I therefore offer them as a contribution to the general pathology of cirrhosis of the liver.

For other facts with regard to this form of cirrhosis, I may refer the reader to the following amongst many papers:—

Cornil,—Arch. de Physiologie, 1874.

Charcot and Gombault, *idem*, 1876, p. 272.

Hanot,—These de Paris, 1875.

Hanot and Schachmann, Arch. de Physiol. 1887, tome ix. p. 1.

ILLUSTRATIONS.

From Drawings by Dr. J. Tatham Thompson. .

Fig. 1. Margin of lobule of liver from Case I. showing the newly-formed connective tissue (*a*), containing numerous branching bile-ducts (*b*). The liver cells at the margin of the lobule are seen to be separated, the connective tissue penetrating between them. At *b b* the termination of one of the bile-ducts in a row of liver cells is seen; *c* liver cells.

Fig. 2. Very low power drawing of part of the liver in Case II. The bile-ducts were injected with Berlin blue, but are not all filled. The remains of the lobules and islets of liver cells which have become detached are surrounded by broad zones of connective tissue, containing dense plexuses of newly-formed bile-ducts (*b*). At *h* the central vein of a lobule, somewhat dilated, is visible.

Fig. 3. A portion of the same section seen under a higher power. The anastomosing plexuses of bile-capillaries (*b*) are better seen.

THE VALUE OF INOCULATION IN PLEURO-PNEUMONIA AS DISCLOSED BY POST-MORTEM EXAMINATION OF THE VICTIMS.

By JAMES M'CALL, F.R.C.V.S.,

Principal of the Glasgow Veterinary College.

(Continued from page 215.)

IN a prior number of this Journal I gave the details of an outbreak of pleuro-pneumonia which had occurred in my practice in Glasgow, and where inoculation had been performed on the animals by Mr Rutherford of Edinburgh. The details as stated were a reprint from the epitome of evidence published and circulated by the Highland and Agricultural Society of Scotland. I also gave an epitome of the evidence emitted by Mr Rutherford before the Departmental Committee of the Privy Council, in so far as it called my evidence in question, and as promised in the concluding sentence of the last article published in this Journal, "I shall now, in the first place, refer to the objections which Mr Rutherford has taken to my evidence; and in the second place, I shall give in detail the history of a recent outbreak of pleuro-pneumonia on the same premises; and I shall by *post-mortem* and other evidence prove that *Mr Rutherford's inoculation of Salmond's stock in February 1887 not only did not arrest the*

spread of the disease at that time, but that it actually carried it on, and was the cause of a second outbreak in June 1888."

Mr Rutherford's Objections.

In answer to Mr BOWEN-JONES.—"Do you agree with Mr M'Call in this? 'According to Mr Rutherford, this animal was successfully inoculated, the tail was amputated, and it was considered safe.'" "No." "You do not agree with Mr M'Call in that statement?" "No, I do not." "Do you admit that the animal was inoculated?" "Yes." "Do you admit that the animal contracted disease?" "There I do not admit the correctness of Mr M'Call's statement." The statement referred to by both gentlemen, in order to its comprehension, must be read in conjunction with a prior statement made by me, and for accuracy, I shall deal with it first. It is as follows:—

"On 17th February I visited the byre and found a cow showing symptoms of pleuro. This was one of those inoculated on the 9th, and on *post-mortem* both lungs were found to be affected. Mr Rutherford said the inoculation had not taken. The explanation in this case was that the animal had not taken the inoculation, and that it had been affected with the disease before inoculation. Mr Rutherford saw it before being slaughtered."

Now did Mr Rutherford see that animal, and did he make the statement to me which I have attributed to him? His memory cannot play him false, for it was the first animal which was taken out of the stock, exactly eight days after the first inoculation was practised by him on the herd. I again affirm that *he was present and voluntarily made the statement I have placed to his credit*, and he made it after he had examined the tail of each animal he had operated on the previous week. That the animal's lungs on *post-mortem* were found diseased is a fact, and I ask Mr Rutherford to accept it as such, or prove the contrary, not only in this case, but in all the cases that are to follow.

Now to the statement more particularly referred to, viz.:—"On March 1st I required to take another cow and kill it, and I found both lungs bad. This animal was inoculated on the 9th February. According to Mr Rutherford, it was successfully inoculated, the tail was amputated, and it was considered safe: so that if the cow of the 17th (found affected with pleuro) was confirmatory of the fact, that when an animal contracts pleuro-pneumonia by the natural method it cannot be inoculated, the case of the 1st March was the very reverse. Both lungs were bad. With the others, it had the tail amputated, was considered free of disease, and still it succumbed to the disease. It was one of those in the byre when the disease first broke out. The tail of the animal was amputated on the 16th, and on the 28th I found the animal showing symptoms of the disease, and it was killed on 1st March."

That the facts are as I have stated, I again ask Mr Rutherford to acknowledge or disprove. Regarding the inference I have drawn from his own statement, I consider it is a fair one; but, like a few others he has made, the statement has no foundation in fact. Most positively he asserted to me "that when an animal contracts pleuro-pneumonia by the natural method, it cannot be inoculated;" but his

own practice on his own patients falsifies the statement, and *I affirm that the acceptance or rejection of inoculation by a bovine animal is no proof of its being free of pleuro-pneumonia, or actually labouring under the malady at the moment of inoculation.*

But to return—Mr Rutherford does “not admit the correctness of Mr M‘Call’s statement ;” and in answer to the next question, “Do you know the animal I allude to?” admits, “*I do not now—I will tell you why I do not know the animal.* Mr Salmond is a very old gentleman, not able to manage his own business. His son manages it for him.” What inference Mr Rutherford desires to be drawn from the reference he has made to the “very old gentleman” and his “son,” I don’t know ; but when the reader is informed that the “son” is nearly as old as Mr Rutherford, and quite as alive to his pecuniary interests, probably he will agree with me that the son has no reason to feel proud of the compliment Mr Rutherford has so publicly conferred on him.

