, however, we do not concur, that vaccination gives to sheep a short temporary immunity—say for a month to six weeks—from the infection of small-pox. The following extract relating to this subject, from Gasparin's "*Des Maladies contagieuses des Bêtes-à-laine*," has been kindly furnished us by Mr. Ceely.

"§ 151. On ne cite qu'un très-petit nombre d'expériences semblables, qui donnent un lueur d'espoir pour le succès d'une telle opération; mais les expériences qui lui sont contraires sont nombreuses et décisives. C'est ici, l'opposé de ce qui nous arrive pour la clavelisation; dans celle-ci, les expériences affirmatives sont nombreuses, et on ne cite que quelques expériences négatives.

"MM. Husson et Verrier vaccinèrent 233 moutons dans un troupeau où venait de se manifester le claveau. Au bout de quelques jours, la maladie éclata sur les bêtes chez qui la vaccine n'avait rien produit, et ce ne fut que le *quarante-cinquième jour* qu'il se déclara sur celles qui avaient eu la vaccine; la maladie y fut aussi fâcheuse que sur les autres; un grand nombre de bêtes succombèrent.†

"*Cette expérience semblerait prouver que la propriété préservative existe pendant quelques jours, que la peau a besoin de se remettre*

* Dictionnaire de Médecine Vétérinaires.—Art. Clavelée.

† Rapport de la Société centrale de Vaccine, 1811.

“ de la réaction causée par la vaccine avant de se redevenir capable de contracter le claveau, et elle expliquerait le prétendu succès des contr'épreuves tentées par quelques vétérinaires.

“ § 152. Mais d'autres savans soumettaient aussi la vaccine à des expériences tout aussi peu satisfaisantes. Brugnone, à Turin, se prononçait contre ses prétendues propriétés, d'après ses expériences.* Valois, à Versailles, vaccinait 50 moutons; dans chacun eût de deux à quatre pustules bien caractérisées, et trente-trois jours après la majeure partie de ces animaux fut atteinte de la clavelée. Elle fut benigne ou confluyente dans la même proportion que chez les animaux non-vaccinés; quatre y succombèrent.†

“ Enfin plusieurs propriétaires, parmi lesquels nous citerons M. Chancey, après avoir vacciné des moutons, les voyant ensuite attaqués du claveau, en concluaient qu'ils avaient eu la fausse vaccine, quoiqu'elle eût été accompagnée d'une aréole très-apparente.‡

“ Il fallait en conclure que la vaccine n'était pas un préservatif suffisant. Voilà quels sont les travaux qui ont été entrepris relativement à la vaccination des troupeaux. Ils me paraissent offrir des résultats fort clairs, et on ne peut plus guère conserver l'espoir d'aneantir la clavelée par cette méthode. Ce résultat est désagréable, sans doute, mais il n'en est pas moins vrai.”

It will thus be seen that, in one instance, some vaccinated sheep on exposure did not show the disease for 45 days, and in another instance for 33 days.

Even were it proved, but which it has not yet been, that vaccination does protect sheep for one or two months against contracting small-pox by infection, the owners of sheep, we should imagine, would never have recourse to the trouble and expense of having them vaccinated for so short a period of protection, with the uncertainty also of only 35 per cent. of them, on the average, taking the vaccine disease.

Dr. Wm. Budd, of Clifton, in a paper read before the “British Medical Association,” at its annual meeting in 1863, referring to the idea that vaccination gives temporary security, says, “There is, indeed, evidence to render it probable that for some weeks after vaccination sheep are somewhat less prone to take *clavelée*—sheep-pox—in the natural way; but there is clearly nothing specific in the protecting influence. Louis has remarked that typhoid fever hardly ever occurs in persons who may at the time be the subject of any other morbid disturbance. The two facts are probably of the same order.”

The numerous experiments performed by ourselves in the course of this inquiry, as well as those had recourse to in Wiltshire, and those legitimately adopted in Norfolk, in 1848, all negative the idea of vaccination affording temporary security to sheep against small-pox.

* Memorie della Societa Agraria di Torino, 1812.

† Annales d'Agriculture, tome 53, page 60.

‡ Bibl. Brittan. Agr., tome 10, page 216.

We may likewise state that modern continental authorities attach no value to the vaccination of sheep as giving either permanent or temporary protection.

Besides, if the vaccination of sheep were protective against sheep-pox, it could not be rendered practically useful unless sheep themselves could be made, like the human subject, to produce material for their own vaccination; for it would be impossible, or next to impossible, to procure lymph from man or from the cow in quantity enough to vaccinate the large number of sheep which would require to be done *immediately* on the occurrence of an extensive outbreak of sheep-pox.

This difficulty will be more apparent when we state that we were only enabled from the whole of our vaccinated sheep, to obtain sufficient fluid for use upon seven sheep, and that when so used it produced no action in any one of the animals.

Referring to the general subject of vaccination, Dr. Budd remarks that "It, as we all know, offers a specific protection against human small-pox, which is all but complete; against ovine small-pox it offers no specific protection at all. It has been proved by experiments on an enormous scale, performed under every condition to insure accuracy, that vaccinated sheep, when afterwards exposed to the infection of *clavelée*, take the disease in large proportion in the natural way; and that, when inoculated with it, they not only incur the usual consequences, but suffer quite as severely as unvaccinated sheep. Until evidence to the contrary shall arise, the conclusion then seems to be inevitable, that variola ovina and human small-pox, closely as they resemble one another, are of distinct species. They are as two kinds of thistle—as one sort of mushroom to another sort—or as two species of algæ—like almost to identity in looks and outward guise, identical in all their laws of growth and being, but yet specifically different."

Finding that our vaccinations had so completely failed, we resolved to give trial to the *inoculation* of some of the sheep with the virus of human small-pox, and for this purpose 100 were selected, and six punctures used in each.

We were led to the performance of these experiments in consequence of the near approximation in the nature of variolous diseases as they are known to exist among animals, and of the capability of these diseases being transmitted occasionally by inoculation from one animal to another of a different species, thus giving it security for a time against its own small-pox, as well as that belonging to another animal; as, for instance, in the transmission of cow-pox to the human subject.

There is, however, always a difficulty in transmitting an exanthematous affection, apparently of the same kind, from one animal to another of a different species, although it can be propagated readily enough among animals of the same species; while from the numerous failures which occur we might now and then be justified in concluding that some creatures are entirely insusceptible to a virus which easily acts on others. Modifications of the malady

are, however, more generally obtained, these being chiefly referrible to the peculiarity of organism.

