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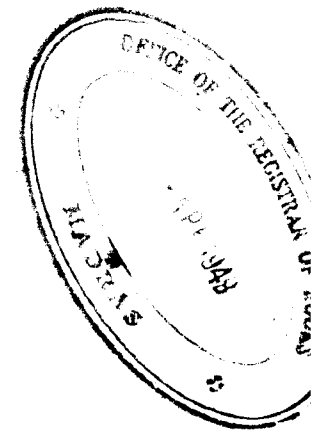
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# THE INDIAN VETERINARY JOURNAL

(The Journal of the India Veterinary Association)



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## NOTICE

# The Indian Veterinary Journal

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EDITOR :

P. SRINIVASA RAO, G.M.V.C.

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*(The Journal of The All-India Veterinary Association)*

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JANUARY, 1949

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## General Articles

AN ESTIMATE OF THE FOOD REQUIREMENTS OF MILCH  
AND OTHER CATTLE IN INDIA AND SUGGESTIONS AS  
TO HOW PRESENT AGRICULTURAL PRACTICE CAN BE  
ADJUSTED TO PROVIDE THEM\*

By

GRAHAME WILLIAMSON,

*Animal Husbandry Commissioner with the Government of India  
helped by K. P. R. Karthi and Ram Swarup, Animal Husbandry  
Bureau, Imperial Council of Agricultural Research*

The available statistics concerning cultivated crops, although they are admittedly inaccurate, do provide a reasonable working basis upon which to make an estimate of the fodder derived from these crops but in computing the part which the uncultivated sources of annual food play and which, after all, is the real mainstay of the livestock of the country, only a few vague indications may be gathered from published figures. Previous authors have used these in different ways and it is only a matter of opinion as to how close or how wide they have come to actuals.

The figures arrived at in this note, like those previously computed, are not absolute but can be taken only as an approximate indication of the most probable requirements and deficiencies. Only British India has been considered.

The following cattle population has to be fed:—

|                                               | Cattle     | Buffaloes  | Total |
|-----------------------------------------------|------------|------------|-------|
|                                               | (Millions) | (Millions) |       |
| (a) Weaned young stock (1 to 3 years old) ... | 17·4       | 5·9        | 23·3  |
| (b) Idle male stock ...                       | 2·2        | 0·2        | 2·4   |
| (c) Cows ...                                  | 36·4       | 15·0       | 51·4  |
| (d) Bullocks and bulls ...                    | 44·6       | 4·7        | 49·3  |

\* Presented before the Crops and Soils Wing Meeting held in December 1945 at Delhi.

The major sources of cattle food are: (1) grass, (2) specially grown fodder crops, (3) straws of food grains, (4) cotton seed and oilcakes, (5) by-products such as bran.

Sufficient grass grows in the country each year to provide an immense quantity of food for animals but, in practice, most of it has to be obtained by grazing and thus its usefulness is limited to certain classes of livestock, that is, those which have time to graze and need no special form of concentrates. It is considered that these resources are available for and can meet the requirements of idle male stock and all cows (excluding female buffaloes used for milk production), that they meet half the maintenance requirements of working bullocks, as these animals are fully employed for about half the year only, and that growing young stock can obtain all their requirements from this source. The amount of milk produced to-day in British India is estimated to be 19.7 million tons, of which 3.3 million tons are used by calves. It is desired to increase that output some three times but that target is, for the time being, unattainable and all that seems practicable is an increase of 50 per cent to bring the total to 28 million tons. This involves no increase in the number of cows.

For purpose of calculation here, the food requirement other than those supplied by grass can most conveniently be expressed in terms of starch equivalent (S. E.) and digestible protein (D. P.) and the amounts of these which are needed are given in Table I.

TABLE I

The starch equivalent and digestible protein required

|                                                                                                    | Total requirements in million tons per annum |       |
|----------------------------------------------------------------------------------------------------|----------------------------------------------|-------|
|                                                                                                    | S.E.                                         | D.P.  |
| Production requirements for 28 million tons of milk ...                                            | 8.85                                         | 1.43  |
| Maintenance of 14 million buffaloes (average live weight 1,000 lb.) ...                            | 13.80                                        | 1.38  |
| Maintenance of 49.3 million working bullocks and bulls (average weight 600 lb.) for six months ... | 19.79                                        | 1.64  |
| Requirements for work (medium work 4 hours daily at 4.1 lb. S.E. and 0.8 lb. D.P. per day) ...     | 33.32                                        | 6.56  |
| Total ...                                                                                          | 70.76                                        | 11.01 |

The ratio of D.P. to S.E. required is 1: 6.43. The nature of the foods which could provide that, the amounts available and the extent of the deficiency is stated in Table II.

TABLE II

Food necessary to provide the required proportion of D. P. and S. E.

|                     | Proportions required | Percentage of composition |       | P at production in million tons | Required in million tons | Deficiency in million tons |
|---------------------|----------------------|---------------------------|-------|---------------------------------|--------------------------|----------------------------|
|                     |                      | S. E.                     | D. P. |                                 |                          |                            |
| Green fodder ...    | 20                   | 10                        | 1.5   | 78.1                            | 182.6                    | 104.5                      |
| Straw ...           | 12                   | 22.5                      | 0.0   | 87.2                            | 109.6                    | 22.4                       |
| Cakes and seed ...  | 3                    | 73.0                      | 25.0  | 3.4                             | 27.4                     | 24.0                       |
| Rice and wheat bran | 2                    | 43.0                      | 8.0   | 1.3                             | 18.3                     | 17.0                       |

The gap between requirements and present production is very wide. In trying to plan how these quantities can be made good, the human requirements must, of course, receive primary consideration but by a readjustment of the cropping programme it appears possible to meet the needs of both human beings and cattle.

The cultivated land in India is now divided for crops roughly as under :

|                                   | Million acres |
|-----------------------------------|---------------|
| Food grains excluding gram ...    | 174           |
| Gram ...                          | 15.5          |
| Oilseeds ...                      | 15.5          |
| Cotton seed ...                   | 14.9          |
| Fodder crops ...                  | 10.5          |
| Others ...                        | 50            |
| Total ...                         | 280.5         |
| Cultivable waste ...              | 92            |
| Forests ...                       | 67            |
| Not available for cultivation ... | 94            |
| Total ...                         | 533.4         |

The present production of cereals is estimated by the Nutrition Advisory Committee of the Indian Research Fund Association to be 13 per cent short of human requirements and there is a 20 per cent shortage of pulses and a 330 per cent shortage of oils and fats. It has been accepted that as a result of various measures under consideration of the Governments, it is not unreasonable to assume that there will be a 50 per cent increase in the yield from land in 10 to 15 years time. As that target is attained it will be possible to produce 13 per cent increase in the present quantity of cereals on 131 acres, releasing 43 million acres which may be devoted, as suggested below, towards making up deficiencies in human and livestock requirements.

As stated above the production of oils and fats needs to be increased 330 per cent in order to provide food for human beings. At the increased rate of yield, the 15.5 million acres now used must be increased to 34 million acres and thus 18.5 million acres more have to be used for that

crop. At present 2.5 million tons of edible oil cakes are produced. When the area and yield are increased, 8.25 million tons will be available. Adding the uncrushed cotton seed which is fed at present, that is 0.94 million tons, the total of cakes and seed will amount to 9.2 million tons. No increase in the acreage under cotton seed is envisaged.

To augment the supplies of concentrated food it is suggested that the present acreage under gram and barley, which are good cattle feeds, may be increased as much as possible or crops of equivalent value where gram and barley cannot be grown. Six million acres are, however, required for the cultivation of green fodder; the remaining 18.5 million acres can be devoted to the cultivation of gram and cereals for cattle. On that acreage, 4.5 and 5.32 million tons respectively can be raised.

The six million acres which may be allotted to green fodder crops along with the 10.3 million acres at present used should provide, on the increased yield scale, the amount required. More nutrients can be made available from this land if leguminous fodder like lucerne and berseem are grown but, assuming that the present proportion between the various fodders persists, the 50 per cent increase of the present output of 7.5 tons per acre on 16.5 million acres will produce 185.6 million tons at 11.25 tons per acre. Straw will remain practically the same as at present. The food provided when the above change is introduced in the cropping programme will be as indicated in Table III.

TABLE III  
*Food provided after changes in the cropping programme*

| Feeding stuffs      | Total weight             |                                   | S.E.     |              | D.P.     |              |
|---------------------|--------------------------|-----------------------------------|----------|--------------|----------|--------------|
|                     | Required in million tons | Feed provided for in million tons | Required | Provided for | Required | Provided for |
| Green fodder        | ...                      | 182.6                             | 185.6    | 18.26        | 18.56    | 2.74         |
| Straw               | ...                      | 109.6                             | 114.4    | 24.66        | 25.74    | 2.78         |
| <i>Total</i>        | ...                      |                                   | 42.92    | 44.30        | 2.74     | 2.78         |
| Cakes and seed      | ...                      | 27.4                              | 9.15     | 20.00        | 6.68     | 6.85         |
| Rice and wheat bran | ...                      | 18.3                              | 1.47     | 7.78         | 0.63     | 1.46         |
| Gram                | ...                      |                                   | 4.5      | ...          | 3.20     | ...          |
| Barley              | ...                      |                                   | 5.32     | ...          | 4.04     | ...          |
| <i>Total</i>        | ...                      |                                   | 27.87    | 14.55        | 8.31     | 3.39         |
| <i>Grand Total</i>  | ...                      |                                   | 70.79    | 58.85        | 11.05    | 6.17         |
| <i>Shortage</i>     | ...                      |                                   | 11.94    | 4.88         |          |              |

The only way in which this deficiency can be made up is by an extended programme of making hay or silage out of the surplus grass which is available during monsoon, and which is otherwise wasted. There are 136 million acres of grazing land in British India. No precise data are available as to how much grass this land produces. The limited information we have goes to show that the production of grass is about two tons green per acre. A third of this can be made into hay or silage, giving the equivalent of 90 million tons of green grass. Assuming the grass to have the value of 6.2 per cent S. E. containing 1.33 D. P., it will provide 5.6 million tons of S. E. with 1.2 million tons of D. P. This still leaves a deficiency of 6.34 million tons of S. E. and 3.68 million tons of D. P. That can be met from concentrated protein food of animal origin of which fish meal should supply a large proportion.

It is recognised that while the ultimate objective must be the provision of food which will allow the cattle of this country to maintain health and to produce on the most paying basis, it is necessary in practice to concentrate on intermediate goals which can be progressively raised as agricultural conditions improve. These intermediate goals must differ from region to region according to markets, agricultural practices, prejudices, etc.; the exact goals are, therefore, a matter of individual administrations to determine.

It is improbable that administrative units can become self-sufficient; inter-adjustment in the supply of protein concentrates must continue. That class of foodstuffs being relatively non-bulky is transportable and thus the difficulty is not insoluble. Table IV illustrates the present position in regard to them.

TABLE IV  
*Present position in regard to foodstuffs*

| Province | Present food available expressed as |         | Ratio of D.P. to S.E. |
|----------|-------------------------------------|---------|-----------------------|
|          | S.E.                                | D.P.    |                       |
| Punjab   | 6,206,579                           | 673,703 | 1 : 9.21              |
| Sind     | 623,817                             | 49,877  | 1 : 12.5              |
| Bengal   | 2,933,233                           | 87,165  | 1 : 33.66             |
| Assam    | 626,548                             | 17,89   | 1 : 35.22             |

The foregoing estimates give what is considered to be an all-India picture of the stock feed position and needs. As a first stage towards the ultimate aim, attention should be given to the production of what is now recognised to be the primary human food requirement from cattle as

expressed by the Nutrition Advisory Committee of the Indian Research Fund Association (1944) and the Agricultural Policy Committee No. 5 (Agriculture, Forestry and Fisheries), that is, the production of more milk and the work entailed in cultivating the land.

As far as the latter need is concerned, it must be admitted that what bullocks there are do in fact cultivate the present acreage although on their low nutrient level they do not do so in an economical manner but, for the immediate present, the standard as it is must be accepted.

Such, however, need not be the case in regard to increased milk production for it has been abundantly proved that immediate returns are to be had from better feeding. If these returns are to be maintained and increased, attention must be paid to the development of the rising and future generations of cows. As an immediate object then, the requirements may be expressed as the production of food for 8.1 million tons of milk per annum, *i.e.*, 50 per cent more than the present supply and for the growth of heifers. The food required is extra to that now grown and it must be produced largely from concentrates because (1) the maintenance requirements of the cows and buffaloes and the present supply of milk is mainly derived from the bulky uncultivated food; (2) a milk production ration necessitates a high proportion of proteins; and (3) the milk is required for heavily populated areas and if it is to be delivered there in the fluid state, it must be produced in or near these areas; such areas have few grazing facilities and so, for the most part, the milch animals and special young stock must be stall fed. A certain amount of green fodder must be provided because there is a lack of it in the present ration. The requirements, as far as milk is concerned, may, therefore, be stated as 2.56 million tons of S.E. and 0.47 million tons of D.P. with a nutritive ratio of 1:6.

