

greater purification than other antigens used in flocculation experiments, on account of their very sensitive indicator effect. Even the hæmocyans used by Boyd¹ and regarded as exceptionally pure following repeated iso-electric precipitations are open to doubt, as it has been shown that at least one of them⁴ contains three components of the same iso-electric point. It would not seem unreasonable, therefore, to suggest that the flocculative behaviour of toxin-antitoxin systems is the rule rather than the exception, and that therefore with a pure system the alpha and beta optima would coincide. This would appear as a more tenable premise, at any rate unless it can be disproved by the use of antigens satisfying higher degrees of purity than the ones so far investigated.

In conclusion, it is submitted that for a pure antigen-antibody system there is no evidence that more than one optimal ratio exists.

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¹ Boyd, W. C., *J. Exp. Med.*, **74**, 369 (1941).

² Boyd, W. C., and Purnell, M. A., *J. Exp. Med.*, **80**, 289 (1944).

³ Miles, A. A., *Brit. J. Exp. Path.*, **14**, 43 (1933).

⁴ Svedberg, T., and Hedenius, A., *Biol. Bull.*, **66**, 191 (1934).

Absorption of Immune Globulin by the Young Lamb after Ingestion of Colostrum

THE absorption of immune globulin by the sucking calf has been studied in considerable detail by a number of investigators. The results obtained are probably typical of ruminants and have been confirmed to some extent for the sheep¹⁻³. A further investigation of globulin absorption is reported here. It is mainly concerned with the immune globulin content of colostrum, the effect of delayed ingestion of colostrum on the lambs' serum proteins and the presence of proteins in the lambs' urine.

Lambs from ewes immunized during the latter half of pregnancy with *B. typhosus* H. antigen were either allowed to suck in the normal way at birth or were bottle-fed for varying periods and then transferred to recently lambed, unsucked ewes. Samples of colostrum, serum and urine were taken during the first ten days and at about five weeks after lambing, for examination by salting out, electrophoretic and immunological methods.

The results of these experiments, which will be published fully elsewhere, may be summarized as follows. The immune globulin of colostrum decreased rapidly during the first two or three days after lambing. It was found to be absent on the twelfth and present on the third day before lambing, in the globulin-rich secretion from the udders of ewes which afterwards yielded colostrum of high agglutinin titre. It thus appears that it can be accumulated over a relatively short period before lambing.

Absorption of immune globulin, in lambs which sucked normally, was shown by a rapid increase in serum globulin, mainly gamma-globulin, and in agglutinin, which was followed by a gradual decrease. In these animals the globulin at five weeks was still higher than at birth, but appreciably less than in the dam. The serum albumin showed a transient fall

in concentration soon after birth, followed by a slight rise to approximately adult values at five weeks.

On delaying the ingestion of colostrum, absorption was found to occur up to 29 hours, but not at 48 hours or more, after birth. These results may be compared with those obtained in calves⁴, which showed absorption at 24 hours but not at 42 hours.

By the time the lambs were five weeks old, there was little difference in the serum proteins of those sucking normally and those which received delayed colostrum or no colostrum at all.

A strong transient proteinuria was found in sucking lambs during the first day or two after birth. The protein present included globulin and showed an appreciable agglutinin titre. This proteinuria was correlated with the absorption of immune globulin.

Lambs were occasionally found in which the serum and urine showed traces of immune globulin before sucking. The amounts concerned were negligible compared with those obtained after sucking.

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¹ Mason, J. H., Dalling, T., and Gordon, N. S., *J. Path. Bact.*, **33**, 783 (1930).

² Earle, I. P., *J. Agric. Res.*, **51**, 479 (1938).

³ Charlwood, P. A., and Thompson, A., *Nature*, **161**, 59 (1948).

⁴ Hansen, K. G., and Phillips, P. H., *J. Biol. Chem.*, **171**, 223 (1947).

Local Anaesthetics and the Potassium Ion

THE action of local anaesthetics on the isolated rat phrenic nerve - diaphragm at 20° C.¹ was studied with particular reference to the potassium ion. All the preparations were left for two hours before use in a bath of 70 ml. of Tyrode solution containing 0.2 per cent glucose.

Table 1. Percentage reduction of contraction of rat diaphragm produced by local anaesthetics, acting for 3 min. in a bath of 70 ml. capacity

Drug (as hydrochloride)	Dose (mg.) producing 50 per cent reduction	Dose (mg.) producing 100 per cent reduction
Procaine	20-30	50
Amylocaine	10	20
Cocaine	5-15	10-30
Amethocaine	1-3	—
Cinchocaine	1-2	—

It was first found that large doses of local anaesthetics produced neuro-muscular block *per se*. The results of contact for three minutes are recorded in Table 1; and relative activities calculated on this basis are of the same order as those found for anaesthetic action². Preparations had to be primed with a few large doses of the anaesthetic before consistent responses could be obtained. Secondly, doses of amylocaine and amethocaine producing a 50 per cent inhibition were potentiated by 45 mgm. of potassium chloride given half a minute before the anaesthetic. On the other hand, 45 mgm. of potassium chloride had little or no action on corresponding doses of procaine, and this suggested a difference of action for this compound. This dose of potassium chloride