The results which followed from the inoculation did not materially differ, either locally or constitutionally, from those which had been obtained from the previous vaccinations.

Thus of the 100 sheep alluded to as being inoculated 30 only gave evidence of the introduction of the virus. Of these 30, two were tested with the counter-proof of *ovination*, and both of them contracted the sheep-pox, and one died. Two others were exposed to the natural disease and took it, and both of them died.

Among other things we were anxious to ascertain whether the sheep which had been successfully inoculated with human variola would prove susceptible to the action of the *vaccine* virus, for which purpose 10 of them were subjected to a subsequent vaccination, two of which became affected by it, and to an extent as great as others not inoculated.

Of the number of punctures and scratches made in inoculating sheep with human variola, 10 per cent. only had effect, this nearly agreeing with the results obtained from vaccination. Thus, taking the whole of the punctures and scratches together, and which amounted to many hundreds in vaccinating the sheep, we found that only 13 per cent. of them gave any evidence of the introduction of the vaccine virus.

The preceding facts not only show the inutility of *inoculating sheep with human variola* to protect them against the sheep-pox, but also that the virus has no special action upon their organisms, as they are still open to the influence of the vaccine, as well as their own particular disease.

In continuation of this report it is necessary that we should refer to certain statements which have appeared in the public papers from Mr. Overman, of Weasenham, Mr. Allen Ramsay, surgeon, of Shelford; Mr. Sprague, surgeon, of Kimbolton, and others, relative to the vaccination of sheep in this country.

In the year 1848, in particular, sheep-pox, as has been previously stated, prevailed to a very great extent in the eastern counties, and continued to do so, with more or less severity, down to the middle part of 1850. The serious losses which were sustained led to various means being tried to check the extension of the disease, both by surgeons, veterinary surgeons, and agriculturists. Foremost among the latter was the late Mr. Henry Overman, of Weasenham, Norfolk, who professed to have protected his flock by vaccination. (?)

At the "Launditch Association," held at Litcham, Norfolk, October 4, 1848, Mr. Overman is reported in the local papers to have said—"That when the disease first made its appearance in that part of the country, he conceived it to be his duty as a letter of rams to endeavour to send them out as safe and free from disease as possible. He tried vaccination, and on the 18th and 19th of July he had 860 sheep vaccinated. He was pleased to think he had done so, for out of that number he had not had a single loss from small-pox. Subsequently he had had 20 score lambs also vaccinated, as he was so sanguine as to the result; and

“ no flock could be more healthy than his was. It was impossible
 “ for the small-pox to appear after vaccination, or, suppose it did,
 “ it reached its height in six or eight days, while in the natural
 “ way it would not reach its height until the 14th day. He had
 “ let one of the rams to Mr. Farrer, of Sporle. The small-pox
 “ was raging in the flock and a man was inoculating the sheep at
 “ the time. This sheep which had been vaccinated did not take
 “ the disease.”

These remarks coming from such a source, gave a great impetus at the time to vaccination, and many farmers who had hitherto depended chiefly on keeping their animals as much as possible from infected flocks now had recourse to the operation. The statement, however, was rather too boldly given, and accordingly Mr. Perry, V. S., of Swaffham, the person alluded to as being engaged in inoculating Mr. Farrer's sheep, forwarded a letter, dated October 8th, 1848, to the "*Norwich Mercury*," in which, after quoting Mr. Overman's remarks with regard to the healthy state of his flock, he asks—"Now, what does all this prove? Are there not
 “ scores of flocks in this country that have not been vaccinated, the
 “ owners of which might say the same? Does this in the most
 “ remote way imaginable prove that vaccination is an antidote to
 “ small-pox? Did Mr. Overman place these said sheep with others
 “ infected with small-pox, and allow the animals to herd together
 “ in common? No, he mentions nothing of the sort; he merely
 “ adds 'no flock could be more healthy than his was;' but the
 “ healthiness of Mr. Overman's flock is no proof that the sheep
 “ are not liable to take the small-pox if exposed to it.”

Referring in particular to the ram sent to Mr. Farrer's, Mr. Perry says,—

“ As soon as the animal arrived at Sporle he was lodged in a
 “ house that he might not come in contact with any other sheep.
 “ He did not take the disease in a natural way, as it is termed,
 “ and why? because like Mr. Overman's other sheep he was not
 “ exposed to the infection. On the day after his arrival at Sporle
 “ a lamb-tup was selected as his companion, and at the request of
 “ Mr. Overman on that day, I *inoculated* his down-tup; the lamb
 “ was also inoculated at the same time. Both animals were
 “ immediately removed to a remote part of the farm, away from
 “ all other sheep.

“ On the eighth day the down-tup had small-pox developing as
 “ well as it possibly could be. It is true he had the disease in a
 “ mild form, but not more so than I have seen thousands have it,
 “ that have never been vaccinated. The lamb did not show the
 “ disease till the twelfth day, and although the eruption was more
 “ extensive, the constitutional effects were almost equally mild.
 “ The animals continued to go through the various stages of the
 “ disease until they had entirely recovered.”

Confirmatory of Mr. Perry's statement is the fact that Mr. Simonds saw this tup at Sporle on October 16th, 1848, and made the following note in his memorandum book:—

“Mr. Overman's tup.”—“Inoculated in the right thigh. Affords

“ ample evidence of having had variola rather severely. An enlargement of the absorbents exists near to the place of inoculation, and also a sore covered with a scab. On the inner side of the fore legs several pustules and small ulcers are still present.”

Besides this instance of the non-protective power of the so-called vaccination to which Mr. Overman's sheep had been subjected, we are enabled to state that two more of his sheep were sent to Mr. Muskett's, of Rougham, whose flock at the time was suffering from natural small-pox. Both these sheep were inoculated while on the farm, one by Mr. Cook, farmer, of Litcham, and the other by Mr. Baldwin, V. S., of Fakenham. Both sheep took the disease and one died.

Notwithstanding this circumstance, Mr. Overman, from his real knowledge of the disease being so very imperfect, affirmed, in a letter published in the “*Norwich Mercury*,” bearing date August 10th, 1848, that the sheep sent to Mr. Muskett's did not take the disease from inoculation. His words are,—“I am satisfied that neither of them have taken the disease, but they have a hard callous substance formed at the part immediately connected with the insertion of the ichor.”

