continued at a higher peak and for a longer period than milk production, but this conclusion could only be tentative in view of the limited amount of information available on the butterfat testing of the milk.

Reply: Unfortunately I have no information on this point, and owing to the uncertainty of the true fat content of ewe's milk (due to the incomplete yield obtained by hand-milking) I do not see that this information could be obtained very easily. Moreover, it would appear that the fat percentage shows rather large variations from day to day, which is a further complicating factor.

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CALF NUTRITION AND THE IMPORTANCE OF NUTRITION IN THE POST WEANING STAGES

by

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This paper is based on research conducted at Ruakura over the last three years into one of the practical problems concerned with lactation.

The aim of the work was to examine the factors involved in calf rearing on the dairy farm, particularly in the post weaning stages, i.e., from the late summer until the following spring. Every spring one sees a number of calves which have obviously come through the winter with difficulty while from time to time one comes into contact with farmers who admit they have lost up to 20% or more of their calves. They maintain that the losses were not incurred until the late autumn, but that from then onwards until the spring growth of pasture became plentiful there was a number of deaths.

The symptoms of the trouble are a fairly rapid loss of condition, scouring, and harshness of the coat. The eyes become sunken and the epethelium anaemic. The faeces become blood stained and in the latter stages areas of the intestinal epethelium are discharged. Such animals refuse to eat, and in the final stages stand at the water trough and sip water constantly. Parasitic gastritis is usually the diagnosis and drenching resorted to, but while intestinal parasites may well be a factor, it is maintained that the chief factors are the plane of nutrition and the methods of grazing management.

For convenience of handling, calves are usually reared in a paddock convenient to the milking shed, and depending on the area of the paddock and the growth of pasture the calves will remain in the calf paddock for some weeks after they are born and commonly until they are weaned.

At weaning the calves will be placed in a paddock which is not wanted by the milking herd or for silage and hay. They will remain in this paddock probably until the late autumn, and the paddock finally becomes a series of rough overgrown patches and bare closely grazed areas. There is apparently plenty of rough feed and yet the calves do not thrive. Examination of the paddock makes it evident however, that the actual area being grazed by the calves is relatively small. During this period the pasture frequently becomes overgrown at first and later becomes dried up and unpalatable, poor in quality and quantity, and it is at this time that calves which have been reared more or less satisfactorily begin to exhibit the conditions of unthriftiness.

In conducting the investigation the main object was to build up in a practical manner the vigour and resistance in the early stages so that the calves would enter the autumn and winter and early spring in good condition, for it is generally acknowledged that the dangerous period is fairly well over by August, i.e., when the young spring grass commences to grow.

In connection with this problem, I cannot do better than refer you to a paper by Taylor (1) in which he stresses the importance of nutrition in building up resistance to disease which is clearly borne out by his work in parasitic gastritis in lambs.

Calves are not good grazers and under conditions of set stocking and with a high concentration of stock the calf paddock soon becomes unpalatable. The alternative to this is to feed concentrates, which beyond a certain point is uneconomic, or to provide more palatable pasture by frequent movement of the calves. The best pasture on the dairy farm goes of course to the milking herd, but by means of rotational grazing methods the calves can be sent ahead of the cows and encouraged to graze since by this means they are offered the freshest pasture in its highest nutritive state.

Over a period of three years groups of calves have been subjected to various treatments in an endeavour to examine the factors involved which in some instances result in a calf mortality of 20% or more. The calves used were Jerseys or Jersey Cross stock, and all received the same pre-weaning treatment. A standard ration of milk and concentrate was used, which varied in quantity with the age of the calf. The calves were weaned off separated milk at five months and off concentrates at six months.

From birth the calves were run in the calf paddock until pasture became plentiful, i.e., in October, by which time the calves were old enough to be driven around the paddocks, and they were then grouped for their respective treatments. The general plan of treatment for the set stocked groups being for them to remain in the calf paddock until the pasture became unsatisfactory: they were then moved to a fresh paddock. After the autumn rains they were moved to a fresh paddock in which they remained until the end of the trial.