When further cross-examined by Sir George Macpherson Grant regarding the same cow, Mr Rutherford admitted “that it was inoculated by him, *but that it was not successfully inoculated.*” That is a truth, but it was unknown to Mr Rutherford when he gave the finishing touch to his operation by docking the tail. That animal was affected before Mr Rutherford inoculated it, and he was in complete ignorance of the presence of the disease.

CHAIRMAN.—“You said if you inoculated an animal with pleuro-pneumonia in its system the disease would develop itself in *three weeks?*” “*Yes, it would ; generally earlier.*” Will Mr Rutherford be kind enough to state the proof for fixing the period within three weeks, and at same time reconcile it with the further statement he has made, “*I only inoculate those that I am satisfied are not diseased.* All suspects must go down.”

“Is it true, then, that in Mr Salmond’s outbreak in Glasgow, referred to by Mr M‘Call, although you inoculated on February 9th, cases occurred as late as the 9th of April, two months after inoculation?” “That statement does not convey to you the actual facts of the case. It is an incomplete statement: very incomplete indeed, and *a very misleading statement.* There were actually three lots of cows in that man’s premises ; that is to say, there was the lot that I inoculated: there was a lot that was left simply because they were unfit for inoculation, and were subsequently inoculated ; and there was the lot that he purchased in to be inoculated immediately after the outbreak was reported.”

Errors in judgment we all make, and in the drawing of inferences there is room to honestly differ, but for inventing and disseminating “a very misleading statement” there is no excuse ; it is a dastardly act, and I shall now attempt to purge myself from the imputation.

In my evidence I am reported to have said, “On 9th February Mr Rutherford inoculated Salmond’s cows, and also the cow in calf and the two yearling heifers belonging to me. He first of all took the temperature of all the animals to see whether they were in health. On completing his examination he said there was *only one* above the normal,” etc.

“I said, ‘Are you satisfied that you have got all the others fit subjects for inoculation?’ He said, ‘Yes.’ Mr Rutherford inoculated all the other animals that he considered fit subjects, but there were several

cows he did not inoculate, as they were about to calve or had calved within eight days. On the same day (9th February) Mr Salmond said, 'If you will allow me, we will buy some cows and put them into the byre.' He purchased three cows at the Wishaw sale, and five at the Paisley sale, for the purpose of being inoculated and thoroughly protected."

I now call upon Mr Rutherford to point out and explain what is very misleading in that statement. Mr Rutherford says, "There actually were three lots of cows in that man's premises; the lot that I inoculated; the lot that was left and were subsequently inoculated; and the lot purchased to be inoculated;" but in making these statements he only reiterates what I had said. I therefore call upon him to point out what is misleading in my statement, or withdraw the charge.

CHAIRMAN.—"I want to ask you whether any of the cattle inoculated on February 9th showed the disease on April 9th? Yes, they did, but they were *reported* by me not many days after the inoculation to the owner. They were pointed out by me to the owner for him to do his part; that is to say, bring them to Mr M'Call's notice. He never did so, and I do not think Mr M'Call was attending the byres as closely as I was. I was in the byres every other day almost."

Leaving these graceful and generous remarks to be dealt with hereafter, I shall now enumerate the order in which the cows after inoculation presented symptoms of pleuro-pneumonia and required to be slaughtered:—

No. 1 Cow slaughtered 17th February; inoculated 9th February								
" 2 "	"	"	1st	March	"	"	"	
" 3 "	"	"	4th	"	"	"	"	
" 4 "	"	"	"	"	"	"	"	
" 5 "	"	"	7th	"	"	17th	"	
" 6 "	"	"	"	"	"	"	"	
" 7 "	"	"	15th	"	"	9th	"	
" 8 "	"	"	22nd	"	"	17th	"	
" 9 "	"	"	4th	April	"	16th	"	also
on 24th and on 29th of February.								

The last cow referred to is one of the three cows purchased at Wishaw sale to *prove the value of preventative inoculation*; but, strange to say, it was placed in the byre, and thus allowed to inhale the virus for eight days prior to inoculation. Can Mr Rutherford reconcile this case, or indeed, any of the other cases with the following statements which he has made? "Successful inoculation confers immunity. I mean by *successful* inoculation that the operation shall be carried out in a proper manner. I have reason to know that it is very improperly performed. I have never known an animal successfully inoculated succumb or even contract the disease. Inoculation arrests it at that stage (incubation), for at that time there is no lung lesion. It is absolutely necessary that your operators should be thoroughly up in their work, but there would be difficulty in finding such gentlemen at present. I would appoint them only by examination. My experience enables me to detect quite well what are the appearances of a successful inoculation, but the fear is of inoculation falling into wrong hands.

If animals are inoculated and still take the disease, it is the fault of the operator"!

While waiting Mr Rutherford's reply, I may be allowed to say that surely he never intended these remarks to be put in print and scanned by his professional brethren, for they are not only a direct insult to them, but a tissue of "very misleading statements."

As an operation, inoculation in pleuro-pneumonia is one of the most simple the veterinarian has to perform. Professor Williams in his examination is reported to have said, "Anybody could inoculate;" and certainly he cannot be much of a veterinarian who cannot introduce a seton into a cow's tail.

So much for the operation—now for the result. Mr Rutherford says, "If animals are inoculated and still take the disease, it is the fault of the operator." Is this penned in ignorance, or with the desire to mislead? In either case it is "a very misleading statement."