With reference to this statement we may remark that the local effects here spoken of, can only be regarded as affording good evidence of the success of the inoculation.

It is necessary now to explain that Mr. Overman's sheep had all of them been operated upon by a Mr. Wells, a medical practitioner of Swaffham, *and that probably not more than a dozen of them had been, in reality, vaccinated with current vaccine lymph.* For his so-called vaccinations Mr. Wells is said to have used a “sherry-coloured” fluid, which he carried about from farm to farm in ounce phials nearly filled. Some of the correspondents of the local papers described it as probably consisting of an irritating agent mixed with “gum water.”* Mr. Overman himself admitted to Mr. Simonds that a fluid was used on his sheep by Mr. Wells; but that a dozen of them were done with “points,” and that he could not discover any difference in the local action produced by this system of vaccination, and that adopted by Mr. Wells.

In continuation of Mr. Overman's vaccinations, and of Mr. Wells' proceedings, we have to state that, in consequence of a natural outbreak of the sheep-pox in July 1848, the latter named person was engaged to *inoculate* the sheep belonging to Mr. Muskett, to whose farm Mr. Overman's two sheep, previously alluded to, had been sent. There is, however, in reality a great doubt whether, even in Mr. Muskett's case, all the animals were properly done with the virus of sheep-pox, inasmuch as Mr. Simonds, who examined the flock no less than *three weeks* after the professed inoculation, found many of them in the earliest stage of the *natural* disease, and giving no signs of inoculation.

* See Mr. Edmund Oldfield's letter to the “*Norwich Mercury*,” November 29, 1848, and also Mr. William Smith's letter to the “*Norfolk News*,” December 7, 1848.

The fact of the natural sheep-pox being at that time in existence in the flock was mentioned to Mr. Overman by Mr. Simonds, with whom he had arranged for five of the vaccinated lambs to be sent to Mr. Muskett's for the purpose of exposing them to the infection, and an equal number to be forwarded to the Royal Veterinary College to be tested by inoculation with the virus of sheep-pox. Both these arrangements, however, Mr. Overman declined to carry out, basing his objections chiefly on Mr. Simonds' statement, that some of Mr. Muskett's lambs were the subjects of the *natural*, and not of the inoculated disease. This determination was communicated in the following letter:—

“ Weasenham Rougham, Norfolk,

“ SIR,

“ October 20, 1848.

“ I HAVE seen Mr. Muskett this morning, and he expresses his surprise that you should have told me last Monday that his lambs were suffering from the small-pox in the natural way. Mr. Cook, of Litcham, said the same to Mr. Muskett on Tuesday last at Lynn Market. Mr. Muskett's statement made to me this morning is, ‘My lambs have not ailed anything since they recovered from the inoculation several weeks since.’ From the appearance of the lambs this morning I have no hesitation in saying they have recovered, and therefore under these circumstances it would be no test for me to send five lambs there, and after re-considering the subject of our conversation, I have determined not to send any of the sheep to the Veterinary College.

“ I am, &c.

To Mr. Simonds.

“ HENRY OVERMAN.”

The pressure, however, which was continued to be put on Mr. Overman by those who knew all the facts relative to his so-called vaccinations ultimately induced him to explain in a letter to the “*Norwich Mercury*,” dated November 22, 1848, that, besides the ram sent to Mr. Farrer's which took the disease, one of the two sheep sent to Mr. Muskett's had died, and the other became affected with variola. They were inoculated, he says, “but one never took the disease but died of gangrene ensuing from the inoculation, the other is alive and well and ailed very little from the experiment.” He goes on to remark that “three of the rams are now at Mr. Caldwell's at Hilbro', two of which have hitherto escaped the small-pox entirely, but one has taken the infection.” He also adds, that three rams are at the Hon. F. Baring's, of Buckingham. “I sent my shepherd,” he says, “to see how they were going on. The disease was there, but my own sheep were all untouched.” Two more rams he states were hired by Mr. Gates, of Illington, and that “the disease, natural and by inoculation, had here carried off 49 out of 800 sheep. After the rams had been about 10 days there, my shepherd pointed out to Mr. Gates that one of them had the small-pox; it had, however, passed its height, the pox was dying off and nothing had occurred to Mr. Gates and his two shepherds to indicate that it had taken the disease.”

In commenting on the statement relative to the escape of the rams at the Hon. F. Baring's, Mr. Edmund Oldfield, who has been referred to in the recent discussion on the vaccination of sheep in the Wiltshire papers as an advocate of the system, says in a letter to the "*Norwich Mercury*," dated November 29, 1848, "It is true that the three rams sent to the Hon. F. Baring's are at present free from the disease, and simply from the reason that his breeding flock has had no small-pox among them. Some of Mr. Baring's 'crones' and fat sheep, however, in another part of the farm have been affected; but the ewes with which Mr. Overman's rams were placed have remained perfectly free from the disease."

In taking leave of Mr. Overman's published statements of the utility of vaccination, we may remark that although he ultimately admitted that several of his sheep did contract variola, he nevertheless endeavoured to show that the operation to which they had been subjected had mitigated the severity of the disease. This opinion is evidently based on an imperfect knowledge of the whole subject of vaccination, and in his particular case it possesses no value whatever. Notwithstanding this it is to be regretted that Mr. Overman should have refused some further counterproofs of inoculation and exposure being had recourse to, by sending some sheep to the Veterinary College, and also to the farm of his neighbour, Mr. Muskett, according to his promise.

We come now to the case of the sheep belonging to Mr. Hudson, of Castleacre, which were also operated upon in July 1848 by the aforesaid Mr. Wells. These sheep, consisting of tups, ewes, and lambs, on being exposed to the infection of sheep-pox, about three weeks after the supposed vaccination, took the disease. The malady was first noticed among the lambs, and from them it extended to the other sheep. Four days after the appearance of the sheep-pox, Mr. Hudson had 400 ewes, 40 crones, 10 rams, and 19 ram lambs inoculated. The operation was very badly and roughly performed, so much so that the virus took effect on only 186 of the animals.

On the 16th day succeeding the inoculation the animals not taking were re-inoculated, but even then many of them did not contract the infection, from the imperfect manner in which the operation was again performed. Under such circumstances, the natural and inoculated disease going on simultaneously, the ultimate loss proved very heavy, and brought great discredit on the system of inoculation for sheep-pox, more especially as the circumstance occurred in a flock the property of so well-known and distinguished an agriculturist. Many of the sheep whose lives were spared were rendered permanently lame from the extensive ulceration and sloughing which resulted from the roughly made punctures.