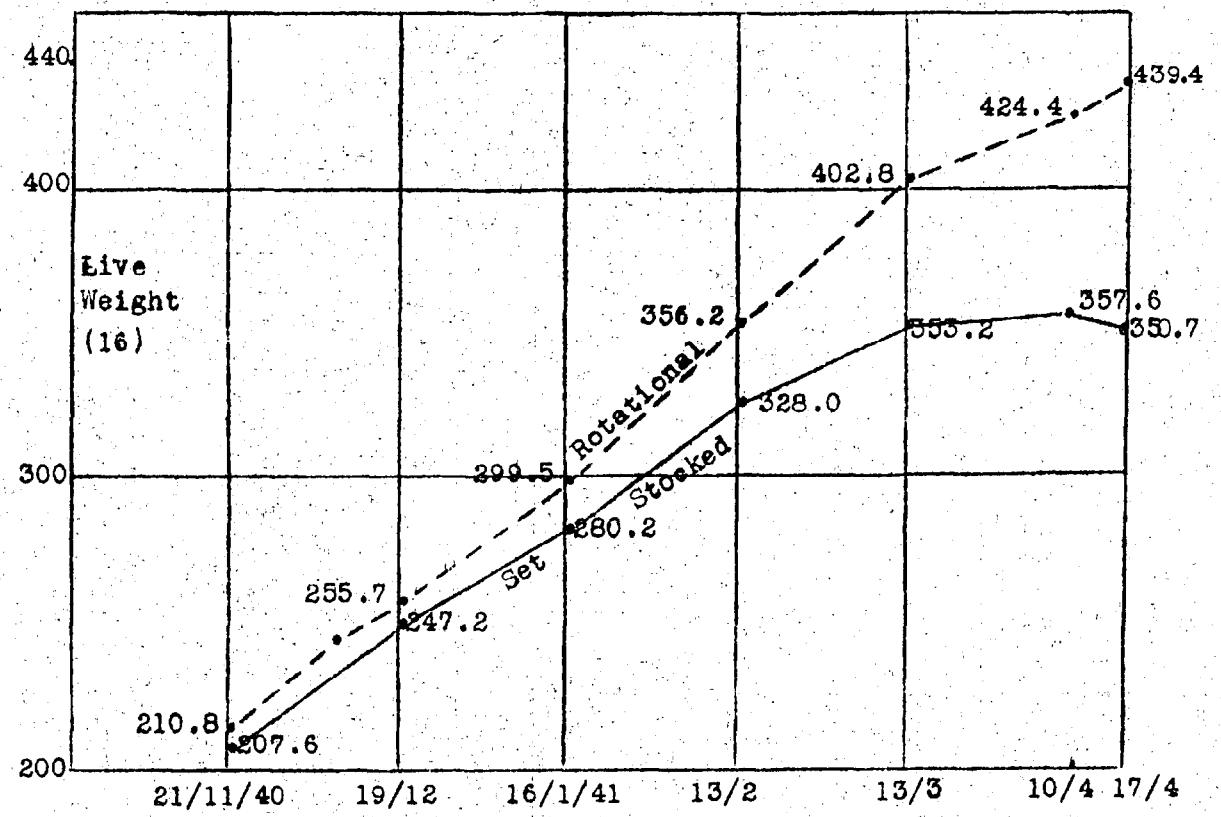
1940-1941 TRIAL: The first year's trial commenced with two groups of calves, one group being set stocked as outlined above, and the second group being grazed ahead of the cows.

The progress of the two groups may be seen from the liveweight gains and the growth curve from the 21st November, 1940, at which time the calves were grouped and the treatments imposed. The grazing treatments were discontinued after the 10th April, 1941, since by that time supplementary feeding with hay and silage was necessary for both groups.

The mean initial and final liveweight of the groups was as follows :-

Group	Liveweight (lbs.) Initial 21.11.40.	Final 10.4.41.	Increase
1. Set stocked	207.6	350.7	143.1
2. Rotationally Grazed	210.8	439.4	228.6

GRAPH 1. LIVE WEIGHT CURVES 1940-41.



The effect of set stocking is evident and at the termination of the grazing treatment it was obvious that special treatment would be needed by the set stocked group if a high mortality was to be avoided. Seven of the set stocked calves were immediately placed on a diet of separated milk and meal, and two more received treatment later. In addition to the improvement in the diet, dosing for worms was carried out under the direction of the Parasitologist, Mr Whitten. For this part of the work the calves were run together but sub-grouped for dosing into a control and two experimental groups. One experimental group received Cu SO_4 and nicotine sulphate and the other group received Tetrachloroethylene.