The two principal factors in the success of the operation are, firstly, that the animal to be operated on shall at the date of operation be free from the disease; and, secondly, a pure and living virus wherewith to inoculate the animal. Now, neither Mr Rutherford nor any other man knows at the time of operating, nor for some weeks after, whether or not he has had these two factors. Can Mr Rutherford recognise an animal in the incubative stage of pleuro-pneumonia, or can he with the aid of the microscope recognise the pleuro virus from any other virus, or say whether its organisms are alive or dead? No, he cannot, and yet he has the audacity to assert that "if animals are inoculated and still take the disease, it is the fault of the operator."

If it is so, how is he to reconcile his failures in those instances I have enumerated, and in those yet to follow? No professional fee can be due for performing an operation where failure is the fault of the operator, and it would be interesting to know whether Mr Rutherford has always acted in conformity with the doctrine.

Now to the charge made against me of want of attention and undue delay in removing affected animals. It is true the owner did not desire me to remove his cows, nay, I think I might venture to assert that his desire was in the opposite direction, and I have no hesitation in charging Mr Rutherford with the same desire.

In the performance of my duties as Inspector under the Act, I neither ask nor expect assistance or guidance from the owner of the stock that has been placed under restrictions. It is my duty to guide and direct, and I have always done so, and I ask no one to share the responsibility. But was I remiss in the removal of the affected cows? By a reference to the table of removal of animals, it will be seen that 1 cow (and the first animal after inoculation) was removed for slaughter on 17th February, another on 1st March, other 2 on 4th March, other 2 on 7th March, 1 on the 15th, and 1 on the 22nd of March; and lastly, 1 on 4th April.

In my evidence I say, "On 3rd March I found four cows showing symptoms of pleuro." These are the animals entered under dates 4th and 7th as removed and slaughtered; and I now ask Mr Rutherford if when informed by the owner on the 3rd of March that I had resolved on slaughtering all four animals next morning, he did not the same evening write me a note requesting that three of them might

be left, and only one killed, as they could not harm their neighbours, and that the outbreak was practically at an end?

Influenced by his request, I removed only two on the 4th, but the other two I felt compelled to remove on the 7th.

Then as to the last animal removed. In my evidence I stated: "On 21st March a brown cow (purchased at Wishaw) exhibited symptoms of pleuro-pneumonia. This is one of the three cows purchased at Wishaw for preventative inoculation; but as no compensation would be given, I allowed her to wait till 4th April. I would not have allowed her to live so long except for the inoculation, in case it should be said I was in too great a hurry."

Further comment I do not feel inclined to make, although the occasion is tempting, and I now leave the verdict (as to my remissness in the removal of the animals to slaughter) with every confidence in the hands of my professional brethren.

History of the Second Outbreak of Pleuro-pneumonia in Mr Salmond's Stock.

In consequence of information supplied to me by the Police, I visited Mr Salmond's cow-sheds on 16th June 1888, and in course of my inspection of the stock I detected a cow (No. 1) exhibiting symptoms of pleuro-pneumonia. In the absence of Mr Salmond, junr., I arranged with Mrs Salmond that the animal would be removed to the slaughter house the following morning. The float-cart was accordingly sent, but Mr Salmond objected to the animal's removal, giving as his reason that the cow was "getting better." I mention these circumstances to show that Mr Salmond has a mind and will of his own, and is not the guileless and ingenuous "son" Mr Rutherford would lead us to believe. I may further mention that the cow was not given up until I had written an official letter, and until (as I was informed) Mr Rutherford had also examined the animal.

Before proceeding further, it is necessary that I should explain (1) that the history of each animal as recorded was voluntarily supplied to me by Mr Salmond, junr., and that he alone is responsible for the accuracy or otherwise of the same; (2) that the statements in each case as to temperature, pulse, etc., are given on the authority of one of my assistants, Mr Matthew Graham, M.R.C.V.S.; (3) that the statements regarding the *post-mortem* appearances emanate from the pen of my colleague, Professor Limont; and (lastly) that I superintended the removal of all the animals, the inspection of the carcasses as to their fitness or otherwise for human food, fixed the compensation to be paid the owner, through him *invited Mr Rutherford to come to Glasgow to inspect the organs*, detained the diseased lungs for days, and in short, personally discharged all the duties appertaining to my office as Inspector to the Local Authority of Glasgow.

Cow I. History.—Bought 7th March 1888 in Glasgow, and said to have come from Limerick. Inoculated on 7th April by Professor MacQueen, who at the same time inoculated other 7 cows. Appeared healthy till a fortnight prior to removal to slaughter house on 20th June.

Post-mortem.—Left lung extensively hepatized and adherent to chest-wall.

Diagnosis.—Pleuro-pneumonia of recent origin.

Cow II.—Large brown cow, examined 21st June. Breathing disturbed, temperature 105°, pulse 65, respirations 25. Coughing and not feeding well.

History.—Purchased 1st May 1888 at Paisley Auction Mart. Fed and milked well till four days ago. Not inoculated. Slaughtered 22nd June 1888.

Post-mortem.—Whole lung examined as it lay on the table with the inferior (convex) aspect of the trachea uppermost. In this position the aspect of the lung visible to the observer is called in the Report “superior,” the aspect on the table “inferior.”

Report.—Second lobe from apex of right side is solid on its superior aspect, and there is thickening of the pleura towards the margin on its inferior aspect; there is similar thickening of the pleura over most of the surface, which is torn and rough owing to the separation of pleuritic adhesions. These thickenings are hard and firm. On palpation the solid portion is found to be a mass about the size of a very large clenched fist, and of almost cartilaginous hardness. The hardness comes nearly to the superior surface (where there is thickening of the pleura), and quite to the inferior surface (where there is thickening of the pleura and separated pleuritic adhesions). On dividing the mass by two incisions at right angles, it is found to be separated from the healthy lung tissue by a septum of solid connective tissue about half an inch thick. This septum is absent on the inferior aspect, because here the solid mass reaches the separated pleuritic adhesions. The lobules of the mass are separated by an excessive amount of connective tissue, exactly like that of the septum between the mass and the healthy tissue. The lobules themselves are solid, but friable, red when first cut, but rapidly becoming much darker when exposed to the air. The smaller bronchi in it may perhaps have somewhat thickened walls.