The following feeding stuffs (Table V) fed approximately in the proportion stated below, will provide that:

TABLE V  
*Extra feed required for milk*

|                       | Average<br>per cent of<br>S.E. | Average<br>per cent of<br>D.P. | Proportion | Quantity<br>recorded in<br>million tons |
|-----------------------|--------------------------------|--------------------------------|------------|-----------------------------------------|
| Green fodder          | 10                             | 1.5                            | 20         | 10.22                                   |
| Cakes and oil seeds   | 73                             | 25.0                           | 1          | 1.51                                    |
| Gram or other legumes | 71                             | 13.0                           | 2          | 1.02                                    |
| Cereal by-products    | 43                             | 8.0                            | 2          | 1.02                                    |

As regards feed for heifer calves, it is estimated that 8.8 million of the present female young stock are undergrown and that early returns may

be expected from better feeding. The nature of the concentrates they need may be expressed as indicated in Table VI.

TABLE VI  
*Extra feed for heifer calves*

|                       | Proportion | Quantity<br>(in million<br>tons) |
|-----------------------|------------|----------------------------------|
| Cakes and oil seeds   | 2          | 0.32                             |
| Gram or other legumes | 1          | 0.16                             |
| Cereal by-products    | 2          | 0.32                             |

The total extra requirements for both forms of production and the present estimated production are given in Table VII.

TABLE VII  
*Total extra requirements*

|                     | Estimated<br>present<br>production | Extra<br>quantity<br>required | Percentage<br>of increase<br>desired |
|---------------------|------------------------------------|-------------------------------|--------------------------------------|
|                     | Million tons                       | Millions                      |                                      |
| Green fodder        | 78.1                               | 10.22                         | 13                                   |
| Cakes and oil seeds | 3.4                                | 0.83                          | 25                                   |
| Gram and pulses     | ...                                | 1.18                          | 100                                  |
| Rice and wheat bran | 1.32                               | 1.34                          | 102                                  |

A plan to meet these needs may be formulated on the same basis as that previously used but in this case the proportions of the foods are somewhat different and although it cannot be assumed that a 50 per cent increase in the land yield can be expected in the time under consideration, calculations may be based upon a proportionate increase of 25 per cent but again human requirements from the land are of primary consideration. After human needs in cereals are met, 17 million acres of land will be released from these crops and simultaneously the production of cereal by-products will be increased by 0.13 million tons. By the same practice, 0.62 million acres will be released from pulse production. On the other hand, 12.4 million extra acres will be needed for oil crops if the target is to provide for even half of the present human deficiency, but it will provide 3.1 million tons of extra oilcakes. The immediate need of 10.22 million tons of green fodder should be covered in a 25 per cent increase in yield of the present acreage. The position then would be, in relation to the limited target set, that there is a surplus of 2.27 million tons of oilcake and

a deficiency of 1.18 million tons of gram and pulses and 1.21 million tons of cereal by-products, while there is 5.22 million acres of land available for further use. It should be employed for the production of either gram, pulses or cereals which will approximately meet the balance of requirements.

### A STUDY OF THE CELLULAR ELEMENTS AND HAEMOGLOBIN CONTENT OF THE BLOOD OF SOUTH INDIAN CATTLE

BY

K. N. GOVINDAN NAYAR, K. T. K. NAMBIAR and G. A. SASTRY

*Department of Physiology, Madras Veterinary College.*

It has been known from a very long time that the cellular elements of the blood of animals normally vary within limits and widely under pathological conditions. Since the pathological variations are marked, an enumeration of the cellular elements per unit volume of blood is of very great importance in clinical diagnosis. The clinical application is made use of in veterinary field also to a great extent. As the normal variations in itself are of a wide range, correct data about the same under different conditions is of importance in arriving at a correct diagnosis. Till now, in this College, references were being made for the normal values to the figures given in standard text books, all of which pertain to the foreign breeds of cattle. How far these figures were applicable to the South Indian breeds of cattle was not clear and, with this purpose, this work was undertaken. Along with this, the normal differential leucocytic counts and the Haemoglobin values were also estimated.

According to Dukes, the normal average R.B.C. count for cattle is 6.3 millions and for the W.B.C. count 7900 per Cmm; the differential leucocytic count being—Lymphocytes 64 per cent, Neutrophils 21 per cent, Eosinophiles 5 per cent, and Monocytes 10%. The average Haemoglobin value according to him is 12 gms. per cent.

Other foreign workers have observed that "blood Hb. in cattle and sheep vary normally between 8 and 17% with an average of 11.5 per cent and a figure between 9.5 and 13.5 considered as normal."

In India, Sankaranarayanan (1937) and Mullick and Pal (1943&1945) have done some work on the haematology of Indian cattle and have observed that the normal R.B.C. count in adult cattle in Izatnagar was 8.1 millions per Cmm., and the normal W.B.C. count was 9000 per Cmm. The Hb. value according to them was between 11 and 12.5 gms. per 100 cc. of blood.

How far the above values can be applied to the South Indian cattle has not been worked out till now and though ours is only in the nature of a preliminary enquiry, and, not done in quite ideal and controlled conditions, still, it gives us a fair idea of the normal values in the cattle of this presidency.

#### TECHNIQUE

Oxalated blood was collected from healthy adult bullocks and cows. R.B.C. and W.B.C. counts were taken by means of the Thoma-Zeiss Haemocytometer and the diluents used were Hayem's and Thoma's fluids respectively.

Differential leucocytic counts were taken from an average of 300 leucocytes counted, and the percentage of each category calculated. Unoxalated blood smears were taken direct from the venous blood of the animal as oxalated blood smears were not found to give satisfactory results due to the extreme shrinkage of the cells, and consequent difficulty in identification.

Haemoglobin estimations were made in Gms. per 100 cc. of blood. The method adopted was Wong's method of estimation by finding the iron content of the blood and subsequently the Hb. from the same. But, during the later stages of the work, the photoelectric-colorimetric method (acid haematin) was used. The variations in values between the two methods adopted were very negligible.

The results of the analysis are given in the tables appended.

#### OBSERVATIONS

The average counts of R.B.C. and W.B.C. from 80 animals belonging to the different breeds of cattle were found to be 6.53 millions and 8100 per Cmm. respectively. Individual variations existed from 4 to 10 millions in the case of R.B.Cs and from 4 to 14 thousands in the case of W.B.Cs. The result of Hb. values obtained from 40 animals was found to be 9.1 gms. per 100 cc. of blood with individual variations from 7 to 12 gms.

An examination of the differential leucocytic counts revealed a close similarity in those of the 30 Mysore type of animals that were examined. We may point out, however, that the animals referred to above, were not animals possessing any pedigree or other relevant history sheets to certify to their breed. But they were all animals having the breed characteristics in their general appearance and build. From these data it is suggestive that it is possible to have a distinctly similar leucocytic picture in each of the various cattle breeds and a confirmation of this is possible only after a

TABLE I

| Sp. No. | R.B.C. in millions per c.m.m. | W.B.C. per c.m.m. | Differential leucocytic Counts |              |              |           | Hb gms% |
|---------|-------------------------------|-------------------|--------------------------------|--------------|--------------|-----------|---------|
|         |                               |                   | Lymphocytes                    | Neutrophiles | Eosinophiles | Monocytes |         |
| 1       | 6.705                         | 8100              | 59.9                           | 29.9         | 9.0          | 1.2       |         |
| 2       | 7.240                         | 9200              | 56.0                           | 39.4         | 2.4          | 2.2       |         |
| 3       | 5.610                         | 6000              | 47.9                           | 41.7         | 8.5          | 1.9       |         |
| 4       | 4.410                         | 7200              | 58.6                           | 27.6         | 11.7         | 2.0       |         |
| 5       | 8.900                         | 7000              | 50.9                           | 33.9         | 14.8         | 0.1       |         |
| 6       | 5.140                         | 12800             | 80.0                           | 12.0         | 6.0          | 2.0       |         |
| 7       | 7.09                          | 12600             | 68.82                          | 25.45        | 3.90         | 1.83      |         |
| 8       | 6.52                          | 9300              | 57.14                          | 35.24        | 6.48         | 1.11      |         |
| 9       | 5.34                          | 9200              | 67.3                           | 25.1         | 6.7          | 0.9       |         |
| 10      | 10.395                        | 12000             | 76.0                           | 19.0         | 1.2          | 3.8       |         |
| 11      | 6.280                         | 9800              | 58.49                          | 35.09        | 3.50         | 2.92      |         |
| 12      | 9.865                         | 7900              | 77.5                           | 14.2         | 6.2          | 2.1       |         |
| 13      | 7.518                         | 9400              | 68.97                          | 21.90        | 7.94         | 1.89      |         |
| 14      | 6.482                         | 8700              | 76.9                           | 18.1         | 1.5          | 3.5       |         |
| 15      | 7.353                         | 7600              | 55.48                          | 33.79        | 7.77         | 2.96      |         |
| 16      | 7.480                         | 8100              | 60.0                           | 20.2         | 13.6         | 1.2       |         |
| 17      | 7.360                         | 8900              | 59.5                           | 25.7         | 10.0         | 4.8       |         |
| 18      | 8.030                         | 10800             | 68.0                           | 21.0         | 5.0          | 6.0       |         |
| 19      | 5.630                         | 10300             | 55.0                           | 23.0         | 20.0         | 2.0       |         |
| 20      | 5.730                         | 10600             | 78.0                           | 12.0         | 7.0          | 3.0       |         |
| 21      | 6.290                         | 6000              | 53.0                           | 31.0         | 12.0         | 4.0       |         |
| 22      | 6.800                         | 11400             | 46.0                           | 46.0         | 5.0          | 3.0       |         |
| 23      | 6.280                         | 5.900             | 35.3                           | 61.1         | 1.0          | 2.3       |         |
| 24      | 5.560                         | 6400              | 65.0                           | 27.0         | 6.0          | 2.0       |         |
| 25      | 6.440                         | 6500              | 57.0                           | 33.0         | 5.0          | 5.0       |         |
| 26      | 7.750                         | 6200              | 55.5                           | 33.5         | 7.5          | 3.5       |         |
| 27      | 7.110                         | 16100             | 76.0                           | 16.0         | 6.0          | 2.0       |         |
| 28      | 7.980                         | 9600              | 56.5                           | 36.5         | 6.0          | 1.0       |         |
| 29      | 7.140                         | 10400             | 20.6                           | 67.0         | 27.0         | 1.0       |         |
| 30      | 6.380                         | 6400              | 73.5                           | 21.5         | 1.0          | 2.0       |         |
| 31      | 7.420                         | 7000              | 73.0                           | 21.0         | 3.0          | 4.0       |         |
| 32      | 5.420                         | 10400             | 82.0                           | 9.0          | 5.0          | 4.0       |         |
| 33      | 7.900                         | 13600             | 52.5                           | 32.0         | 11.5         | 4.0       |         |
| 34      | 5.500                         | 8600              | 71.0                           | 22.0         | 5.0          | 2.0       |         |
| 35      | 6.060                         | 7000              | 71.0                           | 22.0         | 3.0          | 4.0       |         |
| 36      | 7.150                         | 11000             | 78.5                           | 8.0          | 13.0         | 0.5       |         |
| 37      | 5.600                         | 7200              | 67.0                           | 26.5         | 5.5          | 1.0       |         |
| 38      | 6.340                         | 8400              | 69.0                           | 21.0         | 7.5          | 2.5       |         |
| 39      | 6.540                         | 6100              | 62.5                           | 18.5         | 14.0         | 5.0       |         |
| 40      | 5.310                         | 8500              | 68.0                           | 17.0         | 14.0         | 1.0       |         |
| 41      | 5.940                         | 5200              | 51.0                           | 42.0         | 1.0          | 1.0       | 8.3     |
| 42      | 5.550                         | 8500              | 50.5                           | 32.0         | 5.0          | 5.0       | 8.5     |
| 43      | 5.370                         | 10100             | 52.5                           | 33.0         | 5.0          | 5.0       | 10.5    |
| 44      | 6.190                         | 9200              | 50.0                           | 43.0         | 4.0          | 4.0       | 8.5     |
| 45      | 6.800                         | 8400              | 55.0                           | 42.0         | 2.0          | 2.0       | 10.6    |
| 46      | 4.970                         | 9000              | 75.0                           | 21.0         | 2.0          | 2.0       | 9.0     |
| 47      | 5.810                         | 7400              | 60.0                           | 36.0         | 2.0          | 2.0       | 9.0     |
| 48      | 5.400                         | 2800              | 76.5                           | 18.0         | 2.5          | 2.5       | 9.0     |
| 49      | 5.120                         | 7600              | 37.2                           | 57.6         | 2.6          | 2.6       | 8.3     |
| 50      | 4.590                         | 11000             | 69.5                           | 27.0         | 4.0          | 4.0       | 8.3     |
| 51      | 3.790                         | 7600              | 48.0                           | 42.0         | 2.5          | 2.5       | 8.3     |
| 52      | 5.980                         | 6000              | 41.0                           | 54.0         | 2.0          | 2.0       | 6.2     |
| 53      | 6.100                         | 9700              | 64.5                           | 25.0         | 6.0          | 6.0       | 9.7     |
| 54      | 9.465                         | 9100              | 57.0                           | 40.2         | 1.4          | 1.4       | 10.0    |
| 55      | 5.600                         | 3000              | 59.6                           | 38.8         | 1.0          | 1.0       | 12.0    |
| 56      | 6.750                         | 3200              | 67.5                           | 24.5         | 2.0          | 2.0       | 8.3     |
| 57      | 4.960                         | 4000              | 63.0                           | 28.5         | 3.0          | 3.0       | 8.0     |
| 58      | 4.700                         | 3400              | 53.2                           | 30.0         | 8.0          | 8.0       | 9.7     |
| 59      | 5.050                         | 4600              | 53.3                           | 30.0         | 4.0          | 4.0       | 8.0     |
| 60      | 5.285                         | 4600              | 36.7                           | 43.3         | 6.7          | 6.7       | 11.8    |
| 61      | 3.925                         | 4200              | 47.0                           | 49.0         | 1.0          | 1.0       | 9.7     |
| 62      | 5.820                         | 10600             | 72.0                           | 21.0         | 4.0          | 4.0       | 8.0     |
| 63      | 6.750                         | 6000              | 89.0                           | 9.0          | 1.0          | 1.0       | 9.0     |
| 64      | 6.300                         | 8600              | 70.0                           | 21.0         | 3.0          | 3.0       | 11.2    |
| 65      | 2.400                         | 4000              | 65.0                           | 30.0         | 4.0          | 4.0       | 10.0    |
| 66      | 5.260                         | 6600              | 58.0                           | 30.0         | 5.5          | 5.5       | 5.0     |
| 67      | 7.020                         | 5400              | 55.0                           | 33.0         | 2.0          | 2.0       | 7.0     |
| 68      | 10.540                        | 10400             | 52.0                           | 36.0         | 2.0          | 2.0       | 10.2    |
| 69      | 4.780                         | 10400             | 57.0                           | 25.0         | 2.0          | 2.0       | 12.1    |
| 70      | 6.600                         | 7200              | 50.0                           | 46.0         | 1.0          | 1.0       | 4.6     |
| 71      | 11.210                        | 8000              | 88.0                           | 22.0         | 4.0          | 4.0       | 7.4     |
| 72      | 6.530                         | 12000             | 49.0                           | 14.0         | 5.0          | 5.0       | 9.5     |
| 73      | 8.320                         | 7200              | 65.0                           | 28.0         | 2.0          | 2.0       | 8.0     |
| 74      | 6.460                         | 6200              | 69.0                           | 24.5         | 2.0          | 2.0       | 9.6     |
| 75      | 6.960                         | 10000             | 71.5                           | 19.5         | 2.1          | 2.1       | 11.0    |
| 76      | 5.920                         | 6800              | 43.5                           | 45.5         | 3.5          | 3.5       | 7.7     |
| 77      | 7.460                         | 6200              | 68.0                           | 25.0         | 2.0          | 2.0       | 9.0     |
| 78      | 5.690                         | 13200             | 67.0                           | 24.0         | 3.0          | 3.0       | 10.6    |
| 79      | 5.420                         | 7200              | 60.0                           | 20.0         | 1.5          | 1.5       | 11.5    |
| 80      |                               |                   | 50.0                           | 41.0         | 2.0          | 2.0       | 8.0     |
| Average | 6.530                         | 8100              |                                |              |              |           | 9.1     |