Without going into all the details of Mr. Wells' proceedings in the matter of the vaccination of sheep, we deem it necessary, however, to quote some remarks, relating thereto, from two of Mr. Perry's letters to the "*Norwich Mercury*," dated October 18 and November

1, 1848. "About the same time," he says, "that Mr. Overman's sheep were vaccinated, a friend of mine had his sheep *done by the same gentleman*, so that it is fair to presume that the operation was as skilfully performed in the one case as in the other. Six weeks after the operation, a rumour was widely spread that vaccination was inefficacious as a preventive of small-pox in sheep. This opinion was entertained by my friend, and consequently he had his sheep inoculated. It was only a small lot of five score, and *perhaps* the majority of the animals took the disease through this medium, but there were several that were not affected by the inoculation. Subsequently the small-pox broke out amongst these sheep in the natural form, and five of them died."

In his second letter Mr. Perry observes, "I am not aware that there are more than three persons who have tried *these vaccinations* in my immediate neighbourhood, one I have already mentioned as having failed, and at that time I could say nothing of the other two. At the present moment, however, small-pox is taking its usual course in both these flocks also, not being at all checked in its virulence by the vaccination."

With reference to the same subject, Mr. R. Carter, V.S., of Swaffham, informed Mr. Simonds by letter, dated July 24, 1848, that "the farmers had *already* found that the sheep readily took the small-pox after vaccination, and to lessen the fatality they were having recourse to inoculation." Mr. Carter further remarked that he had been called upon to inoculate many vaccinated sheep, and that they contracted the disease in the usual manner.

These details fully prove that the so-called "*West Norfolk Vaccinations*," to which so great an importance was attached by the public press, during the late outbreak of sheep-pox in Wiltshire, and chiefly in consequence of the letters which were published by well-known agriculturists, possess in truth no real value whatever in determining the important question of the protective influence of the vaccine disease upon sheep.

Indeed, as we have already shown, it cannot be said that the sheep, in Norfolk,—with but very few exceptions—were vaccinated at all, nevertheless it became the more necessary that the full particulars should be recorded in a Report of this description.

We proceed to relate the instances of *legitimate* vaccination of sheep in Norfolk. At a meeting of the "*Wayland Association*" held at Watton, October 26th, 1848, Mr. Rose, surgeon, of Swaffham, in alluding to the existence of the sheep-pox among the Norfolk flocks, said "that at the time small-pox in sheep first made its appearance in this county it took us all by surprise. No one knew what to do and how exactly to proceed. Advice was solicited on all sides. In consequence of the disease being at Narford, Mr. Turner of Narborough asked my son to try vaccination upon a few of his sheep. He vaccinated three and assured himself afterwards that they took the vaccination."

“ These sheep subsequently contracted small-pox and one of them died.”

Mr. Smith, V.S., of Norwich, in a letter to the “*Norfolk News*,” in November 1848, states, “On the 20th of October last I vaccinated carefully with lymph,—taken from vesicles on children’s arms on the 19th, and kindly furnished to me by two medical friends,—10 ewes on a farm at Wroxham. It had, in every instance, but little or no effect, even simple punctures would have produced as much.” Mr. Smith goes on to remark that “Mr. Geo. Taylor, surgeon, of Mattishall, had written to him as follows: ‘About September 13th, 1848, I vaccinated 10 sheep upon a farm at Bylaugh, with lymph taken not many days before from a good vesicle on an arm. On the same day, in the same place, and with some of the same lymph, I vaccinated a child; every puncture in the child produced a healthy vesicle, but not a single puncture in the sheep had any effect, although each sheep was vaccinated in three or four places. All these sheep I inspected on the seventh day, the result being as I have stated above. They were then all vaccinated again with lymph taken but a few hours previously from an arm. A few days afterwards I again examined these sheep, but not a vesicle was to be found, there being no more irritation than a simple incised wound would have produced. I then vaccinated three or four others, but, as before, without producing any effect. I vaccinated the sheep very carefully, and the conviction left on my mind was that the disease was not to be conveyed from the child to the sheep.’”

In a second letter of Mr. Smith’s to the same paper, dated December 7th, 1848, he observes that Mr. Joy, surgeon, of Northwold, had furnished him with the following facts:—“Immediately upon hearing that sheep-pox had reached this country, I determined on trying the value of vaccination, and therefore selected five sheep for experiments, viz., two rams, two ewes, and one lamb. A vesicle was formed by the evening of the fifth day after the operation, but the result was very unsatisfactory, as, instead of the areola spreading as it does in the human arm, on the sixth day, it, with the vesicle, began to diminish, and on the seventh it had wholly disappeared leaving no eschar behind.”

Mr. Joy also vaccinated several more sheep at the request of some friends with a like result. He afterwards inoculated his own small flock of four-score sheep, which did remarkably well excepting two. The five vaccinated sheep, when subjected to inoculation, differed in no respect from the others, and consequently “my prior opinion,” writes Mr. Joy, “was confirmed, that vaccination was of no avail.”

Mr. Cook, farmer, of Litcham, vaccinated with success two of his sheep. One died afterwards from a natural attack of the sheep-pox, and the other took the disease from inoculation. Mr. Cook obtained current vaccine lymph from a surgeon for the purpose of the experiment.

Bearing also upon this part of our Report, we extract the following from a letter in our possession:—"During the year 1848 variola ovina prevailed to an alarming extent among the flocks in Norfolk, and as vaccination was said to be a prophylactic, it was extensively put in practice. Having, however, great doubts as to the possibility of communicating the vaccine disease to the sheep, I determined on putting it to the test of experiment. A farmer having lent me three hoggets to practise on, I procured some vaccine lymph from the National Vaccine Establishment, and vaccinated one of the sheep in eight punctures; at the same time I vaccinated a child. Two of the punctures on the left flank of the sheep had a slight redness on the 10th day, but no vesicle arose, and the little redness was all going on the following day. The punctures in the child's arm took the regular course, thus showing satisfactorily that the lymph was good. I next vaccinated, directly from the child's arm, another of the sheep in seven places. On the 5th day each puncture presented a raised spot, the base of which was about the diameter of a sixpence. No vesicle formed on any of these spots. On the 7th day the effects had vanished, and nothing but the punctures were visible. The third sheep I vaccinated with lymph taken from vesicles on a cow's teats, but as no effects were produced, it is probable that the cow was not the subject of true vaccinia, although two or three other cows were similarly affected in the same dairy. Another surgeon endeavoured to vaccinate sheep, and obtained similar results to my own. We may fairly conclude that the numerous vaccinations which were performed hastily, and necessarily with less care in some parts of the county, would prove of no practical utility."