Examination for worm infestation was made by means of worm egg counts of the faeces. It is of special interest however, to compare the egg count of the rotational and set stocked groups at the termination of the grazing treatment, and before special feeding and dosing was carried out.

Worm Egg Count : Eggs Per Gram of Faeces

Rotational Group	Set Stocked Group
60	1160
60	200
0	400
60	930
0	260
30	1430
30	230
30	300
60	1230
0	1500
260	1430
0	1800
60	1000
0	460
100	

A table which does not require statistical treatment to show a difference in favour or rotational grazing.

The results of the dosing programme, as shown by the worm egg count, have been statistically treated by Mr Paton and his staff, and I hope he will comment on the results. The efficiency of the Cu SO_4 and the Tetrachlorethylene for worm control will, I hope, be commented on by Mr Whitten. It is sufficient for me to say that drenching and feeding did not prevent four of the set stocked group from dying, although the calves which died were not those showing the highest worm egg count.

1941-1942 TRIALS: The 1941-42 trials were carried out mainly to test the value of drenching with phenothiazine.

Two groups of calves were similarly treated to those of the previous year, i.e., set stocked and rotationally grazed, but the rotational grazing commenced about one month earlierthan the previous year. On the 29th of January the set stocked group was sub-grouped into drenched and undrenched groups. Drenching with Phenothiazine was carried out once a month. The main points of interest in 1941-42 trials was that the rotationally grazed group again showed superior gains compared with the set stocked groups, as may be seen from the liveweight curve. The two remaining points of interest are:

1. Drenching with Phenothiazine did not make any significant reduction in the worm egg count when compared with the non drenched group.
2. There was, however, as in the 1940-41 trial, a significant difference in the worm egg count between the rotational and set stocked groups in favour of the rotational method of grazing. The initial and final liveweights prior to drenching were as follows:

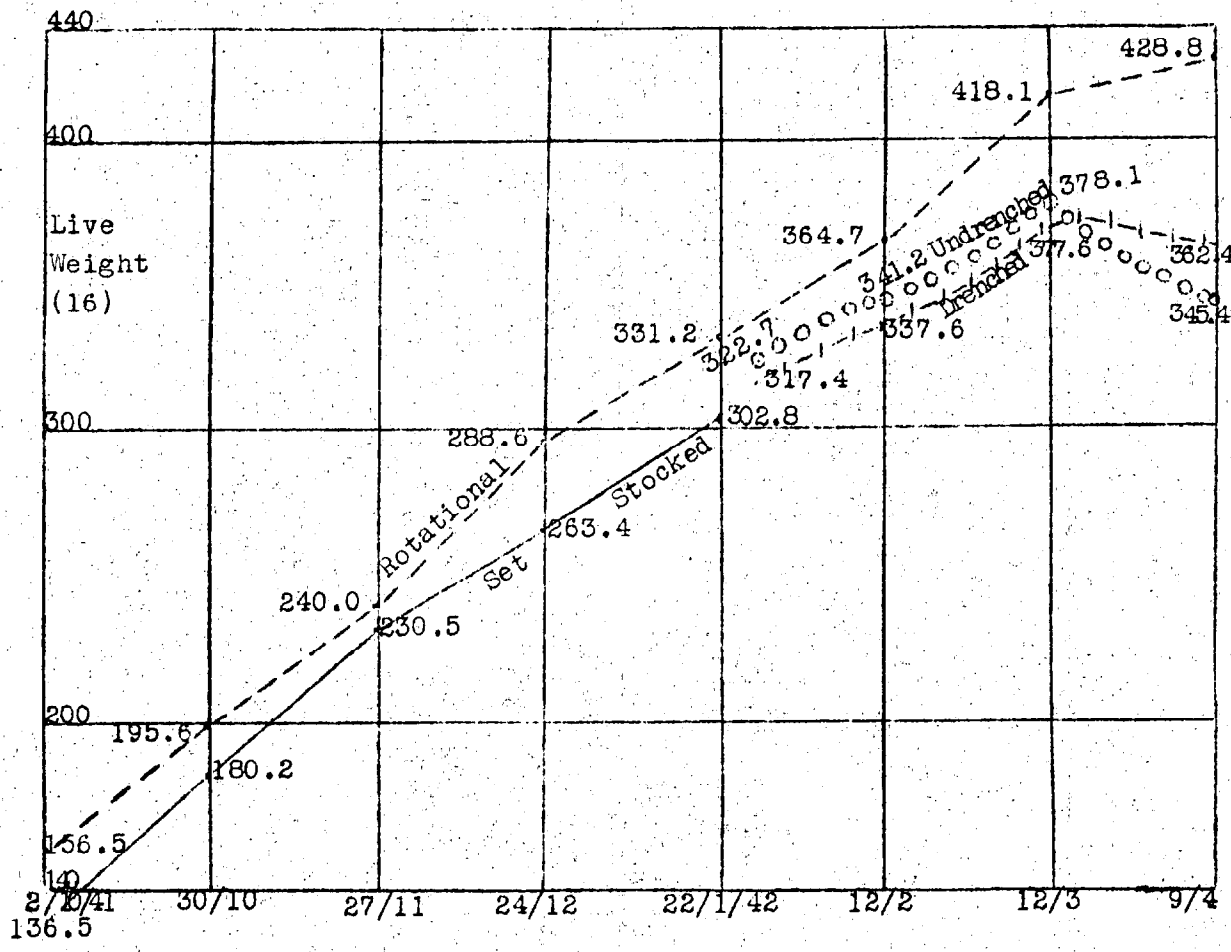
Group		Liveweight (lbs.) Initial 21.10.41.	Final 22.1.42.	Increase
3.	Set stocked group	136.5	302.8	166.3
4.	Rotationally grazed group	156.5	331.2	174.7