TABLE II

Differential Leucocytic counts from the 30 Mysore type of animals Examined.

| S. No.  | Lymphocytes % | Neutrophiles % | Eosinophiles % | Monocytes % |
|---------|---------------|----------------|----------------|-------------|
| 7       | 69            | 25             | 4              | 2           |
| 9       | 67            | 25             | 7              | 1           |
| 10      | 76            | 19             | 1              | 4           |
| 12      | 78            | 14             | 6              | 2           |
| 13      | 69            | 22             | 7              | 2           |
| 14      | 77            | 18             | 2              | 3           |
| 18      | 68            | 21             | 5              | 6           |
| 20      | 78            | 12             | 7              | 3           |
| 24      | 65            | 27             | 6              | 2           |
| 26      | 56            | 34             | 7              | 3           |
| 27      | 76            | 16             | 6              | 2           |
| 30      | 72            | 21             | 4              | 2           |
| 31      | 73            | 21             | 3              | 4           |
| 34      | 71            | 22             | 5              | 2           |
| 35      | 71            | 22             | 3              | 4           |
| 36      | 78            | 8              | 13             | 1           |
| 37      | 67            | 26             | 6              | 1           |
| 40      | 68            | 17             | 14             | 1           |
| 45      | 55            | 42             | 1              | 2           |
| 50      | 64            | 27             | 6              | 4           |
| 53      | 65            | 25             | 3              | 6           |
| 58      | 53            | 30             | 9              | 8           |
| 64      | 70            | 21             | 6              | 3           |
| 71      | 68            | 22             | 6              | 4           |
| 73      | 65            | 28             | 5              | 2           |
| 74      | 69            | 45             | 8              | 3           |
| 76      | 44            | 25             | 5              | 2           |
| 77      | 68            | 24             | 5              | 2           |
| 78      | 67            | 24             | 6              | 3           |
| 79      | 60            | 20             | 19             | 1           |
| Average | 68            | 23             | 6              | 3           |

TABLE III

The differential leucocytic counts from 37 Non-Descript Animals.

| S. No   | Lymphocytes<br>% | Neutrophiles<br>% | Eosino philes<br>% | Monocytes<br>% |
|---------|------------------|-------------------|--------------------|----------------|
| 1       | 60               | 30                | 9                  | 1              |
| 2       | 56               | 40                | 2                  | 2              |
| 4       | 59               | 27                | 12                 | 2              |
| 5       | 51               | 34                | 14                 | 1              |
| 8       | 57               | 35                | 7                  | 1              |
| 9       | 58               | 35                | 4                  | 3              |
| 15      | 55               | 34                | 8                  | 3              |
| 16      | 60               | 25                | 14                 | 1              |
| 17      | 59.5             | 25.7              | 10                 | 4.8            |
| 19      | 55               | 23                | 20                 | 2.8            |
| 21      | 53               | 31                | 12                 | 4              |
| 23      | 36               | 61                | 1                  | 2              |
| 25      | 57               | 33                | 5                  | 5              |
| 28      | 56               | 37                | 6                  | 1              |
| 29      | 67               | 27                | 1                  | 5              |
| 33      | 53               | 32                | 11                 | 4              |
| 39      | 62               | 19                | 14                 | 5              |
| 41      | 51               | 42                | 6                  | 1              |
| 42      | 51               | 32                | 12                 | 5              |
| 43      | 52               | 33                | 10                 | 5              |
| 44      | 50               | 43                | 3                  | 4              |
| 47      | 60               | 36                | 2                  | 2              |
| 49      | 37               | 58                | 3                  | 2              |
| 51      | 48               | 42                | 8                  | 2              |
| 52      | 41               | 52                | 3                  | 2              |
| 54      | 57               | 40                | 2                  | 1              |
| 55      | 59               | 39                | 1                  | 1              |
| 59      | 53               | 30                | 13                 | 4              |
| 61      | 47               | 49                | 3                  | 1              |
| 66      | 58               | 30                | 7                  | 5              |
| 67      | 55               | 33                | 10                 | 2              |
| 68      | 52               | 36                | 10                 | 2              |
| 69      | 57               | 25                | 15                 | 3              |
| 70      | 50               | 46                | 3                  | 1              |
| 80      | 50               | 41                | 7                  | 2              |
| 38      | 69               | 46                | 5                  | 3              |
| 22      | 46               | 21                | 7                  | 3              |
| Average | 54               | 36                | 7                  | 3              |

more detailed examination. Here, we may suggest, that the proper place for such work will be the various approved farms in this Province where pure bred animals may be obtained and variations due to other factors can be studied under controlled conditions.

In all these animals, a lymphocytic count varying from 60 to 70 per cent and neutrophilic count varying from 18 to 25 per cent were obtained. The average differential count was: Lymphocytes—68 per cent; Neutrophiles—23 per cent; Eosinophiles—6 per cent and Monocytes—3 per cent.

The comparative leucocytic picture from 37 other animals which could not be described as belonging to any particular breed and were all of the non-descript variety is given in the table. The average count in these cases were Lymphocytes—54 per cent; Neutrophiles—36 per cent; Eosinophiles—7 per cent and Monocytes 3 per cent.

## ACKNOWLEDGEMENTS

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## BACTERIAL CHEMOTHERAPY IN VETERINARY MEDICINE\*

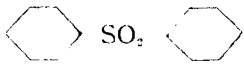
By

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## INTRODUCTION

By introducing the term 'chemotherapy' Ehrlich intended to mark off from the general body of pharmacology a particular type of investigation having as its aim the discovery of chemical substances acting specifically on pathogenic infections. His motive was to shift the interest of pharmacologists from the host to the attacking parasite. The aim of chemotherapy was to find substances maximally toxic for the parasite and minimally toxic for the host. The development of this work was described by Dale (1923), who emphasized that despite Ehrlich's concepts no really fundamental advance had been made in our knowledge of chemotherapy.

With the advent of the sulphonamides Ehrlich's general concepts were largely confirmed and an immense impetus was given to chemotherapeutic research, but a very large number of compounds usually have to be tested before a satisfactory drug is produced. Even when one has found a highly active drug there are many pitfalls, which are illustrated by the work on 4: 4'-diamino-diphenyl sulphonate  $H_2N$    $SO_2$    $NH_2$ . It was originally shown (Buttle *et al.*, 1937) that it was highly active against streptococcal infections in mice, but it was soon found that, due to methaemoglobin production and cyanosis, it was too toxic for use in man. McEwen *et al.* (1941) found that it was well tolerated in cattle and starting from these observations we began to study its properties.

We found that it was more active than any of the sulphonamides against *Str. agalactiae* and produced the most persistent blood-levels in calves. Then came disappointments. Moderately large doses in sheep were liable to produce toxic nervous symptoms and the drug produced methaemoglobinaemia in pigs and horses. It seemed, however, that it would be valuable in the treatment of calf diseases until we found that, instead of being more active than the heterocyclic sulphonamides against some gram-negative organisms, it was less active, being only about three times as active as sulphanilamide. Again, it appeared that it would be much superior to sulphanilamide for the treatment of

\* This paper formed the basis of a talk given to the Eastern Counties Veterinary Society in May 1946. 'Veterinary Record' 42n: March 1947.

† Henceforth called "sulphone."

mastitis by oral dosing, but then we found that, in contrast to sulphanilamides it produced lower milk than blood-levels. Because of its lower toxicity and much greater activity it appears, however, that it may have a place in the treatment of mastitis by oral dosing.

Sulphone persists very well in the milk following injection into the udder, and is probably more persistent than any of the other sulphonamides (Francis, 1947). It appears, therefore, that it will be the sulphonamide of choice for this purpose. Good results have been obtained in preliminary experiments, but final conclusions must await more extensive trials.

## THE PHARMACOLOGY OF THE SULPHONAMIDES

*Information obtained by giving Single, Oral and Intravenous or  
Intraperitoneal Doses*

We have studied the behaviour of the common sulphonamides in the calf, sheep, pig and horse, following a single oral and intravenous or intraperitoneal dose of each drug. This has enabled us to reach conclusions concerning the absorption and excretion of the sulphonamides in the various species.

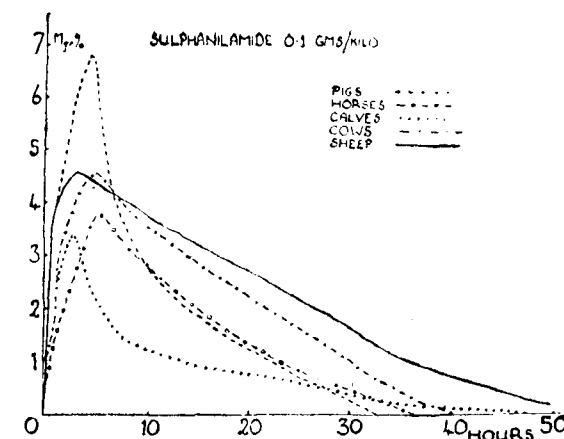


Figure 1. Blood-levels produced by sulphanilamide in animals following oral dosing.

The simplest method of expressing the results is to measure the blood-level curve area (B.L.C.A.), which is a function of the concentration of drug in the blood and the time that it persists (Figure 1).