We now pass on to notice the published statements of Mr. Allen Ramsay, surgeon, of Shelford, Cambridgeshire, and also those of other surgeons with whom he was associated in 1848, in the vaccination of sheep: these gentlemen being the principal advocates of the system.

During the late outbreak of sheep-pox in Wiltshire, Mr. Ramsay sent the following letter to the "*Standard*," which again revived the question of the vaccination of sheep, and led also to a correspondence between himself and Mr. Kent Norris, Hon. Sec. to the "*Wilts Mutual Association for preventing the Spread of the Small-pox in Sheep*."

"To the Editor of the '*Standard*.'"

"SIR,—I have just read a letter in your journal of last Monday headed 'Small-pox in Sheep,' signed 'J. T. Twynam, Land Agent,' wherein Mr. Twynam says, 'why not try vaccine as a mitigant.' I beg to inform that gentleman that in 1853 (? 1848), during an outbreak of small-pox, vaccination was fully and fairly carried out, and its protective power tested and established. Hundreds of sheep and lambs were vaccinated by me and by others

under my superintendence. Valuable tups belonging to Jonas Webb, after having been vaccinated, were sent into flocks where small-pox was known to be raging (one, I recollect, that belonged to the Duke of Grafton). Sheep and lambs after being vaccinated were penned on my own premises with others labouring under small-pox in its most virulent form, and in no single instance did they take the disease or become in any way affected. If flock-masters will write to Mr. Jonas Webb, of Babraham; Mr. Samuel Jonas, of Chrishall Grange, Royston; or to Messrs. Hurrell, Long, and Rowley, of Harston; Mr. J. Ellis, of Triplow; Mr. John Headly, of Whitelesford, all in this county; or to Mr. Henry Overman, of Weasenham, Mr. E. Oldfield, of Foulden Hall, both in Norfolk; they will get such a statement of facts with regard to the protective power of vaccination as will, I am sure, deter them from introducing so loathsome a disease as small-pox into their flocks by inoculation, recommended though it be by Professor Simonds or any other Veterinarian.

"I am, &c.

"ALLEN RAMSAY, L.R.C.P., M.R.C.S."

"Great Shelford, Cambridge,
September 23rd."

Firstly, we have to remark with reference to the statements contained in this letter, that at the time it was written, Mr. Ramsay had probably forgotten that both of Mr. Webb's rams, which were sent to the Duke of Grafton's, took the sheep-pox naturally. From memoranda in our possession, it appears that on their arrival at the Duke's farm they were put with some ewes which had been the subjects of sheep-pox about 10 weeks before, and which were believed to be now in a healthy condition. The contrary, however, proved to be the case, and the result was that the rams became infected. It is true the malady assumed so mild a form that the lives of the animals were not endangered, but this in no way lessens the value of the fact of their having contracted the disease.

If reference be made to Mr. Jonas Webb's letter, dated September 29th, 1862, and published in the "*Mark Lane Express*" and other papers, it will be seen that he does not assert positively that none of his rams sent out contracted the small-pox: he merely says that he "did not lose a ram, nor was he aware that any of them took small-pox; if they did it was in so mild a form that he was unaware of it."

With regard to the other gentlemen mentioned by Mr. Ramsay, we have already disposed of Mr. Henry Overman's cases of vaccination, and Mr. Edmund Oldfield would appear to have little or no confidence in the prophylactic power of the operation, for in one of his letters to the "*Norwich Mercury*," dated November 8th, 1848, we find that he states, "From what I have seen of sheep which have been vaccinated by medical men from points, it appears to me to be of no use, as it takes so little effect on the animal."

The statements of Mr. Jonas, Mr. Headly, Mr. Hurrell, and Mr. Rowley, all of whom wrote to the Wiltshire papers in 1862

in favour of vaccination, merely show that they each exposed a vaccinated sheep or two for an unexplained length of time, to the infection of sheep-pox, and that these sheep escaped taking the disease. This fact, in our opinion, possesses no value whatever, in rightly determining a question of this kind, as owing to the varying susceptibility of sheep to contract the small-pox, the same thing may be said of hundreds of sheep which had not been vaccinated.

Thus, Mr. E. Oldfield states in one of his letters, dated Nov. 29, 1848, and published in the "*Norwich Mercury*," that Mr. Barton, of Threxton, writes, "My ewes were inoculated, but my hoggets were not; yet, although they were in an adjoining field, and lately in the same field, I have not had a single case among them, and they have not been vaccinated." He goes on to observe, "A neighbour of mine bought some shealings, and turned them into a field with his inoculated ewes, and they also have escaped."

In further commenting on Mr. Ramsay's statements, we have to notice in the next place his proceedings in the case of the vaccination of the sheep belonging to Mr. Ellis, of Triplow. It is, however, necessary *firstly* to observe that Mr. Ramsay considered in 1848, that vaccination was of little use unless the lymph was first passed through the system of the cow, before being used upon the sheep. This, judging from a letter to the editor of the "*Times*," dated December 13, 1848, he appears, contrary to the experience of other persons, excepting, perhaps, his then assistant, Mr. Sprague, to have had no difficulty in doing, and of obtaining thereby a sufficient quantity of lymph for vaccinating hundreds of sheep. Mr. Ramsay thus writes, "Small-pox amongst sheep having made its appearance in this neighbourhood some months since, I advised a friend of mine to have his flock vaccinated. I introduced some vaccine lymph into the system of the cow, and from that source his flock has been vaccinated. The disease passed through its different stages, both in the cow and in the sheep, precisely as it does in the human subject. Some thousand sheep have, in this and the adjoining parishes, been vaccinated in this manner, not from each other, but every sheep direct from the cow."

With lymph thus procured, Mr. Ramsay himself, as he informed Mr. Simonds by letter, vaccinated ten sheep belonging to Mr. Ellis, of Triplow, on Nov. 18th, 1848. Two of these sheep he subsequently selected to be tested by inoculation with the virus of sheep-pox, and, according to agreement, they were sent for this purpose to the Royal Veterinary College. Respecting the vaccination and selection of these sheep, Mr. Ellis wrote as follows:

"DEAR SIR,

"Triplow, Dec. 5th, 1848.