It will be seen that the initial difference of 20 lbs. in favour of the rotational group on the 21st October was only increased by the 22nd January by 8.4 lbs., but that the difference in favour of the rotational grazing widened rapidly from then onwards. The set stocked group was sub-grouped for drenching on the 29th January and the following initial and final weights were as follows:-

Group		Liveweight (lbs.) Initial 29.1.42.	Final 9.4.42.	Increase
3A.	Set Stocked, undrenched	322.7	345.4	22.7
3B.	Set Stocked, drenched	317.4	362.4	45.0
4	Rotationally grazed	342.8	428.8	86.0

The liveweight curves for the 1941-42 treatments are given in the following Graph:-

GRAPH 2. LIVE WEIGHT CURVES 1941-42.



1942-43 TRIALS: The trial was enlarged in the 1942-43 season to investigate two management factors, one being the value of the practice of running the calves with the milking herd compared with rotating them ahead of the herd. The other factor being the importance of the control of the pasture under set stocked conditions.

As was pointed out previously, a paddock grazed by calves when pasture growth is good rapidly becomes a series of overgrown patches and closely grazed areas. If, therefore, the problem was one of palatability of the pasture only, then control of the pasture by topping should improve the set stocked conditions.

Four groups of calves were selected to examine the points, and the treatments imposed for comparison were :-

1. Rotationally grazed ahead of the milking herd.
2. Grazed with the herd.
3. Set stocked uncontrolled pasture.
4. Set stocked pasture controlled by topping with the mower.

Drenching was not done in any Group.

Before summarising the results of the treatments, it must be pointed out that the 1942-43 season was not a normal one, and does not allow a fair indication of the results that would be obtained under better conditions of pasture growth. As is well known, the Waikato suffered a very dry season from January onwards and this affected the trial in several ways - e.g., the group running with the herd did not get the same chance of selective grazing that it would have had if pasture growth had been normal, and in competing with the cows the calves came off second best.

Again the set stocked paddocks did not become so markedly different from each other since the pasture dried up and topping with the mower was only done twice at wide intervals.

Poor pasture necessitated early supplementary feeding and silage had to be fed to all groups from March onwards, so that the intake of parasitic larvae was no doubt reduced compared to what would have been in a wet season. Moreover, the autumn rains did not come until May, when the ground temperature had dropped, and this again did not favour parasitic larvae.