Diagnosis. — Encysted pleuro-pneumonic lung. Softening and breaking down not yet begun, or at least not visible to the naked eye. Encystment as thoroughly established as I have ever seen it.

Cow III. History.—Purchased December 1887 at Paisley. Fed and milked well till middle of March 1888. This cow had not been inoculated, as at the time when Professor M'Queen inoculated the other eight animals she was suffering from what was supposed to be a stomach affection. Slaughtered 22nd June.

Post-mortem.—Whole lung examined in same position as No. 2. Apical lobe of left lung encysted. The cyst wall is formed firstly by a thickening of the pleura to the extent of one-half to three-quarters of an inch; secondly, by a septum of connective tissue, quite half an inch thick, between it and the healthy lung tissue. Both thickened pleura and septum are very hard and firm, so that the healthy lung can easily be dissected off the latter. On incising the superior aspect of the pleura, a yellow diffuent material welled out, and was found to form a layer from one-half to an inch in thickness. On sweeping the finger round in this layer under the pleura, it was found to be traversed by bands fixed to the deep surface of the pleura. Most, but not all of these gave way readily. Some were ascertained to be small hollow tubes. Below this yellow diffuent layer the lung was found to be solid, but very friable, pinkish in some places, but yellow elsewhere. At

points it was yellow and approaching the consistence of porridge, but held together by the bronchi and overgrown connective tissue between the lobules. It contained what were apparently irregular cavities, but these were probably made in the cutting and handling of the lung. On incising the pleura on the inferior aspect, the yellow diffuent layer was found to be absent, the solid mass here reaching to the pleura. It had the same appearance as described above. The solid central mass was now shelled out, except where the large vessels and bronchi entered it, and a long flexible probe passed from the trachea was found (upon dissecting down) to be in a bronchus in the centre of the mass. The deep surface of the septum between the mass and the healthy lung had on it bright red patches about the size of a shilling, apparently the result of hæmorrhage into it. In the central mass itself there were veins containing soft and recent clots. At the posterior extremity of the left lung there was a mass about the size of a gooseberry. It was apparently composed of tubercles.

Diagnosis.—Encysted pleuro-pneumonic lung. Encystment thorough, softening and breaking down proceeding from periphery towards centre, and complete as regards the yellow diffuent layer under the pleura. Communication between the trachea and centre of the mass by open bronchi. Communication between vessels in centre of mass and pulmonary system.

Cow IV. History.—Purchased 17th April 1888 at Paisley. Fed and milked well all through, and was never inoculated. Temp. $103\frac{3}{4}^{\circ}$. Removed for slaughter 22nd June.

Post-mortem.—Whole lung examined in the same way. In posterior part of right lung, about the middle of its margin, but not extending quite to it, was a hard mass about the size of a goose egg. On section its superior aspect was found to be separated from the pleura by a little healthy lung tissue, but on its “inferior” aspect it extended to the pleura, which was here somewhat rough and thickened. There was overgrowth of the connective tissue separating its lobules. The lobules themselves were solid and red. In middle of left lung of same cow was an indurated lobule with bright red points. In the centre of one of the bronchial glands there was a stinking abscess.

Diagnosis.—Pleuro-pneumonic consolidation.

Cow V. History.—Purchased 17th April 1888 at Paisley. Fed and milked well. Never suspected in any way. Had not been inoculated. Removed for slaughter 22nd June.

Post-mortem.—Whole lung examined in same way. Mass similar in every way to that in No. 4, except that it was not so sharply defined; that it had its lines of overgrown connective tissue between the lobules harder and narrower, its lobules not so red; and that there was not so much thickening of the pleura on the inferior aspect. On the inferior aspect of the same lobe, but two inches more in front, was a solid mass about the size of a small pullet's egg. In this one the lines of overgrown connective tissue were not so thick.

Diagnosis.—Two masses of pleuro-pneumonic consolidation.

Cow VI. History.—Bought August 1887 at Paisley. Inoculated 9th of September 1887 by Mr Rutherford. Always fed and milked well. Temp. $101\frac{1}{2}^{\circ}$, pulse 44, respirations 16. Slaughtered 23rd June.

Post-mortem.—Sound lungs. Good carcase.

Cow VII. History.—Bought at Wishaw October 1886. Inoculated 9th February 1887 by Mr Rutherford when pleuro was raging in the byre. Never refused food, and always milked well. Temperature night before slaughter, $102\frac{1}{2}^{\circ}$, pulse 42, respirations 17. Slaughtered 23rd June 1888.

Post-mortem.—Large hard mass in posterior part of right lung. Cross-section revealed a plum-pudding-like mass, about four inches by five, of the colour of red granite. It was solid throughout but friable. One half shelled out almost by its own weight, and showed a yellow porridgy surface. The other half shelled out in the same way, except where large bronchi entered it. A probe was passed along one of these large bronchi into a bronchus in the substance of the solid mass. Each half of mass extended to the pleura over about half its surface, and the pleura in contact with it was thickened to the extent of a quarter of an inch or more. Elsewhere each half was to some extent separated by a connective tissue septum from the next layer, but at places there was complete continuity. This next layer was about an inch and a half thick. It consisted of solid, yellow, very friable lung tissue, which at places was nearly porridgy but held together by the bronchi, etc. Outside this layer the relations varied. At some places there was thickened pleura; at others, lung mainly made up of very tough overgrown connective tissue; at others, solid lung simply showing less degeneration than the layer itself; at others, lung apparently nearly healthy.