"IN accordance with your request I have had the selection of two sheep made by Mr. Ramsay, who now declares them as having recovered from the vaccine disease, and in a proper state for any experiment to be tried upon them. I therefore intend

sending them by the 6 o'clock train from the Whittlesford station, directed to you. Hoping the result of the operation may prove a public benefit."

"To Mr. Simonds."

"I am, yours faithfully,

"J. ELLIS."

About the vaccination of these sheep by Mr. Ramsay himself there can be no doubt, for in a subsequent part of the letter to the "*Times*," just referred to, he says, "Two sheep previously vaccinated by me have been sent to Professor Simonds, for him to test the amount of protective power (if any). I shall also test it myself by inoculating some previously vaccinated sheep with small-pox lymph, and then turn them in among sheep labouring under small-pox. The result of my experiments shall be forwarded to you, should you think them worthy of insertion in your paper."

The two sheep arrived safely at the Veterinary College, and on December 12th, after having recovered from the fatigue of the journey, one was *inoculated* with the virus of sheep-pox in two places on the inner part of the left thigh. The virus employed was 16 weeks old, having been taken from a natural case, August 23rd.

We shall quote the particulars in full of the experiments with these sheep, from notes made at the time.

CASE 1.

"December 12th, 1848.—Inoculated one of Mr. Ellis's sheep.

"6th day after inoculation.—Both punctures have taken effect.

"9th day.—The inflammation has steadily increased up to this time, and seems now to have reached its limits. Roscola Variolosa has appeared in various parts of the skin, especially on the inner sides of the arms and thighs. The animal has fever and loathes its food.

"10th day.—Papulæ are being formed, and can be readily felt in the skin.

"12th day.—Papulæ are well developed; the constitutional symptoms remain the same.

"15th day.—Some of the papulæ have declined; vesicles have formed on others. The animal has less fever.

"Subsequently, the eruption passed regularly through its several stages; its progress differing in no respect from that observed in an ordinary case of inoculation without previous vaccination.

CASE 2.

"January 3rd, 1849.—Inoculated the second sheep; the lymph used for the purpose having been taken from the other sheep belonging to Mr. Ellis on the 15th day of inoculation. Four punctures were made; besides which some lymph was placed on a set of superficial scratches.

"4th day of inoculation.—Two of the punctures are slightly inflamed.

"5th day.—The other two punctures and the scratches also are inflamed.

"9th day.—The local inflammation has reached its height in all the places of inoculation. The constitutional disturbance is rather more than in the preceding case, but not sufficient to endanger the animal's life.

"10th day.—Papulæ are being formed, and *stigmata* exist near to the site of the punctures.

"15th day.—Vesicles are formed on the papulæ, from which, on the 17th day, a good supply of lymph was obtained."

This animal, like the other, gradually recovered, and on the 12th of February the two sheep were returned to Mr. Ellis, for Mr. Ramsay's inspection, and for any further experiments he might wish to try upon them.

From this time no further letters appeared in the public papers from Mr. Ramsay, on the subject of the vaccination of sheep, until the recent outbreak of sheep-pox in Wilts, when, as we have shown, he again appeared as the great advocate of vaccination to give protection to sheep against the disease; in which advocacy he was supported by his late assistant, Mr. Sprague.

There is one point in the letter of the last-named gentleman, addressed to "*Bell's Weekly Messenger*," bearing date October 22nd, 1862, which also requires to be alluded to, viz, that of his having obtained sufficient lymph from two calves for vaccinating nearly 300 sheep.

His words are, "I procured some lymph from a patient, and vaccinated two calves that I might have a plentiful supply of matter. The whole of the sheep—about 300—were then vaccinated, and it was successful in all but about six or seven."

There surely must be some mistake about the quantity of lymph said to be yielded by these two calves. It has been found by Mr. Ceely as well as by ourselves and others, who have resorted to retro-vaccination, as we have elsewhere stated, that but a very scanty supply of lymph can be thus obtained. Mr. Ceely [thus writes, "take an abundance of humanized vaccine lymph from one of the finest and most productive vesicles ever seen, and if you succeed in retro-vaccinating the cow, you may, perhaps, be able to charge scantily a very few points from a vesicle which excites but trifling topical inconvenience." It is also an established fact that in passing humanized lymph through the cow, the action of it has been materially retarded in its progress for several removes after being returned to the human subject.

There is also something very remarkable, in our opinion, in Mr. Sprague's success in bringing 300 sheep, excepting six or seven, in one vaccination under the vaccine disease. We presume that Mr. Sprague assured himself by his own personal examination, of the fact that all the sheep, with the exceptions alluded to, had taken the vaccination, and that he has not given the statement on the authority of the shepherd. That such a thing was sometimes done we have proof, by a letter from Mr. Ellis, of Trip-low, to Mr. Simonds, dated November 20th, 1848. In this communication Mr. Ellis says that "Mr. Hurrell had 400 sheep vaccinated by Mr. Ramsay, or by *others* under his superintendence, and that

" it was left principally with the shepherd to determine whether " it took effect or not." Agreeable to an arrangement, Mr. Ellis would have sent some sheep from Mr. Hurrell's flock to the Royal Veterinary College, for experiment, but for his knowledge of the unsatisfactory way in which they had been examined after the vaccination; and, therefore, the impossibility of ascertaining whether the selected sheep had been successfully vaccinated or not.

Passing from the vaccinations of 1848, we have, in the next place, to direct attention to some experiments of the vaccination of sheep in 1862.

Shortly after the formation of the "Wiltshire Association for preventing the Spread of Small-pox in Sheep," it was determined by the Committee to give trial to vaccination as a preventive of the disease, owing principally, as before explained, to the statements contained in the letters of Mr. Ramsay and others, and also to the strong condemnation of the system of inoculation by Mr. Overman. For this purpose six sheep were procured from Mr. Pritchard of Longcot, near Swindon. Two of these sheep were vaccinated on September 27th, by Mr. Parker, surgeon, of Shri-venham, and on the 9th of October they were forwarded to the farm of Mr. Church of Aldbourne, where they were placed with some animals suffering from small-pox. Here they remained for nearly three weeks without giving any evidence of having contracted the disease, when they were removed to Mr. Hulbert's farm at Langley in Berkshire. The remaining four sheep were vaccinated by Mr. Parker on October 8th, and he reports also with success.