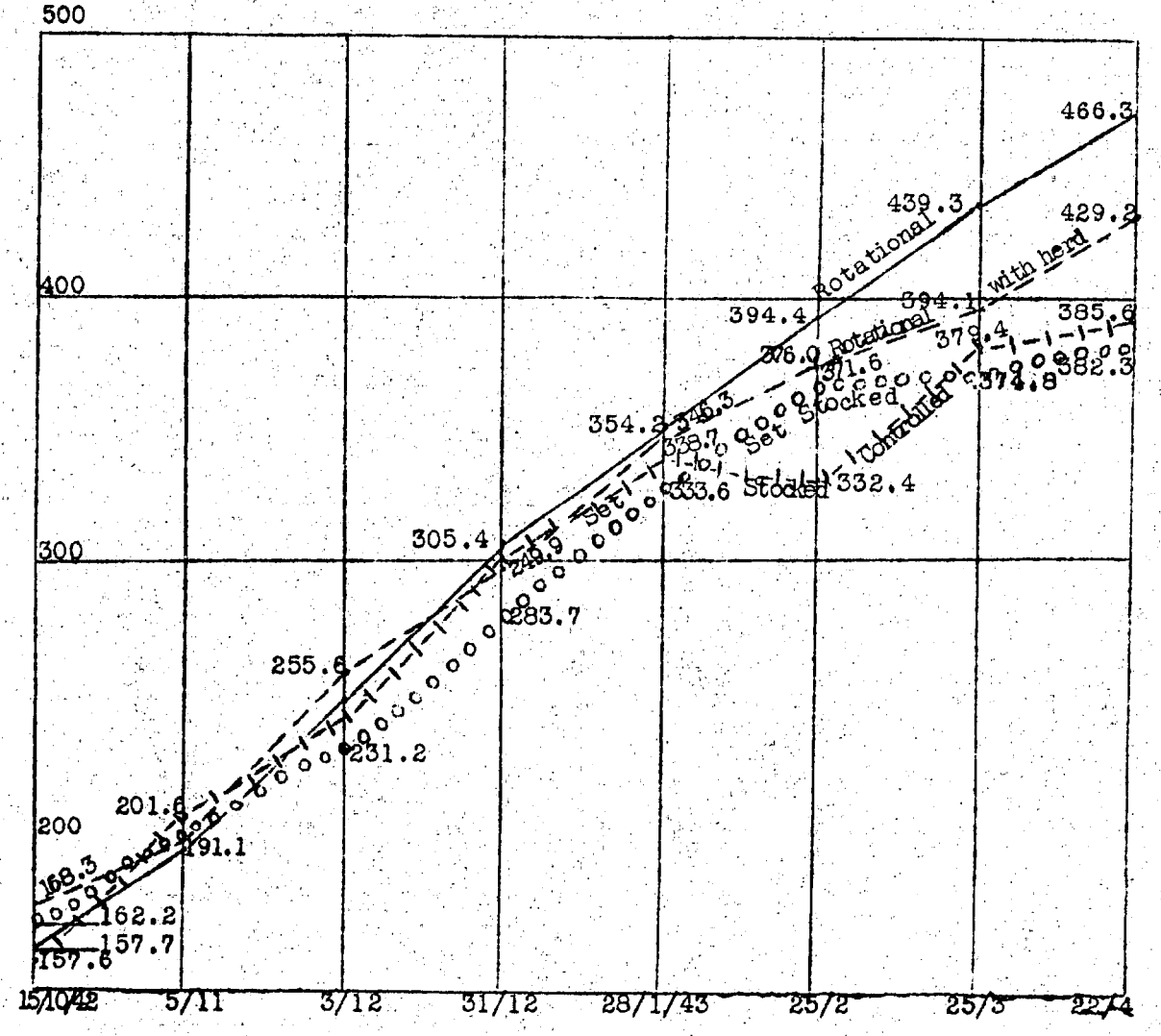
The treatments in 1942-43 commenced on October 13th, and the calves were divided into rotational and set stocked groups. On November 3rd, the rotational group was sub-grouped into rotational ahead of the herd and rotational with the herd, and on November 18th, the set stocked calves were sub-grouped and removed from the calf paddock to their respective areas.

Examination for parasitic infestation being conducted as in previous years.

The following summary of the initial and final liveweights and the growth curve for the four groups indicates the results obtained under the four treatments:-

Group	Liveweight (lbs) Initial 15.10.42.	Final 22.4.43.	Increase
5. Rotationally grazed ahead of cows	157.7	466.3	308.6
6. Rotationally grazed, with cows	168.3	429.2	260.9
7. Set stocked, pasture uncontrolled	162.2	382.3	220.1
8. Set stocked, pasture controlled	157.6	385.6	228.0

GRAPH 3. LIVEWEIGHT CURVES 1942-43.