In general, the calf and sheep absorb and excrete the drugs more slowly than the pig, and the horse occupies an intermediate position. If, however, the B.L.C.A.s given by all the seven drugs in each species are averaged, the B.L.C.A.s in the calf, sheep, pig and horse are almost identical. On the

other hand, there are important differences in the behaviour of individual drugs in the various species (Table I); the behaviour of sulphanilamide in various species is shown in Figure 1.

TABLE I

*Relative Blood-level Curve Areas in Animals produced by Various Sulphonamides. In each Species Sulphanilamide has been given an Arbitrary Value of 1*

|                     | Calf       | Sheep        | Pig          | Horse        | Average |
|---------------------|------------|--------------|--------------|--------------|---------|
| Sulphanilamide ...  | 1.0<br>(1) | 1.0<br>(2.9) | 1.0<br>(1.9) | 1.0<br>(1.9) | 1.0     |
| Sulphathiazole ...  | 0.41       | <b>0.014</b> | 0.28         | 0.38         | 0.27    |
| Sulphapyridine ...  | 1.06       | <b>0.098</b> | 0.57         | 1.0          | 0.68    |
| Sulphadiazine ...   | 0.37       | 0.27         | 0.39         | 1.3          | 0.58    |
| Sulphamerazine ...  | 3.9        | <b>1.1</b>   | 1.32         | 1.6          | 1.98    |
| Sulphamezathine ... | 2.5        | 0.64         | <b>2.32</b>  | 1.8          | 1.81    |
| Sulphone ...        | 6.5        | 0.15         | 1.54         | 2.2          | 2.93    |

Figures in brackets show the B.L.C.A. of sulphanilamide in each species when the area in the calf is given a value of 1.

The average B.L.C.A.s produced by each of the drugs in the four species are shown in Table I. It will be seen that if sulphanilamide is given a value of unity, sulphamezathine and sulphamerazine produce B.L.C.A.s of about 2 and sulphone of 3. Sulphadiazine and sulphapyridine produce B.L.C.A.s of about 0.6 and sulphathiazole of only 0.3. From a consideration of these results and those obtained following intravenous inoculation in the calf and sheep and intraperitoneal in the pig, we can reach the conclusions shown in Table II (overleaf) concerning absorption of the various drugs and their disappearance from the blood.

These results give a correct general impression concerning the behaviour of the different drugs in the four species studied, but there are a number of species differences which should be noted (Table I). In the sheep (and probably the cow, see later), sulphanilamide produced relatively better levels than in the other animals and sulphathiazole was particularly poor. In the calf sulphone was outstandingly persistent, but sulphanilamide produced poor levels. In the pig sulphamezathine was outstanding, and although it also produced the best levels in the horse, sulphadiazine gave higher levels than in the other species.

TABLE II

*The Average Behaviour of Various Sulphonamides in the Calf, Sheep, Pig and Horse*

|                     | Absorption | Disappearance from Blood |
|---------------------|------------|--------------------------|
| Sulphanilamide ...  | +++        | +                        |
| Sulphathiazole ...  | ±          | ±                        |
| Sulphapyridine ...  | ++         | +                        |
| Sulphadiazine ...   | +          | ++                       |
| Sulphamerazine ...  | +++        | +++                      |
| Sulphamezathine ... | +++        | +++                      |
| Sulphone ...        | +++        | +++                      |
| ± ...               | Very poor  | Very rapid               |
| + ...               | Poor       | Rapid                    |
| ++ ...              | Good       | Moderate                 |
| +++ ...             | Very good  | Slow                     |

i.e. +++ in both columns indicates that good blood-levels are produced.

We were particularly interested in the behaviour of sulphone in the calf, and the effect of giving single doses of 0.2 and 0.4 gm./kg. as well as 0.1 gm./kg. were studied. It can be seen from Figure 2 that a dose of 0.1 gm./kg. produced a maximum blood-level of 3.8 mg.%, but increasing it to 0.2 and 0.4 gm./kg. only produced maximum blood-levels of 5.6 and 6.4 mg. %.

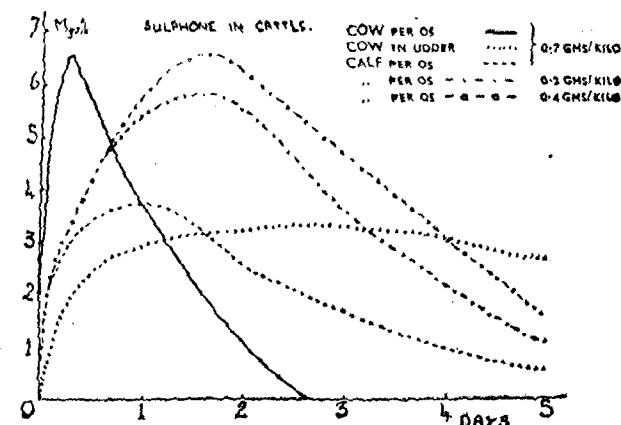


Figure 2. Blood-levels produced by various doses of sulphone in the cow and calf when given per os and into the udder.

This behaviour is not surprising when one considers the very low solubility of sulphone and indeed is advantageous, for it will be seen that a single oral dose of 0.2 gm./kg. produced blood-levels above 1 mg.% for five days.\* None of the calves to which we gave 0.4 gm./kg. showed toxic

\* STEWARD, J.S. (1947, *Vet. Rec.*, 59, 21-7), has shown that this drug need only be given once every forty-eight hours to produce good therapeutic results.

symptoms, but this dose is probably approaching the limit of safety. A related compound, 4:4'-nitroamino-diphenyl sulphone ('364') behaved in a similar way, except that it was even more slowly absorbed.

Four sheep were given doses of 0.2 gm./kg. of sulphone. Average maximum blood-levels of about 7 mg.% were produced after 24-32 hours (Table III).

Two of the sheep died, however, and one of the others showed severe toxic symptoms but eventually recovered. The toxic action of sulphone in the sheep appears to be exerted on the nervous system. Without describing the effects in detail it may be said that the first symptoms are excitement, and ataxia, which begins in the hind limbs; there may be a nervous nodding of the head. The animal soon falls to the ground and lies on its side. The nose may be pointed in a direction at right angles to the spinal cord, in the dorsal plane. Both pairs of limbs may be extended in a forward position or there may be galloping movements. Breathing is rapid, the temperature elevated, and there is often a nervous twitching of the lips or grinding of the teeth. Sheep 5 continued in this state for forty-eight hours but eventually recovered. It is interesting to note that recovery occurred when the blood-level was considerably higher than when the symptoms began. Other evidence suggests that the central nervous system may acquire a certain tolerance to the toxic effects of sulphone.

We have made a less complete study in the cow, but because of the high activity of sulphone against *Str. agalactiae* we have compared it with sulphanilamide and the results are shown in Figure 3.

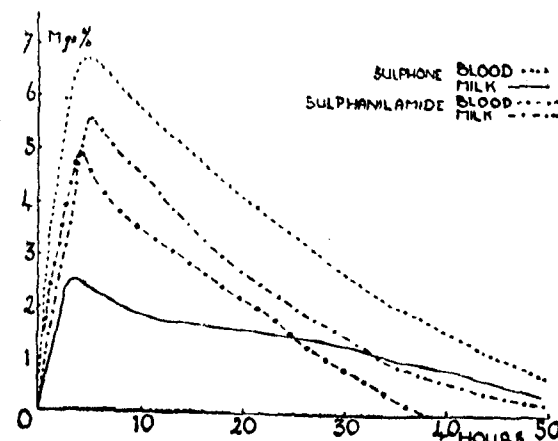


Figure 3. Blood- and milk-levels in the cow produced by sulphanilamide and sulphone following oral dosing (three cows used for each drug).

It can be seen from Table IV, in which the figures for the calf are included, that B.L.C.A. produced by sulphanilamide was twice as great in the cow as in the calf.

TABLE III  
Blood-Levels Produced by the Administration of 0.2 GM./KG. of Sulphone per os to Sheep

| Exp. No. | Sheep No. | Time in Hours |      |      |      |     |     |      |      |      |      |      |      | Time in Days |  |
|----------|-----------|---------------|------|------|------|-----|-----|------|------|------|------|------|------|--------------|--|
|          |           | 1             | 2    | 3    | 4    | 5   | 6   | 7    | 24   | 32   | 48   | 56   | 3    | 4            |  |
| 8 ...    | 35        | —             | —    | —    | —    | —   | —   | —    | 7.0  | 4.6  | 6.0  | 3.6  | 0.7  | 0            |  |
| 15 ...   | 17        | 1.8           | 2.6  | 3.6  | 4.2  | 4.8 | 5.2 | 4.6  | 6.6  | 10.4 | Dead | 3.6  | Dead | 0            |  |
| 16 ...   | 22        | 1.5           | 2.2  | 2.6  | 3.0  | 3.6 | 3.0 | 3.2  | 5.2  | 6.2  | 5.2  | 6.5  | Dead | 2.0          |  |
| 43 ...   | 5         | 1.8           | 2.6  | 2.7  | 2.9  | 3.6 | 3.8 | 4.0  | 4.2  | 6.6  | 5.2  | 4.4  | 4.4  | 2.0          |  |
| Average  | ...       | 1.7           | 2.47 | 2.97 | 3.37 | 4.0 | 4.0 | 3.93 | 5.75 | 6.95 | 5.47 | 4.83 | 2.55 | 1.0          |  |

TABLE IV  
Blood and Milk-level Curve Areas following a Single Oral or Intramammary Dose of 60 G.M. of Sulphone to Cows and 0.1 G.M./K.G. to Calves\*

|       |              | Sulphanilamide | Sulphone |
|-------|--------------|----------------|----------|
| Blood | Cow: orally  | 1              | 2.12     |
|       | udder        | —              | 5.0      |
|       | Calf: orally | 0.44           | 2.85     |
| Milk  | Cow          | 1.22           | 0.84     |

\* A dose of 60 gm. in the cow is probably slightly more than 0.1 gm./kg.

Sulphone produced a slightly greater B. L. C. A. in the calf than the cow, and the shape of the curve was entirely different (Figure 2). As far as we are aware, this is the first time these differences in behaviour between the calf and the cow have been reported, and we now have evidence that they are due to the excessive acetylation of sulphanilamide in the calf. Drugs which give good levels in the calf are not excessively acetylated. The blood-levels produced following injection of sulphone into the udder (Francis, 1947) confirm this belief and indicate that there is no important difference in the rate of excretion from the kidney of the cow and calf. It was disappointing to find that the milk-levels produced by sulphone were only about one-third the blood-levels in normal cows, whereas the milk-levels produced by sulphanilamide were a little higher than the blood-levels (Figure 3).

### Discussion and application of results

#### General Considerations

The effectiveness of any chemotherapeutic drug depends on the blood-levels it produces and its intrinsic antibacterial potency. The average blood-levels produced by the common sulphonamides are shown in Figures 4 and 5,

which give a fair general picture, although it has been shown that there are quite important differences between the various species and that there are big differences in the relative potencies of the sulphonamides against different bacteria.

In addition, the relative importance of the broad bacterial types as disease-producing agents varies considerably from one species to another; it follows that every species presents a separate problem to the person interested in chemotherapy. The subject can perhaps be dealt with most clearly by assessing the relative potencies of the sulphonamides against different bacteria, their toxicity for animals, and then discussing the treatment of specific diseases.

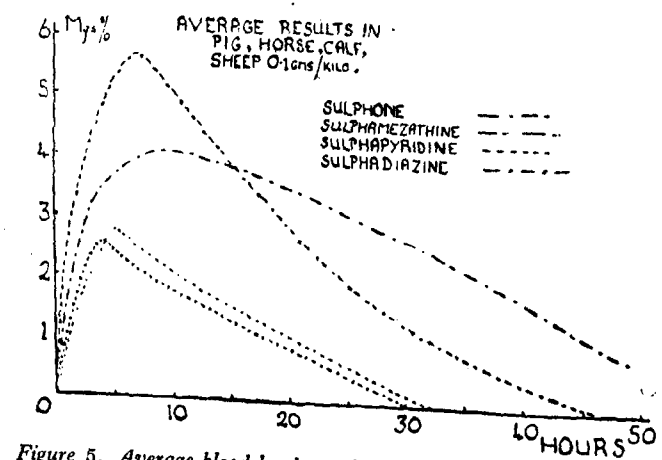
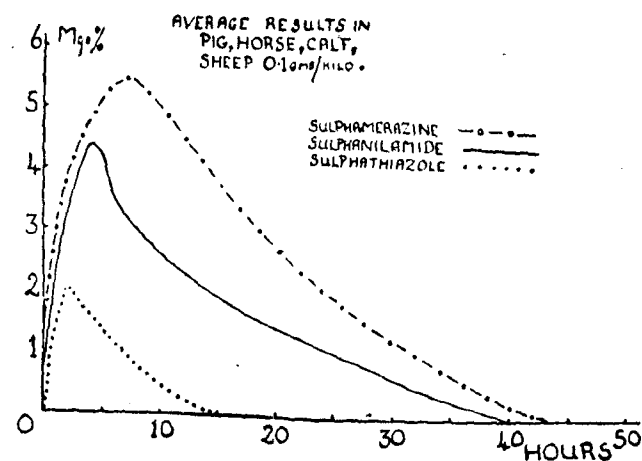


TABLE V  
*The Relative Potencies of the common Sulphonamides against Various Bacteria*

[illegible]

1. Francis, Peters and Davies (1947*b*).
2. Marshall *et al.* (1940).
3. Litchfield *et al.* (1940).
4. Pittman (1942).
5. Schweinburg and Yetwin (1945).
6. Bliss and Deitz (1944).
7. Brownlee (1945).

