

**The transference of immunity from ewe to lamb / by T. Dalling, J.H. Mason,  
and W.S. Gordon.**

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## THE TRANSFERENCE OF IMMUNITY FROM EWE TO LAMB.

By T. DALLING, J. H. MASON, and W. S. GORDON.

DURING the course of our researches into lamb dysentery we devised a method of protecting lambs from dysentery by the inoculation of the mother sheep with a toxin-antitoxin mixture, prepared from the toxin of an anaerobe isolated from lesions in naturally infected lambs. Field results bear out that lambs are protected by such a method: thus in 1926, 2·34 per cent. of lambs born from inoculated ewes died of lamb dysentery, while 18·44 per cent. of lambs from uninoculated ewes died. The figures for 1927 are 0·87 per cent. of lambs from inoculated ewes died, while 8·04 per cent. of lambs from uninoculated ewes developed lamb dysentery.

We have carried out a series of experiments which show that the inoculation of ewes with the above mixture causes the formation of antitoxin in their serum and that lambs born from such sheep have a similar amount of antitoxin.

### *Method of Testing Serum for the Presence of Antitoxin.*

A standard toxin was made by growing the anaerobe in meat broth for 12-15 hours, filtering through paper pulp and sand and then through a Berkefeld filter. The filtrate is precipitated with ammonium sulphate, the precipitate is dried *in vacuo* and the residue is finely powdered. A weighed amount of this powdered toxin is dissolved in saline solution when tests are to be carried out. The toxin in this powdered form has retained its toxic and other qualities for many months. Experiments were carried out to determine the minimum lethal dose of the toxin by the mouse intravenous method, and the minimum skin-reacting dose by the guinea-pig intradermic methods. The smallest amount of toxin causing the deaths of mice and causing skin reactions in guinea-pigs, was used in the testing of the antitoxic content of the sheep sera. Fatal or reacting doses or multiples of them are mixed with 0·2 c.c. of serum, the mixtures allowed to stand at room temperature for about one hour and then injected into mice intravenously or into guinea-pigs intradermically; results are read in the mouse experiments in twenty-four hours and in the guinea-pig tests forty-eight hours later.

### *Testing of Serum from Inoculated Sheep.*

Tests of many samples of serum from inoculated sheep have been made. Table I is the result of tests carried out on samples from ten sheep which were brought to the laboratory for inoculating and testing. These sheep were injected twice during pregnancy and were bled before injecting, after the first inoculation, and on several occasions after lambing. No antitoxin could be demonstrated in any sample obtained before injecting, while in three sheep after one injection, 0·2 c.c. serum protected against one fatal dose of toxin. Of the ten sheep, three failed to develop any detectable antitoxin after the second injection. Sheep 41 is of interest in that it showed the presence of antitoxin after one, but not after two injections. On the day it received its first injection it was necessary to administer 40 c.c. hyper-immune serum. Our test therefore detected passive immunity.



TABLE I.—ANTITOXIN IN SERUM OF INJECTED SHEEP.

Sheep	Before injection	After first injection	After second injection (in days)
40	Nil	P. 1	7 P. 3 24 P. 3 34 P. 3
41	Nil	P. 1	17 nil 24 nil 44 nil
42	Nil	P. 1	17 P. 2 24 P. 1 44 P. 1
43	Nil	Nil	3 P. 2 21 P. 3 32 nil
44	Nil	Nil	14 nil 21 nil 33 nil
45	Nil	Nil	17 P. 3 24 P. 1 44 nil
46	Nil	Nil	14 nil 21 nil 44 nil
47	Nil	Nil	23 P. 2 28 P. 2 54 nil
48	Nil	Nil	25 P. 1 32 nil 50 nil
49	Nil	Nil	16 nil 24 nil 44 nil

Tests done in mice i. v. 0.2 c.c. serum mixed with one or more M.L. Ds. toxin and stood for about one hour before injecting.

Nil = no protection.

7 P. 3, etc. = protection against 3 M.L.Ds. toxin when test done with serum got seven days after second injection, etc.

*Testing of Lamb's Serum for Antitoxin and a Comparison with Antitoxin Content of the Mother Sheep.*

Again, many samples of lamb's serum have been tested for antitoxin content. Table II is the result of testing samples of serum from lambs produced by the ewes referred to in Table I. Samples of blood were drawn on the day of the lamb's birth and again when the lamb was 7-9 days old. The results of the test indicate that the antitoxin content of the lamb's serum corresponded closely to that of the mother sheep.

Our experiments do not indicate whether such antitoxin was developed by the foetus *in utero* or whether it was transmitted to the foetus *in utero* by the mother or via the colostrum after birth.

Experiments will be carried out during this year's lambing season to establish this point.

TABLE II.—COMPARISON MOTHER EWE AND LAMB SERUM—PRESENCE OF ANTITOXIN.

No. ewe and lambs	Lamb serum (day of birth)	Lamb serum (7-9 days old)	Ewe serum (day of birth of lambs)
41	Nil	—	Nil
42	{ (a) No P. (b) P. 3 (c) P. 3	{ Died P. 3 P. 3	P. 2
43	{ (a) Nil (b) Nil	{ — —	P. 2
44	{ (a) Nil (b) Nil	{ — —	Nil
45	{ (a) P. 3 (b) P. 3	{ — P. 3	P. 3
46	{ (a) Nil (b) Nil	{ Nil Nil	Nil
47	{ (a) Nil (b) Nil	{ P. 2 P. 2	P. 2
48	P. 2	P. 2	P. 1

Tests done in mice i. v. 0.2 c.c. serum mixed with one or more M.L.Ds. toxin and stood for about one hour before injecting.

Nil = No protection—all mice died.

P. 3, etc. = protected mice against 3 M.L.Ds. toxin, etc.