Diagnosis.—Encystment (partial and irregular) of pleuro-pneumonic lung of old standing, softening and degeneration at the periphery. Communication between bronchi in centre of mass and larger bronchi passing from it.

Cow VIII. History.—Purchased August 1887 at Paisley. Inoculated by Mr Rutherford 9th September, one month after purchase. Considered healthy always, and is now thick fat. Temp. $101\frac{1}{2}^{\circ}$, pulse 47, respirations 14. Slaughtered 23rd June 1888.

Post-mortem.—Both lungs diseased. Small bit of left lung showed a mass the size of a hen's egg. On section it showed typical "marbling" and "lymph." There was thickening of the pleura over it. Larger bit of the left lung. Very hard at places. Section showed the connective tissue between the lobules increased, and the lobules of a light greenish-yellow colour.

Diagnosis.—Recent pleuro-pneumonic consolidation.

Cow IX. History.—Bought August 1887 at Paisley. Inoculated by Mr Rutherford in September following. Thick fat. Always fed and milked well. Temp. $101\frac{1}{2}^{\circ}$, pulse 50, respirations 16. Slaughtered 23rd June 1888.

Post-mortem.—Numerous cysts, varying in size from that of a pea to that of a small hen's egg, with porridgy and cretaceous contents.

Diagnosis.—Tubercle.

Cow X. History.—Bought December 1887 at Paisley. Fed and milked well. Inoculated by Mr Rutherford. Temp. $101\frac{3}{5}^{\circ}$, pulse 45, respirations 17. Slaughtered 25th June.

Post-mortem.—Whole lung. A considerable number of cysts about the size of small marbles scattered through both lungs. Contents porridgy and cretaceous.

Diagnosis.—Tubercle.

Cow XI. History.—Purchased January 1888 at Paisley. Always fed and milked well. Inoculated by Mr Rutherford. Temp. $101\frac{3}{4}^{\circ}$, pulse 45, respirations 17. Slaughtered 25th June 1888.

Post-mortem.—Whole lung. Many cysts about the size of a marble in both lungs. Contents porridgy and cretaceous. Many have a number of small solid white nodules just outside their capsules.

Diagnosis.—*Tubercle* and secondary *Tubercle*. Posterior tip of left lung of same cow has pleura and lung substance somewhat injected.

Cow XII. History.—Purchased August 1887 at Paisley. Always fed and milked well. Inoculated by Mr Rutherford in September. Slaughtered 25th June 1888.

Post-mortem.—Piece of lung. Numerous very small nodules, which have in their centres single distinct irregular coral-like connections. Excess of mucus in bronchi.

Diagnosis.—Peculiar tubercles. Tip of the piece shows some injection of the pleura.

Cow XIII. History.—Bought December 1887 at Paisley. Inoculated by Mr Rutherford. Milked well. Slaughtered 25th June 1888.

Post-mortem.—Two pieces of lung. One piece shows cysts with porridgy and cretaceous contents, and pleura somewhat injected. The other piece shows lobules tough, of a pale greenish-yellow colour, and exuding much fine froth on pressure.

Diagnosis.—*Tubercle*.

Cow XIV. History.—Bought at Wishaw August 1886. Inoculated February 1887 by Mr Rutherford, when pleuro was raging in the byre. Always fed and milked well, but temperature rose to 106° and continued so for eight days at time of inoculation. Slaughtered 26th June. Temperature night before slaughter $101\frac{1}{2}^{\circ}$, pulse 46, respirations 14.

Post-mortem.—Left lung adherent to six ribs. One large piece of lung shows in its interior the wall of a cyst which has been incised and is now empty. The wall is distinct but not very thick. There is a stinking mass of yellow diffuent material in a cyst about the size of a pigeon's egg, which forms a diverticulum of the main cyst. There are some thrombosed blood-vessels upon the deep wall of the main cyst.

Diagnosis.—Encystment of pleuro-pneumonic lung of old standing.

Cow XV. History.—Bought at Paisley February 1888. Inoculated in March by Professor M'Queen. Fed and milked well up to 22nd June 1888. Slaughtered 26th June. Temperature night before slaughter $101\frac{1}{2}^{\circ}$, pulse 57, respirations 16.

Post-mortem.—Left lung adherent to the 6th, 7th, and 8th ribs. One piece of lung. Close together are two masses of solid lung, each about the size of a large walnut. They are of a muddy coffee colour, mixed with yellow, and are very friable; one is full of cavities which are probably the result of handling.

Diagnosis.—Pleuro-pneumonic consolidation and degeneration.

Cow XVI. History.—Purchased August 1887 at Paisley. Inoculated by Mr Rutherford September following. Always fed and milked well. Temp. $101\frac{1}{2}^{\circ}$, pulse 45, respirations 17. Slaughtered 26th June.

Post-mortem.—Both lungs diseased. One piece larger than a bullock's heart. Pleura shows over nearly its whole extent lymph and

granulations from recent pleurisy. The lung contains an immense number of cysts, most of them about the size of a walnut. In parts these cysts touch each other, and here the lung is nothing more than a mass of them. Each has a distinct wall of connective tissue. The contents of many are bright yellow, and completely diffuent—exactly like the yellow diffuent layer in No. 3. Some, however, have a more solid centre, this centre being quite cheesy when pressed between the fingers. There is no cretification whatever. When the diffuent and cheesy contents are carefully removed, it is found that the cysts are more or less traversed by bronchi into which a probe can be passed. They even form a kind of skeleton for the contents of some cysts.

One smaller piece. Exactly the same, but cysts fewer in number.

Diagnosis.—Numerous small pleuro-pneumonic encystments. Softening and degeneration (from periphery to centre) complete in many, nearly complete in the others.