\*All comparisons in mice are at equal blood-levels, or, in the work of Francis, Peters and Davies (1947*b*) and Pittman (1942), adjustment has been made for differences in blood-levels by using the figures of Rose and Spinks (1946).

† The activity of sulphanilamide is so low that the relationship between it and the other sulphonamides may not be accurate.

Despite the great amount of work done on the chemotherapeutic activity of the sulphonamides, some of which is summarized in Table V, it is even now very difficult to state precisely their relative antibacterial potencies.

Our own results and those of others show that their potency may be very different against different organisms and may vary against the same organisms in different media. In Table V an attempt has been made to relate our own findings to those of some other workers.

The action of sulphanilamide was first demonstrated against Group A streptococci, and it will be seen that against this organism the heterocyclic sulphonamides (all the newer derivatives except sulphone) are only one to two times more potent and sulphone three times more potent than sulphanilamide. Against pneumococci the difference is greater and it will be realized that sulphapyridine, the first of the heterocyclic sulphonamides, was introduced largely for the treatment of pneumonia in man. The position is entirely different with the gram-negative organisms. The activity of sulphanilamide is so low that it is practically useless, but the heterocyclic sulphonamides are quite active. Sulphone, instead of being even more active, however, is only about thrice as potent as sulphanilamide. Of the heterocyclic sulphonamides sulphapyridine generally appears to be the last active. We found sulphamerazine and sulphadiazine more potent than sulphamezathine against *pasteurella septica* infection, but Schmidt *et al.* (1944) tested these three compounds against five different infections in mice and found, on the average, that sulphamezathine was slightly more potent than sulphamerazine and less potent than sulphadiazine. There was very little difference in their relative potencies *in vitro*. Schmidt *et al.* (1944) found sulphadiazine slightly the more potent *in vitro*, but Schweinburg and Yetwin (1945) found that sulphamezathine was on the average about three times more active than the other two drugs against ten species of intestinal pathogens, although this finding should be treated with reserve.

Sulphathiazole may be slightly more active against streptococci than the three drugs just considered, but there can be no doubt that it is definitely more potent against the majority of gram-negative organisms. Unfortunately there is little precise information based on the result of animal experiments. As a generalization and with full knowledge that there may be exceptions, it is perhaps permissible to say that sulphamezathine and sulphamerazine are one-and-a-half times more potent than sulphapyridine and sulphadiazine is slightly more potent. Sulphathiazole is probably one-and-a-half to two times more potent than sulphamerazine.

#### *Toxicity of the Sulphonamides for Animals*

The toxicity of sulphone has already been described. The only animal in which it is entirely satisfactory for systemic use is the bovine. Three calves in poor condition, recently arrived from market, died after large doses of

sulphone, but from the published evidence (Francis, 1946b) it seems that it is no more toxic than sulphapyridine or sulphathiazole for the calf. McEwen *et al.* (1941) found that doses of approximately 0.3 gm./kg. of sulphone produced maximum blood-levels of 12-16 mg.% in heifers. In only one animal were toxic effects observed, and McEwen concluded that the drug was better tolerated than sulphanilamide, which often produces diarrhoea in cattle. These results conform with our own findings and it appears that sulphone is very well tolerated by the cow. On the other hand, published evidence (Francis, 1946b) indicates that sulphathiazole and sulphapyridine may quite readily produce toxic effects in cows.

There is little information concerning the other sulphonamides but Thorp (1945) found that sulphadiazine fairly easily produced toxic effects in calves. Our own observations, together with those in man and laboratory animals, indicate that sulphamezathine is the least toxic of the sulphonamides.

#### TREATMENT OF ANIMAL DISEASES WITH SULPHONAMIDES

Because large numbers of animals are not hospitalized, reliable comparisons between the value of different drugs in many conditions are almost entirely lacking and are unlikely to be obtained in the near future. From a consideration of the pharmacology of the sulphonamides and their antibacterial potency some tentative conclusions have therefore been drawn concerning their probable relative value in different animal diseases. It is fully realized that these tentative conclusions require confirmation in the naturally occurring diseases and the subsequent account should be read with this proviso in mind.

#### *Pneumonia and Septicaemia in Cattle, Sheep and Pigs*

The heterocyclic sulphonamides are highly active against *Past. septica*, which is commonly associated with pneumonia (Table V), and in the calf it is probable that sulphamezathine and sulphamerazine would be the most effective drugs and that there would be little difference in their potency. Sulphathiazole and sulphadiazine would probably be less potent at equal doses, but with frequent large doses sulphathiazole might be that most effective drug, if it were not toxic. Sulphapyridine and sulphone would be less potent than the other drugs and sulphanilamide almost without action. These conclusions are generally confirmed by the findings of Thorp (1945) and it is interesting that sulphathiazole in large doses is probably the most effective of the sulphonamides against bubonic plague (Sokhey and Wagle, 1940), although *Past-pestis* appears to be more resistant to the sulphonamides than *Past. septica*. Streptococcal and pneumococcal septicaemia and pneumonia occur occasionally in the calf, and when they do sulphone would undoubtedly be the drug of choice. In the sheep, sulphamerazine, followed by sulphamezathine, would probably be the drugs of choice against pasteurella infections, which are commonly associated with pneumonia in these animals; sulphathiazole and sulphapyridine produce very poor blood-levels in the sheep. For the joint-ill in lambs, which is caused by streptococci, sulphanilamide will remain the drug of choice.

In the pig sulphamezathine would probably be outstanding, followed by sulphamerazine, and the same would be true of infections due to *Haemophilis influenzae*.

#### Enteric Infections in Calves and Pigs

It has been commonly assumed that sulphaguanidine, or one of the newer drugs which maintain a high concentration in the bowel, would be indicated for the treatment of enteric infections. Whenever these become serious, however, there is invasion of the intestinal mucosa, and frequently in calves and pigs a septicaemia. Work on coccidiosis (Steward, 1946) shows quite clearly that for the treatment of an infection in the intestinal mucosa it is the blood-level which is important, and there is increasing evidence in human medicine that the potent, readily absorbed sulphonamides are much more active than sulphaguanidine, and probably more active than such drugs as succinyl sulphathiazole. For instance, in the treatment of bacillary dysentery, Eisenoff and Goldstein (1943) obtained complete or temporary elimination of intestinal pathogens from 80% of patients treated with sulphathiazole, 70% with sulphadiazine, 63% with succinyl sulphathiazole and only 37% with sulphaguanidine. Scadding (1945) also concluded that the well-absorbed sulphonamides were probably more effective than sulphaguanidine, and emphasized the importance of concentration in the bowel wall, i.e. the blood-level. Some workers, such as Wise and Anderson (1944 and 1945; see also Francis, 1943 and 1946b), have reported good results in the treatment of calf scours with sulphaguanidine, but others have obtained negative results. It is generally recognized that sulphaguanidine has only low antibacterial potency and Brownlee (1945) found it practically inactive against strains of *B. coli* isolated from calves suffering from calf-scours. The U.S. Army authorities now recommend sulphadiazine for the treatment of enteric infection in man. As far as one can judge from the available evidence the relative values of sulphamezathine, sulphamerazine, sulphadiazine and sulphathiazole would be roughly the same as in *Past. septica* infection and they would all be better than sulphaguanidine. It should be realized, however, that many of the organisms causing enteric infections are much less susceptible to all the sulphonamide drugs than is *Past. septica*.

#### Diseases of Horses and Foals

The horse is the only species dealt with in which haemolytic streptococci are the common pus-producing organisms and "secondary invaders." Information concerning the important group of respiratory diseases in the horse has been reviewed by Francis (1942). In some, if not all, a virus, is the primary aetiological agent, but Group C haemolytic streptococci play a very important role, and against this organism there is not a great difference in the relative potencies of sulphanilamide on the one hand, and the heterocyclic sulphonamides on the other. For this reason and because they do not produce much better blood-levels in the horse than sulphanilamide, the latter drug will

probably continue to play an important part in the treatment of equine respiratory diseases.

Horses take sulphamerazine, sulphamezathine and sulphadiazine in their food more readily than sulphapyridine or sulphathiazole and there is probably little to choose between the three former drugs given orally, but sodium sulphamezathine would be the most suitable for injection. Sulphanilamide is of little value for the treatment of the enteric and septicaemic conditions of foals which are usually caused by various species of gram-negative organisms. The heterocyclic sulphonamides are, however, active against most of these infections and their pharmacology in the foal and horse is probably similar. Sulphone cannot be given for the treatment of pneumonia because of methaemoglobin production, but it may be valuable for local application to wounds.

#### Diseases of Poultry

We have done no work with poultry. The results of Marshall (1945), however, indicate that the relationship between the blood-levels produced by the various sulphonamides in chicks is very similar to the average relationship in the four species we have studied (Figures 4 and 5), except that the levels of free sulphanilamide are very low and this drug is known to be valueless in poultry. Poultry suffer chiefly from salmonella and pasteurella infections; sulphathiazole appears to have been used most extensively against bacterial infections without any real trial of the other drugs, and variable results have been obtained (Hinshaw and McNeil, 1946; Bankowski, 1943; Wernicoff and Goldhaft, 1944). Sulphamezathine, sulphamerazine and sulphadiazine would all probably be more effective drugs. These conclusions are supported by the results of Severens *et al.* (1945), who found that sulphamerazine and sulphadiazine were the most effective of seven sulphonamides tested against *S. pullorum* infection in chicks. Birds treated when one day old contained no pullorum agglutinins in their blood when nine months old.

#### DOSAGE OF THE SULPHONAMIDES

From the results described in this paper, together with those obtained by Francis (1947), when repeated doses of the sulphonamides were given to animals, the following doses appear suitable. In calves and pigs an initial dose of 0.1 gm./kg.\* followed by 0.05-0.1 gm./kg. of sulphamezathine or sulphamerazine or sulphadiazine once daily would be adequate (Figure 6), although larger doses of sulphamezathine may be given with safety when this is desirable. In the horse and the sheep the daily dose should not be lower than 0.1 gm./kg., except with sulphone. Calves and pigs need not be dosed more than once daily, with the foregoing drugs, but dosing twice daily is probably desirable in other animals. Slightly larger doses of sulphadiazine and larger

\* A dose of 0.1 gm./kg. corresponds to a dose of 1 drachm/60 lb, or 1 oz./6 cwt.

daily doses given at intervals of eight or twelve hours, of sulphapyridine, sulphanilamide and sulphathiazole, are probably necessary.

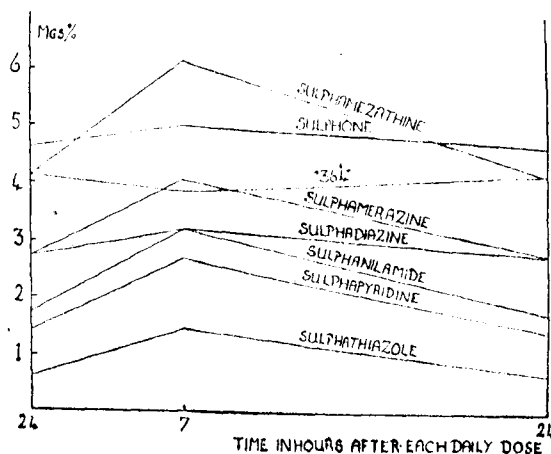


Figure 6

Average blood-levels in calves given an initial dose of 0.1 gm./kilo followed by four more doses of 0.05 gm./kilo once daily.

Blood samples were taken in the afternoon, seven hours after dosing, and in the morning immediately before dosing, i.e. twenty-four hours after the previous dose.

#### PENICILLIN

This drug will obviously continue to play a major part in the chemotherapy of human infections. The position in animals is entirely different: many of the important animal diseases are caused by organisms relatively resistant to penicillin, and in addition penicillin is a drug difficult to administer in practice unless new methods are developed.