On the 23rd of October these sheep were likewise sent to Mr. Hulbert's farm, where, on November 3rd, all six were *inoculated* by Mr. Parker. On the 10th day succeeding the inoculation one of the sheep died from the effects of the inoculated sheep-pox. Mr. Simonds saw these animals on November 18 (15th day of inoculation), and found one of them suffering from confluent sheep-pox, and rapidly sinking; it died on the following day. The second sheep showed extensive local action from the inoculation, indicating ultimate sloughing; the eruption of papulæ was, however, but slight. The third had taken in both inoculated places, and had besides a free eruption on its body. The fourth had taken in both inoculated places, and had also a free eruption. The fifth was in the vesicular state of the malady. The last four named animals ultimately recovered.

We are not aware of any other sheep besides these six having been vaccinated during the late outbreak of small-pox in Wiltshire, and it will be seen that the result does not essentially differ from that arrived at by our experiments.

In a former part of this Report we have described the appearances which we have witnessed in every case of vaccination when satisfactorily performed, and which, we have said, agree with those mentioned by Mr. Ceely, who, in writing on "*variola vaccinia*," observes: "This disease is much modified in the sheep; it quickly " passes through the several stages; lymph forms by the fifth or

“ sixth day, and on the eighth the affection terminates. It differs
 “ altogether from the vaccine of man or the cow.” With a view,
 however, of more fully elucidating the subject we deem it necessary
 to give the details of an experiment of the vaccination of sheep
 which will not only show the peculiarities of the vaccine disease,
 but also that, even when developed to its fullest extent, it does not
 render the animals insusceptible to the action of the ovine virus.*

EXPERIMENT.

“ January 20th, 1848.—Two sheep were vaccinated with fresh
 “ fluid lymph, furnished by Mr. Marson; six punctures were
 “ made in one animal, two on the inside of each thigh, and one
 “ on either side of the sternum. In the other, four incisions only
 “ were used for the insertion of the lymph.”

“ 5th day of *vaccination*.—In the last named sheep, the disease
 “ has taken in all the punctures, but only in two of them in
 “ the other case. Small vesicles are developed; these are filled
 “ with a transparent fluid, and surrounded by a slight areola.
 “ The animals are in good health, the effects being but local.”

“ 6th day.—The vesicles are larger and the areola is rather
 “ deeper in colour.”

“ 7th day.—The vesicles are beginning to decline; the areola
 “ is less visible.”

“ 8th day.—Crusts exist on some of the places of vaccination;
 “ they have, however, fallen from most of them, leaving a slight
 “ blush of redness on the spots.”

“ February 1.—These sheep were inoculated with some *ovine*
 “ *lymph* which was taken on November 15th, 1847, and was con-
 “ sequently about ten weeks old. They both contracted variola;
 “ and although the progress of the disorder differed but little
 “ in either animal, we purpose to give the details in full, and
 “ shall name one sheep C., the other D.”

Sheep C.

“ 5th day of *ovination*.—Two of the punctures are inflamed,
 “ and on the inner side of one thigh a stigma is present near to the
 “ place of inoculation.”

“ 6th day.—The inflammation surrounding the punctures is in-
 “ creasing.”

“ 7th day.—The effects are as yet local. The health of the
 “ animal is undisturbed.”

“ 8th day.—The deep red dye of variolous inflammation is
 “ passing away; the surface of the ovinated places is depressed,
 “ and a rose-coloured efflorescence has shown itself on various
 “ parts of the body.”

“ 10th day.—The efflorescence has disappeared, and here and
 “ there papulæ can be felt.”

* Simonds on Variola Ovina, page 143, et seq.

"12th day.—Vesicles are forming on the inflamed incisions.
 "The papulæ are stationary, from which we infer that they will
 "be removed without passing through their several stages."

"14th day.—The inoculated vesicles are well developed, and
 "we are able to charge several points; the fluid is limpid, but not
 "very viscid. Branny scales are falling from the surfaces of the
 "imperfectly matured papulæ."

"16th day.—Patches of whitened cuticle partially adhere to
 "the sites of the inoculation; a small quantity of purulent
 "matter encircles them, and the cutis is beginning to ulcerate."

"20th day.—The ulcers are superficial, and have a healthy
 "appearance."

Sheep D.

"4th day of ovination.—One incision on the side of the sternum,
 "and another on the postero-inferior part of the abdomen have
 "taken."

"6th day.—The inflammation excited by the virus has spread
 "around each incision, and attained the size of half-a-crown."

"7th day.—No further increase of the inflammation has taken
 "place, but an eruption has broken out, being chiefly confined
 "to the upper and inner parts of the limbs. A febrile state of
 "the system also exists, and the animal refuses food."

"8th day.—With the exception of the ovinated places being
 "umbilicated, there is very little change in either the local or
 "constitutional symptoms."

"10th day.—The patient's health is improved, the diffused red-
 "coloured eruption continues, but no papulæ can be detected."

"13th day.—The skin has regained its normal condition, with
 "the exception of the places of inoculation, which are covered
 "by blanched epidermis, but no lymph can be collected from
 "beneath it."

"22nd day.—Since the last report the cuticle has been desqua-
 "mated in scabs of a dark brown colour; the exposed sores are
 "fast healing."

It scarcely becomes necessary that we should repeat that fresh investigations have substantiated the conclusions which we arrived at in 1848 of the inutility of vaccination. Experiments of the vaccination of sheep are worth but little unless tested by the counter-proof of inoculation.

INOCULATION OF SHEEP.

Many objections have been advanced against the adoption of inoculation as a preventive of sheep-pox, which perhaps it is unnecessary to further discuss. Taking it, however, for granted that this system will not fall into disuse in the event of the re-appearance of sheep-pox in England, we proceed to give the rules for its performance.

1st. The separation from the flock and removal to a distance of all the natural cases before commencing the inoculation.

2nd. The virus to be selected from the mildest possible cases, and taken when perfectly limpid and transparent.

3rd. One puncture only to be made when the virus is fresh and fluid; and not more than two or three punctures when it is dry on points, and a week or two old.

4th. The punctures to be made in the fleshy part of the inner side of the thigh, either with a needle or the point of a very small lancet.

5th. The animals to be divided into lots of about fifty, and the pens in which they are placed to have a space left between them of as large a size as circumstances will permit.

6th. The shepherd to be instructed to very carefully inspect the sheep daily up to the sixth day, and forthwith to take away any found to be diseased.