Cow XVII. History.—Purchased at Paisley February 1887. Inoculated by Mr Rutherford eight days after purchase, when pleuro-pneumonia was in the byre. This is one of the experimental animals allowed to be purchased at the time for preventative inoculation. Temperature night before slaughter $101\frac{1}{8}^{\circ}$, pulse 44, respirations 16. Always fed and milked well. Slaughtered 26th June.

Post-mortem.—Pleuro-pneumonic consolidation. Both lungs extensively hepatized; deposits of tubercles also present.

Cow XVIII. History.—A Canadian cow purchased November 1887 on arrival in Glasgow. Inoculated February 1888 by Professor M'Queen. Always fed and milked well. Slaughtered 27th June 1888. Temperature night before slaughter $101\frac{1}{8}^{\circ}$, pulse 45, respirations 15.

Post-mortem.—Upper division of right lung adherent to 10th, 11th, and 12th ribs. One large piece of lung. Pleura on both sides thicker than usual. The lung contained a hard mass about the size of an orange. On cross-section of this mass, a somewhat smaller solid mass was shelled out of its interior. It almost fell out by its own weight. Its surface was yellow and porridgy. On section its substance proved to be pinkish yellow, solid but friable. The wall containing it was of connective tissue, and about one-eighth of an inch thick, but covered internally by branching tubes. At one point outside the cyst the lung was tough, pale greenish-yellow, and frothy, as in No. 8.

Diagnosis.—Encystment of pleuro-pneumonic lung. Softening and degeneration begun.

Cow XIX. History.—Purchased in Glasgow Market December 1886. Inoculated by Mr Rutherford February 1887, when pleuro-pneumonia was raging in byre. Slaughtered 27th June. Temperature $101\frac{3}{8}^{\circ}$, pulse 44, respirations 15.

Post-mortem.—A few cretaceous cysts. Other porridgy and cretaceous cysts, varying in size from that of a horse bean to that of a small walnut. Part of lung is tough, pale greenish-yellow, and frothy. Pleura is somewhat thicker than usual.

Diagnosis.—Tubercle.

Cow XX. History.—Purchased at Rutherglen September 1886. Inoculated February 1887 by Mr Rutherford, when pleuro was raging in byre. Always fed and milked well. Slaughtered 27th June.

Post-mortem.—Tuberculosis, same as No. 19.

Cow XXI. History.—Purchased December 1887 at Paisley. Inoculated same month by Mr Rutherford. Always fed and milked well. Slaughtered 27th June. Temperature $101\frac{1}{2}^{\circ}$, pulse 45, respirations 15.

Post-mortem.—Sound lungs and good carcase.

Cow XXII. History.—Purchased at Paisley February 1888. Inoculated same month by Professor M'Queen. Always fed and milked well. Slaughtered 28th June. Temperature $102\frac{1}{2}^{\circ}$, pulse 44, respirations 15.

Post-mortem.—Sound lungs and good carcase.

Cow XXIII. History.—Purchased August 1887 at Paisley. Inoculated November 1887 by Mr Rutherford. Always fed and milked well. Slaughtered 28th June. Temperature $101\frac{1}{2}^{\circ}$, pulse 44, respirations 14.

Post-mortem.—Sound lungs and good carcase.

Cow XXIV. History.—Purchased December 1887 at Paisley. Inoculated same month by Mr Rutherford. Always fed and milked well. Slaughtered 28th June. Temperature $101\frac{1}{5}^{\circ}$, pulse 45, respirations 14.

Post-mortem.—Sound lungs and good carcase.

Cow XXV. History.—Purchased at Paisley September 1887. Inoculated by Mr Rutherford. Always fed and milked well. Slaughtered 28th June. Temperature $101\frac{3}{8}^{\circ}$, pulse 46, respirations 16.

Post-mortem.—Sound lungs and good carcase.

Cow XXVI. History.—Purchased at Paisley December 1887. Inoculated by Mr Rutherford same month. Always fed and milked well. Slaughtered 29th June.

Post-mortem.—Sound lungs and good carcase.

Cow XXVII. History.—Purchased at Paisley December 1887. Inoculated same month by Mr Rutherford. Always fed and milked well. Slaughtered 29th June.

Post-mortem.—Sound lungs. Fair carcase.

Cow XXVIII. History.—Purchased at Paisley December 1887. Inoculated by Mr Rutherford same month. Always fed and milked well. Slaughtered 29th June.

Post-mortem.—Sound lungs. Fair carcase.

Cow XXIX. History.—Purchased at Paisley September 1887. Inoculated October 1887 by Mr Rutherford. Always fed and milked well. Slaughtered 29th June.

Post-mortem.—Sound lungs.

Cow XXX. History.—Purchased at Paisley February 1888. Inoculated by Professor M'Queen April 7th, 1888. Fed and milked well. Temp. $101\frac{1}{5}^{\circ}$. Slaughtered 2nd July.

Post-mortem.—Left lung adherent to 6th, 7th, and 8th ribs. Posterior lobe of both lungs voluminous and œdematous. Posterior lobe of right lung badly affected with tubercles of various sizes, all having liquid and cretaceous or (oftener) porridgy and cretaceous contents. Two large ones on the inferior aspect had thickening of the pleura over them. One of these had liquid contents, bronchi traversing it, and secondary tubercles around it. On the superior aspect of the same lobe was a rather deeply seated hard mass. On cross-section it was found to be a solid but friable spherical mass, about the size of a Tangerine orange, enclosed in a rather thin capsule. It was pinkish-

yellow in colour. One-half was shelled out almost by its own weight. It was yellow and porridgy on the surface. The other half along with its capsule was cut out and preserved. The large bronchus supplying this portion of lung was slit open. It showed several translucent nodules upon its lining—especially where smaller branches were given off. In the trachea itself there were some tubercular ulcers.

Diagnosis.—Pleuro-pneumonic consolidation and tubercle.