Apart from streptococcal mastitis, which will be considered separately, there are two organisms against which penicillin may be useful. They are *C. pyogenes* and *Erysipelothrix rhusiopathiae*. Despite a belief that the sulphonamides exert a beneficial effect on 'summer mastitis' and other *C. pyogenes* infections (Roach, 1945; Lovell, 1945) we have found that they have no action against *C. pyogenes* infection in the chick-embryo and only a very slight action against this infection in the mouse: a result similar to that obtained by Kolmar (1941) against *C. diphtheriae* infection, and confirmed by the clinical observations of Arthur (1943), Curtis (1945), Berger (1945). We and other workers (see Woodbine, 1946) have found that the sulphonamides have no action against *E. rhusiopathiae*. We have found that penicillin inhibits the multiplication of *C. pyogenes* in the chick-embryo and protects mice from an acute infection. On the other hand, it has had little or no effect on a few established cases of summer mastitis which we have treated by the infusion of 50,000 units per quarter, and Arthur (1947) has found that much larger doses are ineffective. Again, similar results have been obtained in the

treatment of *C. diphtheriae* infection of guinea-pigs: penicillin is effective against an acute septicaemic infection but not a chronic local lesion (Ercoli *et al.*, 1945; Young and Mood, 1946).

Conflicting results have been reported concerning the value of penicillin against *E. rhusiopathiae* infection in mice. Harvey *et al.* (1945) found it highly effective, but Woodbine (1946, who gives other references) found it of little value. In any event immune serum is very effective against this infection in pigs.

Penicillin is of value in the streptococcal infections of horses, but Doll and Dimmock (1946) found that about 300,000 units of penicillin would have to be given to an averaged-sized horse every three hours to maintain adequate blood-levels—a procedure which could obviously only be carried out on valuable animals.

#### MASTITIS

The treatment of mastitis undoubtedly presents the most important problem in the bacterial chemotherapy of animal diseases, and since the early experiments on the Continent which led to the development of the acridine compounds for the treatment of mastitis were completed (see Francis, 1943) a great deal of field work has been carried out. There have, however, been surprisingly few laboratory studies of the action of chemotherapeutic compounds against *Str. agalactiae*. This is no doubt largely because reproducible infections had not been established in laboratory animals. We have now produced such an infection in chick-embryos and mice (Francis and Peters, 1947).

#### Treatment with Sulphonamides and Antiseptics

Sulphanilamide given orally has become the standard treatment for acute streptococcal mastitis, but although it often produces a marked improvement in the clinical condition there is a consensus of opinion that it is of little value for eradication of infection (Report 1946b; for other evidence see Francis, 1943; Roach and Hignett, 1945). Good results have been claimed following the use of silver oxide and tyrothricin, but both substances tend to be irritant and may cause severe damage to the udder (Schalm, 1944b; Andberg and Weirether, 1943 and 1944). We found them to have little or no action against *Str. agalactiae* infection in the chick-embryo, and according to Klusseodorf (1945) they are being used less frequently in practice. Our work on the value of antiseptics in the chick-embryo supports the conclusion reached from a review of the literature (Francis, 1943) that acriflavine is the most effective of the acridines. There is a complete consensus of opinion that the most favourable time for treatment is when the cow is nearly or completely dry, and Schalm (1944b) has given special attention to this subject; but even then only about 50-60% of bacteriological cures may be expected with one treatment.

It appears that sulphanilamide in oil is one of the most effective treatments and certainly less liable to damage the udder than most others (Sweet

*et al.*, 1944; Johnson, 1944; Edwards and Brownlee, 1946). The results obtained with most of the older remedies, however, have not been outstanding, and Roach (1945) stated that the general feeling of research workers in this country is that a bacteriological cure of *Str. agalactiae* mastitis is something of a rarity.

From our work in the chick-embryo, the mouse and in milk (Francis, Peters and Davies, 1947b) we concluded that sulphone was three to four times more potent than sulphanilamide against *Str. agalactiae*, being the most potent of the sulphonamide group of drugs. In addition, it is about ten times more persistent in the cows udder than is sulphanilamide and probably the most persistent of all sulphonamides. We found that a dose of 10 gm. infused into a lactating quarter, or one affected with acute mastitis, may be left in for two to three days and during this period maintains high milk concentrations and relatively high blood concentration (Francis, 1947).

Suspensions of the sulphonamides are not always easy to inject into the udder, and with the exception of sulphacetamide their sodium salts are too irritant for this purpose. There are, however, a number of complex soluble derivatives of the sulphonamides which can be used, but it should be clearly realized that their activity depends solely on the amount of sulphonamide which they contain, and the sulphonamide in these complex solutions is not necessarily in an active form.

We compared the activity of a number of soluble derivatives in the chick-embryo and mouse (Francis, Peters and Davies, 1947c). The general conclusions were that sulphanilamide L.S.F. was largely inactive due to the stability of the complex and sulphacetamide was also of very low potency. On the other hand, sulphanilamide and sulphone E.O.S., solupyrindine and soluseptasine had about the activity one would expect from their content of the respective parent compounds.

Doses of 10-20 grammes of sulphone infused into all quarters of dry cows produced effective milk concentrations for long periods and blood concentrations for 5-15 days. These results led us to believe that sulphone would be a considerably more effective drug than sulphanilamide for infusion into the cow's udder and some preliminary trials have been carried out. Dry cows which had shown clots in the milk or other evidence of mastitis during their previous lactation were injected by J. Berger M.R.C.V.S. In addition we have carried out work on eradication in two herds badly infected with *Str. agalactiae*. The combined results with sulphone are shown below, and while they are good the effect of a simultaneous single dose of 10 gm. of sulphone and 50,000 units of penicillin was tried.

It will be seen that all of 20 non-lactating quarters were freed of infection and 89% of 34 lactating quarters. These are very good results for a single injection treatment and if they are confirmed it appears that the method

will provide a really practical means of treating clinical streptococcal mastitis and controlling the infection. In the two herds we have studied the infection has been controlled for fourteen and four months respectively.

| Treatment                                              | Number of Quarters |         |             |         |             |         |
|--------------------------------------------------------|--------------------|---------|-------------|---------|-------------|---------|
|                                                        | Dry                |         | Lactating   |         | Total       |         |
|                                                        | No. Treated        | % Cured | No. Treated | % Cured | No. Treated | % Cured |
| Sulphone, 10-20 gm. single dose                        | 35                 | 82      | 16          | 69      | 51          | 78.4    |
| Sulphone, 10 gm., penicillin 50,000 units, single dose | 20                 | 100     | 34          | 89      | 54          | 94.4    |
| Total .. .. .                                          | 55                 | 89      | 50          | 84      | 105         | 86.6    |
| Report, 1946a. Penicillin, 100,000 units, single dose  |                    |         |             |         | 140         | 57.9    |

Both for the treatment of acute mastitis and for the treatment of dry cows only one injection has been used. This is a very important feature and together with the fact that sulphone can be suspended in oil and dispensed in single-dose collapsible tubes renders it much the simplest method of treating mastitis.

#### Treatment with Penicillin

Penicillin, given systemically, does not pass into the milk (Seeley *et al.*, 1945; Barker *et al.*, 1946) but there are now quite a number of papers on its value when injected into the udder. As usual, widely differing results have been obtained by various investigators but they cannot be reviewed here. An American Committee (Report, 1946a) states that the infusion of 25,000-50,000 units of Penicillin per quarter on four successive days produces a cure in most cases of *Str. agalactiae* infection. They state that a single dose of 100,000 units will produce a cure in about 75% of quarters but in trials organized by the A.R.C. (Report, 1946b) only 57.9% of 140 quarters treated in this way were cured; these results are no better than those claimed with many of the older treatments. Two treatments with 20,000 units at an interval of 24 hours gave 79.9% of cures, but more frequent treatments were not advantageous. Less satisfactory results have been obtained in the treatment of staphylococcal

mastitis (Schofield, 1946). It would appear that penicillin will not be so effective that bacteriological control of treatment becomes unnecessary, and treatment is more difficult than with sulphone. The reason why penicillin does not produce a higher percentage of cures may be that it does not reach all parts of the udder, whereas sulphone is absorbed into the blood stream and again secreted in the milk.

Murnane (1945) showed that penicillin was much more persistent in dry than lactating quarters, and quite apart from this, penicillin (or any other non-irritant agent) does not have to be milked out when the cow is not in lactation. For these reasons and because there is a greater tendency to recovery when the cow is dry it appears that special attention might well be given to the treatment of dry cows.

#### SUMMARY

1. The relative potencies of various drugs against *Str. agalactiae* and *Past. septica* infections are described. The behaviour of the sulphonamides when given by a variety of routes in the cow, calf, sheep, pig and horse has been studied.
2. The heterocyclic sulphonamides are only one to two times more potent than sulphanilamide against streptococci, but 4:4'-diamino-diphenyl sulphone is three to four times more active. Sulphanilamide is of very low potency against gram-negative organisms and the heterocyclic sulphonamides are three to nine times more potent. As a generalization, it may be said that sulphamezathine and sulphamerazine are about one and a half times more potent than sulphapyridine, and sulphadiazine is slightly more potent. Sulphathiazole is probably one and a half to two times more potent than sulphamerazine.
3. It is emphasized that mastitis associated with *Str. agalactiae* is probably an infectious disease which can be eradicated from a herd, area or a country. In this it differs from other forms of mastitis.
4. Acriflavine probably remains the best of the 'antiseptics' for injection into the cow's udder. Tyrothricin and silver proteinate were of very low activity against *Str. agalactiae* infection in the chick-embryo. Suspensions of sulphonamides in oil are almost certainly superior to the available soluble derivatives of the sulphonamides for injection into the udder.
5. The value of sulphone for the treatment of mastitis by oral dosing is reduced because it produces lower milk than blood-levels, but it is probably the most persistent of the sulphonamides when injected into the udder. This, combined with its high antibacterial potency, strongly suggests that it will be the sulphonamide of choice for the treatment of mastitis. Doses of 10-20 gm. per quarter have been used and we have succeeded in controlling mastitis associated with *Str. agalactiae* in two badly infected herds. In addition,

Mr. J. Berger, M.R.C.V.S., has had good results using the drug in practice. Although the drug is specially recommended for the treatment of dry cows, good results have been obtained in the treatment of acute and latent mastitis in lactating cows when the drug has been left in for two or three days without milking.

It is evident that at least two injections of penicillin have to be given to obtain the best results in the treatment of mastitis and, in addition, the watery solutions of penicillin which have been used are difficult to handle in the field. In contrast, we have used sulphone in collapsible tubes with a nozzle attached. This greatly facilitates treatment and there is no danger of spreading infection, because a separate tube can be used for each quarter.

6. Sulphone produces the most persistent blood-levels in the domestic animals, except in the pig, where its place is taken by sulphamezathine. Sulphone is less toxic than sulphanilamide for the bovine, but in other species it produces various toxic effects. Apart from sulphone, sulphamerazine and sulphamezathine produce the best blood levels, being markedly superior to sulphadiazine and sulphapyridine, which in turn are much better than sulphathiazole. There are, however, variations in the different species which have been shown in tables. From a consideration of these facts, together with the relative potencies of the sulphonamides, and evidence from the literature, the following conclusions are drawn concerning the probable value of the various drugs for the treatment of diseases in the different animal species: final conclusion must, of course, await extended trials.

7. For the treatment of pneumonia in cattle, sheep, and pigs, sulphamezathine and sulphamerazine will probably be the most effective drugs, although sulphathiazole might be the most active if given frequently and in large doses. In streptococcal or pneumococcal septicaemia and pneumonia in the calf sulphone would be outstanding.

8. There can be no doubt that sulphaguanidine is contraindicated for treating the enteric diseases of animals, because other drugs are more effective. There may be little to choose between the value of sulphamezathine, sulphamerazine, or sulphathiazole in these conditions.

9. Streptococci are of outstanding importance in the respiratory diseases of the horse, and against this organism the heterocyclic sulphonamides are not very much more active than sulphanilamide. In addition, they do not produce much greater blood-levels in the horse. Sulphanilamide will doubtless therefore continue to be used for these conditions, although the new drugs would be more effective. Sulphone produces methaemoglobinaemia in the horse, so cannot be used when there is respiratory distress, but produces better blood-levels than any of the sulphonamides in the horse. In the septicaemic diseases of the foal, which are often associated with gram-negative organisms, the heterocyclic sulphonamides will obviously be superior to sulphanilamide.

10. The bacterial diseases of poultry are chiefly caused by gram-negative organisms and it is probable that sulphamezathine, sulphamerazine and sulphadiazine will be the most effective drugs.

11. It appears that the injection of penicillin into the udder will be of special value in the treatment of mastitis. Apart from this important field, it will probably be less useful in veterinary than in human medicine.

12. In the farm animals, an initial dose of 0.1-0.2 gm/kg.\* of sulphamezathine or sulphamerazine followed by a daily dose of 0.05-0.01 gm/kg. is adequate. In the calf these doses certainly need not be given more than once daily and probably not in the pig when sulphamezathine is used. Sulphamezathine is the most persistent of all the sulphonamides in the pig and the sodium salt can conveniently be given subcutaneously or intraperitoneally and need only be given once daily. To produce equal blood-levels the other sulphonamides would have to be given in larger and more frequent doses. In the horse and the sheep doses should be given twice daily and the total daily dose should not be less than 0.1 gm/kg. Both pigs and horses appear to eat sulphamezathine, sulphamerazine, sulphadiazine and sulphone more readily than the other sulphonamides.