The liveweight curves again show the superior growth obtained when the calves are rotationally grazed ahead of the herd but as in the previous years' treatments, the growth curves keep together fairly well until December or January, i.e., when pasture growth begins to slacken off. The group running with the herd does show a curve which is superior to that of the set stocked groups, but still considerably below that of the group which received the best pasture. As was pointed out previously, however, the 1942-43 season was abnormally dry and pasture scarce in the Waikato.

The two set stocked groups completed their trial with nothing significant between them in their mean liveweight, i.e., 385.6 and 382.3, while the mean liveweight for the group run with the herd was 429.2, i.e. about 45 lbs. heavier than the set stocked while those grazed ahead of the cows averaged 466.3, i.e., about 80 lbs. heavier than the set stocked groups. One further point of interest was that the worm egg counts for the respective groups showed similar, but much smaller differences between groups than in previous years and there were no "highly significant" differences although when the set stocked uncontrolled pasture group was compared with the other groups combined, there was a significant difference in favour of the latter, and also the control of the pasture by topping did improve set stocked conditions when compared with those obtained by letting the pasture become rank.

The foregoing has summarised the three years' work mainly from the experimental point of view but as one of the links in the chain of animal production and in reproduction, the investigation is also of importance. Poorly grown calves, which are the result of poor nutrition are undersized for mating the following spring and summer. Mating is in consequence delayed because the yearlings are both physically and sexually retarded. This in turn causes the two year old heifer to be late and undersized at parturition; which means that physical maturity is again retarded by lactation. As proof of this a number of grade heifers bought in last May averaged 766 lbs. at calving in July, while Ruakura heifers average 875 lbs. and the heifers bought in were quite well grown for commercial stock.

Reference:

(1) Taylor, E.L. The Interaction of Nutrition & Parasitism with special reference to Parasitic Gastritis. Vet.Record, Volume 55. 10. 1943.

DISCUSSION

Professor C.P. McMeekan: Emphasised the importance of the study from the viewpoint of effect on subsequent lactational performance, and expressed the hope that this aspect would be followed up. In respect to the question of size upon efficiency of production, he pointed out that, since all the main dairy breeds are roughly equal in their ability, efficiency in production per acre varies immensely with size, making the small Jersey the most efficient breed in New Zealand. Within a breed, however, production increases with size and, providing that the increase is proportionately greater than the size increase, the larger the Jersey the more efficient it will be. Data is required on this latter point.

Dr J.F. Filmer: Asked if there was any effective economic way of raising the plane of nutrition of weaned calves other than that of rotating them ahead of the cows?

Reply: Pasture is New Zealand's cheapest food and the cost of concentrates limits their use. The problem resolves itself into a choice between the cost of the time and labour involved in rotating the calves ahead of the cows and supplementary feeding. Prolonged feeding with separated milk might meet the situation.

Mr R.E.R. Grimmett: Asked if immunity to parasites was due to their not harmfully affecting well nourished animals or to their being actively repelled by such animals.

Reply: The animal is not immune to parasites but develops a resistance to harmful infestation. A high plane of nutrition is necessary for the development and upkeep of this resistance and the lowering of the plane of nutrition even in the adult is attended by a lowering of resistance and an increase of the parasites. Just how the resistance operates is not known because with one exception it is not known how the parasites exert their harmful effect.

Dr F.W. Dry: The work of Mr Ward and Dr McMahon has directed attention to the very great importance of non-genetic factors, and causes us to think especially of non-genetic factors acting early in life, or before birth, and producing lasting effect. The examination of a situation from the genetic angle may thus help to show the hopefulness of seeking results by means other than breeding.

Reply: In most of our animal research the genetic and the non-genetic factors are difficult to dissociate, for while we may endeavour to clearly define or eliminate the genetic aspect of a piece of work by large groups or replicate treatments, we do not appreciate the susceptibility of the very young animal to factors having a lasting effect or to the adaptability of the older animal to rise to the situation over a short period at any rate. The mature animal can, by drawing on its reserves, show no significant response under conditions which will retard the young animal for life. The permanent stunting of the young animal is an extreme case. There is no reason to suppose it does not exist in all gradations. The use of identical twin calves should help us to get a much clearer idea of the interaction of genetic and non genetic factors as they operate in the field. The increasing knowledge and use of hormones should also make it possible to extend or supplement the animals genetic and physiological make up.

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