Cow XXXI. History.—Purchased March 1888 at Paisley. Inoculated by Professor M'Queen April 7th 1888. Slaughtered 2nd July.

Post-mortem.—Sound lungs. Sound carcase.

Cow XXXII. History.—Purchased at Paisley August 1887. Inoculated September 9th following by Mr Rutherford. Slaughtered 2nd July 1888.

Post-mortem.—Sound.

Cow XXXIII. History.—Purchased at Paisley November 1887. Inoculated by Mr Rutherford December 31st 1887. Temperature increased, and the animal evidently unwell for eight days in February 1888. Temp. 1st July $101\frac{1}{2}^{\circ}$, pulse 44, respirations 17. Slaughtered 2nd July 1888.

Post-mortem.—Left lung extensively adherent to chest wall. All parts of both lungs show tubercles, and especially collections of tubercles with porridgy and cretaceous contents. There is a large mass on the superior aspect of the posterior lobe of left lung. There is a still larger mass, the size of a large lemon, on the inferior aspect of the same. Over the larger masses the pleura is thickened. In the last-mentioned mass the connective tissue is greatly overgrown and very hard. It cannot be very distinctly separated from the walls of the tubercular cysts which have replaced the lobules. When the contents of these cysts are turned out, the connective tissue and bronchi are left as a complete skeleton, which formerly supported the porridgy and cretaceous material replacing the lobules. The bronchi in this mass were plugged by yellow catarrhal material. In connection with it, there was a subordinate mass, the size of a small hen's egg. This consisted of numerous yellow lobules about the size of a small Indian pea. They gave each lobule the appearance of a bunch of currants.

Diagnosis.—Pleuro-pneumonic consolidation and tubercle.

Cow XXXIV. History.—Purchased at Paisley March 1888. Inoculated 7th April 1888 by Professor M'Queen. Slaughtered 4th July.

Post-mortem.—Much the same as No. 33.

Diagnosis.—Pleuro-pneumonic consolidation and tubercle.

Cow XXXV. History.—Purchased September 1887 at Paisley. Inoculated same month by Mr Rutherford. Slaughtered 4th July 1888.

Post-mortem.—The lung, especially the large posterior lobes, is voluminous and very œdematous. At the posterior tip of the right lung there is slight evidence of recent pleurisy in the shape of "lymph." There are a few small collections of pearly tubercles on the inferior aspect of the posterior lobe of the left lung.

Diagnosis.—Tubercle.

Cow XXXVI. History.—Purchased at Paisley November 1887. Inoculated December 31st 1887 by Mr Rutherford. Slaughtered 4th July 1888.

Post-mortem.—Much similar to No. 35.

Diagnosis.—Tubercle.

Cow XXXVII. History.—Purchased at Paisley March 1888. Inoculated 7th April by Professor M'Queen. Slaughtered 4th July 1888.

Post-mortem.—Sound lungs. Fair carcase.

Such, then, is the history of the second outbreak of pleuro-pneumonia in Salmond's stock, and I contend that there is in it material to prove "that Mr Rutherford's inoculation of the stock in February 1887 (the date of the first outbreak) did not arrest the spread of the disease at that time, but that it actually carried it on, and was the cause of a second outbreak in June 1888.

In order to save time and trouble, I now append a Table showing the date of purchase of each animal, the date of inoculation and slaughter, and the *post-mortem*.—

No.	Purchased.	Inoculated.	Slaughtered.	Post-mortem.
1	March 7, 1888.	April 7, 1888.	June 20, 1888.	Pleuro-pneumonia recent.
2	" 1, "	Not inoculated.	" 22, "	Encysted Pleuro-pneumonia.
3	" Dec. 1887.	Do.	" " "	Do. Do.
4	April 17, 1888.	Do.	" " "	Pleuro-pneumonic Consolidation.
5	" " "	Do.	" " "	Do. Do.
6	August 1887.	Sept. 9, 1887.	" 23, "	Sound Lungs.
7	October 1886	Feb. 9, "	" " "	Encysted Pleuro-pneumonia.
8	August 1887.	Sept. 9, "	" " "	Recent Pleuro-pneumonic Consolidation.
9	" " "	" " "	" " "	Tuberculosis.
10	December 1887.	Inoculated.	" 25, "	Do.
11	January 1888.	Do.	" " "	Do.
12	August 1887.	Do.	" " "	Do.
13	December "	Do.	" " "	Do.
14	August 1886.	February 1887.	" 26, "	Encysted Pleuro-pneumonia, old.
15	February 1888.	Inoculated.	" " "	Pleuro-pneumonic Consolidation.
16	August 1887.	September 1887.	" " "	Pleuro-pneumonic Encystments.
17	February "	February "	" " "	Pleuro-pneumonic Consolidation.
18	November "	" 1888.	" 27, "	Encysted Pleuro-pneumonia.
19	December 1886.	" 1887.	" " "	Tuberculosis.
20	September "	" " "	" " "	Do.
21	December 1887.	December 1887.	" " "	Sound Lungs.
22	February 1888.	February 1888.	" 28, "	Do. Do.
23	August 1887.	November 1887.	" " "	Do. Do.
24	December "	December "	" " "	Do. Do.
25	September "	Inoculated.	" " "	Do. Do.
26	December "	December 1887.	" 29, "	Do. Do.
27	" " "	" " "	" " "	Do. Do.
28	" " "	" " "	" " "	Do. Do.
29	September "	October "	" " "	Do. Do.
30	February 1888.	April 7, 1888.	July 2, "	Pleuro-pneumonic Consolidation and Tuberculosis.
31	March "	" " "	" " "	Sound Lungs.
32	August 1887.	Sept. 9, 1887.	" " "	Do. Do.
33	November "	Dec. 31, "	" " "	Pleuro-pneumonic Consolidation and Tuberculosis.
34	March 1888.	April 7, 1888.	" 4, "	Do. Do. Do.
35	September 1887.	September 1887.	" " "	Tuberculosis.
36	November "	Dec. 31, "	" " "	Do.
37	March 1888.	April 7, 1888.	" " "	Sound Lungs.