*Acknowledgment.*—I am indebted to W. Russel for his assistance with this work.

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\*A dose of 0.1 gm/kg. corresponds to a dose of 1 drachm/60 lb. or oz./6 cwt.

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## NUTRITIONAL PATHOLOGY

BY

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It is proposed in this digest to deal with certain aspects of the science of nutritional pathology, the principles which should guide us in evaluating the importance of diseases imputed to nutritional factors, and an approach to the right method of feeding livestock. Our knowledge regarding animal diseases due to malnutrition, undernutrition and dietary deficiencies is much less than what is known of the corresponding subject in human beings. The Veterinary Colleges are not at present sufficiently equipped to impart such knowledge and it is with the greatest difficulty that practical demonstrations on the subject, are available. Now that we are undergoing a transition it is evident that research should meet the new problems, as the etiology of such diseases often baffles the skill of the most experienced practitioner. It is a matter of surprise that despite the advancement of veterinary science information regarding nutritional factors on animal health is still scanty.

In view of the rather extensive use of the different kinds of foodstuffs a knowledge of the quantity and quality of the actual nutrients present in them is necessary to determine the value of each foodstuff. A complete feed should consist of

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|------------------|------------------|
| 1. Carbohydrates | 4. Mineral salts |
| 2. Fats          | 5. Water         |
| 3. Proteins      | 6. Vitamins      |

each of which merits separate consideration.

## Role in nutrition

Carbohydrates constitute the main portion of the ration of farm animals and are the most abundant nutriment in feeding stuffs. They are quantitatively the predominating ingredients of most plants and cereals, like barley, oats and maize, and must be broken down by digestion into simple compounds before absorption can take place. All the end products of digested carbohydrates are simple sugar, ie. dextrose, fructose and galactose. These sugar present in the blood stream and lymph, serve as the principal source of energy to the animal body and also as a source of fat. Carbohydrates are also stored as glycogen in almost all the organs of the body but chiefly in the liver and muscles. It forms a readily available source of energy being converted into dextrose as the needs of the system require.

**Fats:**—The organic foodstuffs, fats, carbohydrates and proteins are all complex chemical compounds which must be broken down by the process of digestion before they can be utilised by the system. Rape cake, linseed cake, cotton seed cake are all good sources of fat when fed to farm animals. Fats in suitable amounts are also found in plants and leafy fodder but are on the whole less abundant compared with the sources mentioned above. Fat is the reserve food material occurring in nearly every organ and cell of the animal body. It is a concentrated form of fuel containing much more energy per unit than any of the other nutrients.

**Proteins:**—These are the body building foods that enter into the structure of the body to replace the wear and tear that take place in the tissues. Proteins occupy an important position as they are the only nutriment which contain nitrogen in forms available to the animal body. The nutritive value of proteins is due to substances formed after digestion which yield certain products known as amino acids. It is these amino acids rather than proteins that are absorbed and carried by the blood stream to the various organs for tissue-repair and maintenance of the body. There are 18 or more of these amino acids; some of them are essential to life itself, while others are essential to growth only. Therefore different proteins may differ considerably in nutritive value: hence the farm owner should have some knowledge about the amino acid content of the proteins to be sure that he is providing the proper kind as well as the proper amount of protein in the ration. Feeding stuffs rich in proteins are oil cakes, legumes, dried blood and the cereal by-products. The non-leguminous hays, straws, fodder, fresh grasses and silage contain the smallest amount of protein.

**Mineral salts:**—The mineral constituents are found in such feeding-stuffs as hay, straw, grain, wheat bran, bone meal and the by-products of oil seeds like rape, linseed and cotton seed cake. For the growing young animal, the cow, and in fact of all animal species, a sufficient intake of minerals is necessary if development is to take place properly. The skeleton, that is the bony structure of the body, the blood and the body fluids all contain a certain amount of mineral matter, hence the necessity of mineral elements in the feed for proper nutrition. Young animals fail to develop properly if given an insufficient supply of mineral matter, and mature animals when deprived of these elements become weak and languid and finally die. When the ration is deficient in mineral constituents, the mineral matter of the bones is used to supply the deficiency for a time. The mineral elements, calcium phosphorous, iron, potassium, sodium, copper, cobalt and iodine, to mention the more important ones, are essential for the nutrition of all animals. These salts when dissolved in the body fluid go to build up the blood, brain, bone and nervous tissue. Animal foodstuffs are likely to be more deficient in some

minerals than in others, particularly in calcium, phosphorous and iron. Calcium and phosphorous are important in their relation to the growth and maintenance of the skeleton. Iron, which forms a part of the haemoglobin of the blood, cannot be formed without iron salts and a trace of copper salts, nor is the secretion of the thyroid gland possible without salts containing traces of iodine. Sodium in the form of sodium chloride is found especially in the body fluids. Potassium is found abundantly in the tissues such as the muscles, glands and nerves, while the fluids blood, plasma and lymph contain small amount of it.

Water though not a food in the sense of being a nutriment, is nevertheless most essential to the organism, for by its use nutriment is carried to and waste products removed from the tissues. In the absence of water the waste products of the body become too concentrated and their elimination by the kidneys is likely to injure their delicate cells and tubules. Further gastric disorders are also brought about on account of interference with the normal process of digestion.

Again, water is being continually eliminated from the body by the skin, kidneys, lungs, bowels and bladder, and so, it becomes all the more necessary to replace this loss by an ample supply, if good health is to be maintained.

Vitamins are substances present in various food-stuffs which are essential for the utilisation of food, maintenance of health and for growth. Some foodstuffs are particularly rich in one vitamin while deficient in another, hence the necessity of a feed which contains an adequate quantity of each vitamin not only for the animal itself but also for the vitamin content of the milk which the cow produces. Vitamins are now considered therapeutic agents of great potency for the identification of subclinical grades of various deficiencies, and an understanding of the conditions under which vitamin deficiencies occur is necessary to stay the losses caused by a lack of these substances.

#### Nutrition in disease

There are three conditions in nutritional disorders which are significant and are discussed here in a general manner. They are (1) Undernutrition (2) Malnutrition and (3) Dietary deficiency diseases.

**Undernutrition.**—This term signifies a general state of ill-health on account of habitual underfeeding.

**Malnutrition.**—In this, the body is undernourished owing to a insufficiency of food, the wrong sort of food, or the food consumed is not absorbed on account of some disease.

**Dietary deficiency diseases.**—These are a group of diseases which due to a lack of some substance in the food reveals itself in defects of one sort or another.

### Effects of undernutrition

The clinical picture is one of extreme emaciation with reduced functional capacity of the individual organs and of the body as a whole on account of starvation. A physical examination reveals a general wasting of the body with complete absence of fat and atrophy of the muscles.

Later, on account of continued wasting the pulse and respiration become slower and slower and death finally takes place. Treatment when the case is taken in hand early is to give a light, easily digested, nutritious diet. Constitutional treatment consists in the administration of tonics containing iron and arsenic.

### Effects of Malnutrition

Contrary to undernutrition, malnutrition is generally met with in animals when the quality of food consumed does not build tissue yield energy. It is also met with when there is actual insufficiency both in quantity and quality of the nutritive elements needed for growth and reproduction. The most striking disorders met with in animals maintained on a wrong diet are (1) Sterility due to a long-continued insufficiency of food, when fertility gradually diminishes and ultimately disappears (2) sterility arising from mineral deficiency either in the food or soil (3) abortion due to a lack of minerals and (4) ocular troubles as a result of diets deficient in vitamin A. Treatment of all such cases should be directed to the most prominent symptoms present. The fittest only survive; animals suffering from malnutrition are more susceptible to infectious diseases and parasitic infestations. To overcome these, special consideration should be given to the quality of the food.

### Nutritional factors in dietary-deficiency diseases

Clarity will be observed by discussing the more important diseases in terms of nutritional causation.

**Carbohydrates.**—The occurrence of diabetes mellitus and acetone bodies in cows are the result of a break down in the carbohydrates metabolism.

Diabetes mellitus is rather a rare disease in animals. The condition is more often seen in aged dogs. A typical case of diabetes is a wasting disease with the well-recognised symptoms of passing large quantities of urine, thirst, hunger and lassitude, with sugar in urine. The metabolic changes are the result of nervous disorders also of the liver and pancreas. In treatment, the first essential is to limit the amount of carbohydrate in the diet and substitute foods rich in proteins and fats. As regard drugs, insulin has been used with success in dogs.

Acetonemia is seen in dairy cows during the milking period, and is followed by a loss of condition with a marked decline in the milk yield. Acetone bodies are found in the blood, urine and milk. Therapeutic measures is to inject dextrose intravenously or subcutaneously.

**Proteins.**—Some of the errors attributable to diet deficient in protein are emaciation, delayed sexual maturity and low productivity. Animals in a state of emaciation are benefited greatly when given food-proteins. Many cases of delayed sexual maturity and low productivity are cured when the animals are given enough food of good quality to eat. Acute protein deficiency rapidly leads to a state of unbalance; thus, if there is a deficiency of protein in the diet for any length of time, the body is called upon to provide proteins for its normal functions at the expense of the proteins stored up in its tissues. Such a state will eventually interfere with the health of animal and pave the way to disease conditions. Besides these considerations, it has been found that lucerne contains very little of the amino acids, cystine or methionine necessary for wool production, consequently when sheep are kept exclusively on a diet of lucerne-hay, the wool crop is substantially lowered even though the amount of protein feed is ample in quantity. It seems safe, therefore, not to keep animals on one type of rations but to provide a mixed dietary which will supply all the proteins in a generous measure, as it is quite possible that wool growth is influenced by the proteins in the diet of the sheep.

**Fats:**—The deliberate fattening of animals for human consumption is outside the scope of this article. Our knowledge of fat requirements for animals is not at all satisfactory, but we do know that a certain quantity is necessary for the maintenance of health and for normal growth. The commonest example of an excessive deposit of fat in the body is a condition known as obesity. It is usually met with in aged overfed dogs which get no exercise. The condition is also met with in ponies which are highly fed and do little work. For treatment, attention to diet is of first importance, carbohydrates and fats should be cut down as much as possible. Preparations of the thyroid gland are reported to be beneficial.

**Minerals:**—The necessity of supplying minerals has already been mentioned. Our object will now be to survey briefly the more important diseases that occur with a greater frequency than is generally thought possible. That deficiencies in certain mineral ingredients may have serious consequences is now generally realised. On the one hand we know that it is impossible to secure growth or production if the animals are fed on rations low in minerals, while on the other hand feeding an excessive amount of minerals when it is not required is definitely harmful to the animal.

### Calcium and phosphorous deficiency

The importance of the mineral content of the ration becomes apparent when an insufficient intake of calcium and phosphorous results in a depraved appetite (pica) manifested by a craving for bones, wood, soil or putrid material on the part of the animal. The eating of putrid material is definitely harmful, as the animal is attacked with botulism resulting in death. When cattle are pastured on lands exhausted of certain elements, notably phosphorous, they are seen to be unthrifty, stunted, and are delivered of still born calves. Other troubles due to phosphorous deficiency are loin disease of cattle in America, and lamsiekte of cattle, sheep, and goats, in Africa.

Calcium deficiency has been observed in all species of livestock and brought about by feeding materials poor in Calcium. Cows in milk appear to be particularly susceptible when kept on rations deficient in calcium. In the case of the laying hen, calcium must be provided liberally to overcome the laying of soft eggs. Other diseases connected with a disturbance of calcium metabolism are milk fever and tetany. The name milk fever is a misnomer, for there is no fever, but a marked and rapid lowering of the blood calcium at calving time. The trouble begins with cerebral excitement followed by a drowsy condition and paralysis. The animal lies immovable, the eyes remain closed, the breathing often becomes laboured and accompanied by groaning. Throughout the attack the animal ceases to feed or ruminate. Cases of milk fever, if not treated promptly, usually die in a few days. The injection of calcium salts by the intravenous route often results in a spectacular recovery. Tetany is a disease in which there are continuous contractions of the muscles of either the fore or hind limbs. The condition occurs with certain diseases of the stomach and intestines, also in connection with the removal of parathyroids. The actual disorder is however believed to be a disturbance of the blood calcium. An etiological connection exists between rickets and osteomalacic tetany, both being connected with a disturbance of calcium metabolism peculiar to these diseases. Treatment of tetany should be directed to treating the cause of the trouble whether digestive, metabolic, rickets or osteomalacia. If the causal factor is directly traceable to the digestive system, means to improve the functional derangement by dieting and relief of indigestion are essential to cure the condition. Occasionally when the attack is very severe, it may be necessary to prescribe sedatives such as bromides, chloral hydrate, or morphine. Calcium boro-gluconate is also of distinct advantage when given during attacks. Rachitis or osteomalacic tetany responds markedly to calcium and phosphorous therapy.