7th. The operator himself to examine each sheep individually on the sixth day with a view not only to ascertain whether the inoculation has taken, but to the removal of every animal showing infection; such being a natural case. The animals should be, after this time, kept as quiet as possible; be well supplied with fresh water, in which a small quantity of the nitrate of potash is dissolved, and, if the time of year permits, green food should be given in preference to any other. In the further progress of the inoculated disease every confluent case should be removed and kept apart from the other sheep.

8th. Care to be taken that all uninfected flocks are kept at as great a distance as possible, and that all intercourse by persons or shepherds' dogs employed about infected sheep be prohibited.

During the late outbreak of the disease in Wiltshire, the following facts were established with regard to inoculation. In the case of Mr. Harding, of Etchilhampton, whose flock consisted of 400 sheep, 82 natural cases occurred, and 33 deaths followed. Of the 318 inoculated animals only one died.

In the case of Mr. Simon Hitchcock, of Allcannings, 48 natural cases occurred in a flock of 291 sheep, and 12 deaths took place. Of the 243 inoculated animals, seven died.

In the case of Mr. Neate, of Allcannings, 133 natural cases occurred in a flock of 983 sheep, and 50 deaths took place. Of the 850 inoculated animals, 27 died.

The exact proportion of the number of natural cases and deaths, to that of inoculated cases and deaths, in Mr. Parry's flock, of Allington,—the one first affected,—could not be correctly ascertained, owing principally to the circumstances that when the disease appeared its true nature was not suspected, and that it had progressed unchecked from two to three months before inoculation was had recourse to. The deaths, however, from the natural and the inoculated disease were, as nearly as could be made out, 50 per cent. of the former, and 3 per cent. of the latter.

It is nevertheless true, however, that inoculation often proves most destructive to sheep, when badly performed, and proper care is not bestowed on the animals. Many instances of this kind occurred in Norfolk in 1848; in some of which the mortality was as high as of 20 per cent. From records, however, in our possession of the inoculation of 6,000 sheep in Norfolk, including the cases just

referred to, we find that the average rate of mortality amounted to only 5 per cent. We have also a record of 7,000 sheep, belonging to different flock-masters, which were inoculated at the same time in the eastern counties, and the deaths among them amounted to only $2\frac{1}{2}$ per cent. on the average; this favourable result arising chiefly from the circumstance that the inoculations were carefully performed.

Indeed, Mr. Perry, V.S., of Swaffham, in his letter to the "*Norwich Mercury*," dated Nov. 1st, 1848, mentions an instance in which he inoculated 1,209 sheep, with a loss of only eight by death.

The experience of all persons, both in England and on the continent, agrees in bearing testimony to the fact that lambs suffer to a much less extent from inoculation than aged sheep; that many of them scarcely show any constitutional disturbance, and that the mortality among them is seldom more than one, or one and a half per cent., and indeed often *nil*.

Before concluding this Report we deem it right, and chiefly as a matter of history, to state that there seems to be little doubt that the sheep-pox existed in this country in 1710 and 1711. In a work on "*Eruptive Fevers*," by Dr. Thomas Fuller, bearing date 1730, we find the following statement:—

"There was, about the year 1710 or 11, upon the South downs
"in Sussex, a certain fever raging epidemically among the sheep,
"which the shepherds called the small-pox; and truly, in most
"things, it nearly resembled it. It began with a burning heat,
"and unquenchable thirst; it broke out in fiery pustles all the
"body over. These pustles matured, and, if death happened
"not first, dried up into scabs about the 12th day."

"It could not be cured, no, nor in the least mitigated, by
"phlebotomy, drinks, or any medicines or methods they could
"invent or hear of."

"It was exceedingly contagious and mortal, for where it came
"it swept away almost whole flocks; but yet it could in no-wise
"be accounted the same with our human small-pox, because it
"never infected mankind."

It remains only for us to state, that, taking the whole subject of the vaccination and the inoculation of sheep into consideration, we have arrived at the following

CONCLUSIONS.

1st. That sheep-pox is not known to have existed in England but on three occasions, namely, in 1710-11, 1847-50, and 1862.

2nd. That sheep-pox is rightly considered as being always the result of infection, and its extension among sheep is governed by precisely the same laws as its prototype in man.

3rd. That the malady may be defined to be an infectious eruptive fever, which occurs as a rule but once in the same animal, without reference as to whether it arises naturally or is produced by inoculation.

4th. That the deaths from the natural disease often amount to

75, and are but seldom less than 25, per cent., while many of the animals whose lives are spared are left in a worthless condition.

5th. That the vaccination of sheep cannot be relied upon as a preventive, or mitigant of sheep-pox, as the vaccine disease in these animals is but very imperfectly developed, even in the most successful cases.

6th. That even if the vaccination of sheep were protective, a serious drawback to its adoption would be that not more than 35 per cent. will probably be influenced by it, on a first vaccination, and this under the most advantageous circumstances in the selection and command of lymph.

7th. That the vaccination of sheep on the principle of retro-vaccination has no value beyond an ordinary vaccination, nor does the plan materially increase the supply of lymph at command.

8th. That the inoculation of sheep with the virus of human small-pox is equally as inefficacious as vaccination.

9th. That the *ovination* of cows cannot be resorted to as a means to furnish lymph, these animals being insusceptible, as it would seem, to the action of sheep-pox virus.

10th. That the segregation of infected animals, although often of much value in arresting the progress of sheep-pox, if immediately had recourse to, and perseveringly carried out day by day, is nevertheless almost impracticable when large flocks have to be dealt with.

11th. That the slaughtering and burying of the infected animals is justifiable only in the very earliest invasion of the flock, and in those cases in which the disease assumes a confluent character.

12th. That the only remaining conservative measure is inoculation, which, if rightly carried out, offers considerable advantages for the following reasons:—

- a. That it gives security against a natural attack of sheep-pox.
- b. That it limits the period of the existence of the disease in the flock.
- c. That it mitigates the severity of the malady.
- d. That it saves the lives of many animals which otherwise would be sacrificed, and produces comparatively but little loss of condition.
- e. That it controls the extension of the disease, as one confluent natural case does more to diffuse the poison than probably 50 ordinary inoculated cases would do.
- f. That the mortality of the inoculated disease, when compared with the natural, is on the average as 3 per cent. in the one case, is to 50 per cent. in the other.

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LONDON:
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,

Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.