A brief analysis of the above may be rendered as follows:—

Cows inoculated and found on <i>post-mortem</i> affected with pleuro-pneumonia				11
Do. not inoculated	"	"	"	4
Do. inoculated	"	"	" Tuberculosis	9
Do. "	"	"	Sound	13
Total . . .				37

To prove that the inoculation practised by Mr Rutherford on the animals implicated in the first outbreak did not arrest the spread of the

malady, I again direct attention to the facts connected therewith as given in detail, and more particularly to the circumstances connected with cow No. 9 (p. 312), inoculated 16th, 24th, and 29th July 1887. This cow, it will be remembered, was purchased along with other three at Wishaw for the express purpose of showing the value of inoculation, and how it would protect them from the disease (pleuro-pneumonia) which, as Mr Salmond has frequently said, was at the time "raging in his byres." It was in no manner benefited by the operation, but, on the contrary, at the average period of incubation it presented all the symptoms of an animal affected with the malady contracted by the natural method, viz. infection.

Coming down to the last outbreak, I shall now single out a few cases for analysis:—

Cow VII. was purchased in October 1886, inoculated 9th February 1887, when pleuro was raging in the byre, and slaughtered 23rd June 1888, so that *this animal belonged to both outbreaks*. She was not killed during the first outbreak because she exhibited no well-marked symptoms of being affected with pleuro, but, nevertheless, she was affected; and I contend, the *post-mortem* proves conclusively that this animal alone was sufficient to keep up the infection in the byre, and to transmit the disease to every animal entering the cowshed; for the *post-mortem* makes it clear that the diseased portions of her lungs communicated with one of the large bronchi, and that a whalebone probe could be passed from it into the centre of the encapsulated mass.

In a lecture which I delivered to the members of the West of Scotland Veterinary Medical Association in January 1886, on the disease in question, I stated: "If during the course of the malady when contracted by the natural method, *i.e.* inhalation of the virus, a portion of lung tissue becomes encapsulated (there is a proneness to this), although that animal to all appearance has made a complete recovery, and has been allowed to mix with sound animals for weeks and months with apparent impunity to those around it, still whenever the time comes that the air penetrates the capsule, and the tissues liquefy, the imprisoned microbes will escape in the breath, and thus, that animal, although recovered from the disease, and not now labouring under the specific disease, still has become anew a source of infection. Unfortunately, the same holds equally good with the inoculated animal if it should have contracted the seeds of the disease by the natural method prior to or at the time of its inoculation; and as inoculation is scarcely ever practised until the disease has declared itself present in a number of the herd by the natural method, and consequently must have been present there for some weeks, the chances are that several animals are affected in every herd before inoculation has been had recourse to.

"Therein lies the danger, and no doubt is the reason that inoculated animals have been so frequently known to propagate pleuro among sound animals."

Cow VIII. may be dismissed with the remark that if the inoculation was successful when practised on 9th September 1887, it failed in protecting the animal eight months, as there can be no doubt that this animal had laboured under an attack of pleuro-pneumonia for a period not less than six weeks prior to its being slaughtered.

Cow XIV. is interesting in this respect, that the case is the counter-

part of No. 7, and again establishes the direct connection betwixt the first and second outbreaks.

Cow XVI., like No. 7, had an open and direct communication from the encapsulated mass to the bronchi, and this animal although inoculated, and although it always fed and milked well, had the power to infect sound cattle, and was another and additional source of infection.

Cow XVII. again proves the close connection between the first and second outbreaks, for it is one of the experimental animals allowed to be purchased at the time (of the first outbreak) for preventative inoculation.

The case of Cow XVIII. is interesting, and clearly demonstrates the source of infection. She was a Canadian cow purchased on arrival in Glasgow, but not inoculated until she had been about three months in the byre.

Case XXX. is the counterpart of No. 16.

Case XXXIII. is a complicated one of pleuro-pneumonia and tuberculosis, in no way benefited by inoculation.

Case XXXIV. is much the same as No. 33.

With no desire to annoy Mr Rutherford, but to arrive at the truth, I again ask him to reconcile these cases with the following statements also contained in his evidence :—

“Is inoculation always effectual?” “Yes, inoculation will undoubtedly always arrest and stamp out pleuro-pneumonia.”

“Vaccination does not take with an infant, why should inoculation always take with an animal?” “It is the case that it does. One thing you may depend upon is this, that if they will not take inoculation, they will not contract the disease; it is impossible for an animal to resist inoculation and subsequently to contract the disease.” “In *post-mortem* examination I have never been able to meet any inoculated animals with the disease.”

In the belief that I have proved (what I undertook to do) that inoculation did not arrest the spread of the disease on Salmond's stock at the time of the first outbreak, and that it was the keeping of inoculated but affected animals alive, in the belief that they were sound animals, and rendered so by inoculation, that induced the second outbreak, I will now conclude by a quotation from the lecture I delivered on the occasion previously referred to: “No doubt if great care be exercised in selecting the subjects for inoculation, and if none but non-infected animals be inoculated, the contagion cannot be spread by them; but he is a bold man who would declare that after he had exercised all his skill he could not be mistaken, and that he had not inoculated any animal that had contracted the disease by the natural method. The man is not born who can discriminate with accuracy in this matter, and I repeat therein lies the, I might almost say, sole objection to the practice of inoculation for the eradication of pleuro-pneumonia, and it is an objection which will never be got over, because it is but a limited extent of the chest of the cow which is open to percussion and auscultation.”