### Rickets, Osteomalacia, Osteoporosis and Osteofibrosis in relation to calcium and phosphorous deficiency

Rickets is a disease affecting young animals characterised by a failure of growing bone to calcify or harden properly. It is due to a lack of calcium and phosphorous and can occur when either one or both these elements are wanting in the feed or when there is a disproportion between the relative quantities of the two. In dogs, a common cause of rickets is an insufficiency of Vitamin D. Rickets is usually seen in young animals separated from its dam. The first signs to appear are digestive disturbances, but in other cases the disease begins with a disturbance of movement. The most striking evidence of the disease is a change in the bones; they are softer than normal and bend when any weight is put upon them. Deformities such as bandy legs, knock knees and what is known as chicken breast are quite common.

Osteomalacia is a disorder of the bony system of the adult animals in which, owing to a lack of calcium, the bones become softened and are liable to break. It may also be due to a lack of vitamin D in the diet. In ruminants the cause is usually one of a phosphorous deficiency.

The disease is commonly met with in cattle and sheep when the pastures are deficient in phosphorous. It is very uncommon in other animals. Both rickets and osteomalacia are fundamentally alike, but with distinct changes on account of a difference in the bony structure of the adult and young animal. In this disease, pica-like symptoms are first seen followed later by painful conditions of the bones. The animal spends most of its time lying down, is unwilling to rise and only does so when forced. On walking, and also on rising, a peculiar cracking sound is heard on account of the loosening of the joint capsules. Osteoporosis is a similar condition resulting from faulty bone metabolism but the changes in the bones are quite distinct from rickets and osteomalacia. In this case the bone is porous due to resorption of calcium salts from the bony skeleton. The condition is serious, as the bones having become light and tender cannot bear the weight of the animal body.

Osteofibrosis is a nutritional disease associated with a comparative excess of phosphorous in the feed. This has been demonstrated experimentally and the disease reproduced by feeding horses on a phosphorous rich diet in which the calcium phosphorous ratio is greater than 1 to 2. An excess of phosphorous in the diet will have the effect of rendering it relatively deficient in calcium and this condition may, therefore, be looked upon as also a calcium-deficiency disease. The incidence of this disease has been observed in horses, asses and mules, and is associated with bran feeding, a food rich in phosphorous. Goats and pigs are similarly affected.

The most obvious symptoms shown by animals are lameness of one or more than one leg and thickening of the bones. The facial bones become progressively enlarged, and the condition in horses is commonly known as 'big head'. When the nasal bones are involved the breathing becomes snuffling and laboured. The most distinctive peculiarity of this disease is its preference for the marrow cavity. An alteration of the structure of the bones followed by fibrosis of the bone marrow and partial replacement of the bones with soft poorly calcified fibrous tissue can be relied upon as indicative of this disease.

#### Prophylaxis and treatment

Diseases caused by an insufficiency of calcium and phosphorous due to errors in diets can be prevented or treated in any one of three ways viz. (1) By feeding under natural conditions an abundance and variety of food-stuffs. In this way the animals consume all the minerals and Vitamins they require. (2) By feeding a special mineral supplement. (3) By enriching the soil with mineral and nitrogenous fertilisers. Other lines of treatment are to give feeds rich in both phosphorous and calcium as bone meal, skim milk and butter milk. Of the various calcium preparations calcium carbonate is useful. If phosphorous alone is required, sodium phosphate is excellent. So closely intervenient is this calcium-phosphorous factor in disease problems that it is absolutely necessary to provide the minerals in the proportion used in the body. A ratio 1 to 1, or 2 to 1 may be used safely.

#### Iodine deficiency

*Goitre*:—When the iodine intake is insufficient, an enlargement of the thyroid gland, is seen as a marked swelling in affected animals. The trouble usually results from a deficiency of iodine in the soil, or in the feed and water. When iodine is deficient, all varieties of farm animals are likely to suffer. Calves, colts, lambs, and piglets are born with enlarged thyroids and often show a peculiar condition of hairlessness. The death-rate amongst them is high. The treatment in these cases is to give small doses of potassium iodide in the drinking water, or the swelling may be made to subside by small doses of fresh thyroid gland or glandular extracts.

#### Iron, copper and cobalt deficiency

Nutritional anaemia is brought about by an insufficiency of haemoglobin, the oxygen carrying pigment of the blood. It may depend on certain conditions, one in which the cells are large and fully saturated with haemoglobin (hyperchromic macrocytic) and the other in which the cells are small and deficient in haemoglobin (hypochromic microcytic).

Hyperchromic anaemia is due to a deficiency of a substance normally stored in the liver and necessary for the normoblastic formation of

blood in the bone marrow. This form of anaemia does not respond to iron therapy, but requires liver extracts. As there is an uncertainty regarding this form of anaemia in animals it will not be discussed here. The colouring matter of the red corpuscles, haemoglobin, is continually being formed throughout life, and whenever the body reserves of iron become depleted on account of a less intake of iron and copper, nutritional anaemia develops. Such a condition is seen in cattle, sheep and goats when there is a deficiency of iron, copper and cobalt in the fodder and grain on account of a deficiency of these minerals in the soil. It is beyond question that the so called Bush sickness of New Zealand, Salt lick of cattle in America and Pine of cattle and sheep in Scotland are a type of diseases which respond rapidly to treatment when an adequate supply of these minerals are provided; and, here in India, there is ample reason to believe that anaemias which occur as a result of diets inadequate in these substances are the main causes of malnutrition of cattle in this country.

#### Mineral Toxicosis

Flourine intoxication, a hitherto unknown disease in India, is found to be prevalent in certain parts of the country namely Madras, Hyderabad and Mysore. The cause has been found to be flourine communicated through the drinking water with a high flourine content. In cattle the malady manifests itself clinically by a gradual loss of condition, vitality and weight. In more severe cases the disease attacks the permanent teeth and is accompanied by a thickening of the bone forming the lower jaw, also thickening and bony growths on the leg bones. The hooves are prolonged and in spite of exercise do not wear down. Fractures of the ribs are also met with. The disease, though not spectacular in the sense of devastation, yet causes enough harm by a condition of ill health sufficient to disable an animal giving its maximum output in work, and in the case of cows by low milk secretion and reduced fertility. Exploratory work in the treatment of fluorosis by the administration of iron, cobalt, and copper, shows that the addition of these elements to the feed of animals renders the intake of flourine compounds less toxic by lessening their severity, but does not entirely eliminate its bad effects.

#### Vitamins

Vitamins play an important part in nutrition. The prominent position which the study of vitamins already holds continues to increase in importance, and a number of laboratory procedures have been developed in recent years to enlarge the clinical diagnostic approach to vitamin deficiency diseases.

*Vitamin A*:—Nature produces this vitamin in plants as a pigment called carotene which after conversion in the animal body has the same

physiological action as vitamin A. This vitamin is found in abundance in all green foods, hay and carrots. It is also found, though to a lesser extent, in yellow maize, linseed cake and cotton seed cake. The majority of vitamin A deficiency cases are seen in fowls, but it is also the most common vitamin deficiency disease of cattle. Symptoms of vitamin A deficiency appear in cattle of all ages after they have been kept for a prolonged period on a ration containing too little carotene. Before marked clinical signs appear, an early deficiency condition can often be seen in animals unable to see their way in dim light by stumbling over objects placed in their way. The ocular change is commonly known as night blindness. Cows and bulls fail to reproduce in advanced vitamin A deficiency but this stoppage of sexual activity is not permanent. If the cows conceive they later either abort or give birth to weak or blind calves. Calves suffer from vitamin A deficiency within a few days after birth, unless their ration is adequate in this factor. Calves deficient at birth are weak and slow to get up, are affected with eye changes in the form of commencing corneal opacity if not totally blind, hairlessness on parts of the body and respiratory affections. An intercurrent infection of navel-ill has been seen by one of us in a dairy herd amongst a batch of calves, the predominating signs being corneal opacity, a swollen umbilicus, unhealthy appearance, diarrhoea and swollen joints. With regard to prophylaxis and treatment, special attention should be paid to dietetics, as this is of the utmost importance. A liberal amount of green foods and carrots, or, the addition of cod liver oil, should be allowed till such time as the condition of the animal returns to normal. In fowls the predominating signs of vitamin A deficiency, apart from other symptoms, are ocular changes which take the form of inflamed eyes and an accumulation of white cheesy material under the eyelids. The edges of the eyelids become granular and a sticky fluid causes the lids to stick together. The obvious method of preventing the development of this deficiency is to supply an adequate quantity of this vitamin in the feed.

**Vitamin B:**—Ruminants do not seem to be affected by the absence of this vitamin in feed, as the Vitamin B factors are known to be synthesised by bacteria in the digestive tract of these animals which is probably sufficient to meet their requirements. This form of vitamin deficiency occurs chiefly in fowls and dogs. Polyneuritis in fowls is characterised by paralysis of the muscles of the legs, neck, and wings. When this occurs, the head is drawn sharply back over the body, so that the bird is unable to stand. It usually dies. In dogs, after an initial stage of restlessness, irritability and nervousness, advanced symptoms of muscular tenderness, and paralysis of the hind quarters (polyneuritis) develop. In the treatment of this deficiency, resource should be had to such foodstuffs containing an abundance of vitamin B, such as dried yeast, wheat bran, wheat germ, liver, muscle meat milk, and the vitamin B factor thiamine.

**Vitamin C:**—Farm animals, including poultry, synthesise enough vitamin C for their requirements. Dogs also synthesise their own vitamin C, but cases have been reported where dogs suffered from a condition resembling Scurvy and were cured by ascorbic acid (vitamin C). Such cases are probably due to a failure of vitamin C synthesis in the animal body.

**Vitamin D:**—This deficiency is very rare in cattle. For the cure and prevention of rickets in calves, a good supply of green foods rich in calcium and phosphorous and also in vitamin D should be provided. Other factors such as sunlight and exercise have a beneficial effect. The specific treatment of rickets in dogs is the giving of vitamin D in addition to a supply of calcium and phosphorous.

#### A NOTE ON

#### 'BOVINE LYMPHANGITIS' IN MADRAS PROVINCE\*

BY

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**Introduction:**—Studies pertaining to diseases clinically similar to Bovine Lymphangitis date back to the early part of 19th century. Sourillon (1829) described 'Bovine Farcy' as a chronic infective disease of cattle characterised by purulent inflammation of the superficial lymph glands and lymphatics, and fairly prevalent during the latter half of 19th century in France. Diseases bearing clinical similarity to the above condition have also been recorded in different countries in the subsequent years, each author describing the malady under a new nomenclature. A few of such names are:—Bovine Farcy, Bovine lymphangitis, Lymphangitis Farcinosa bovis, Tropical actinomycosis, Infectious lymphangitis of cattle, Bovine infectious lymphangitis, Farcin du boeuf (French), Haurt Wurm des Rindes (German). While this disease entity has been recorded in France (Sourillon) (1829), Guadelope (Couzin, 1917) (Besson, 1913), Mauritius, (Maillet, 1837), Kenya and Central Africa (Daubney, 1927), Sumatra (Vryberg, 1907), Brazil (Magelhaus, 1928), and in India (Raymond 1908, Holmes 1909, Sheather 1921, V. K. Iyer 1926, 1928, 1934); a farcy-like disease appears to have been detected in Egypt (Mason, 1919), America (Traum, 1919) and in Germany by Schelgel (1913).

\*Presented to the Eighth Provincial Veterinary Conference conducted by the Madras Veterinary Association on 25th September 1948.

Besides a clinical description of the disease, a detailed investigation was first conducted by Nocard (1888) to ascertain the etiology of this condition and he described a streptothrix which was later classified as *Actinomyces Farcinicus* (*Streptothrix Farcinica*). Diseases akin to 'bovine farcy' have been described by various authors later, ascribing different organisms as their causative agents; but, as pointed out by Huttyra and Marek *et al* (1946), 'their relationship to bovine farcy is doubtful as the causal organism of these affections is sometimes gram-negative and sometimes represented by gram-negative bacilli or filaments without true branching and also experimental transmission in these diseases is negative.'

In India, bovine lymphangitis was first described by Holmes (1908) and by Raymond (1909), who conducted independent investigations of an outbreak of the disease in the army transport bullocks at Calcutta. In the same year, this disease was also recorded in Madras Province in an outbreak amongst the conservancy bullocks of the Corporation of Madras. Sheather (1921) conducted early investigations and, later on, the various aspects of the disease were studied in detail by V. K. Iyer (1926, 1928 and 1934). This disease has been recorded in Bengal, Assam and, from the available records with us, also in the border districts of Orissa. An infective parotiditis has been described in Central Provinces and Berar, whose etiology has not yet been established.

Holmes (1908), studying the etiology of bovine lymphangitis in India, ascribed a streptothrix as the causative agent, while Raymond (1909) described a gram-negative short bacillus as the significant organism. Sheather (1921) described also a gram-negative organism resembling in other characters with the Preisz-Nocard bacillus. V. K. Iyer, (1924, '26, '28 and '34) described a gram-negative short bacillus showing bipolar staining as the causative organism which was later identified as one resembling *Pasturella pseudo tuberculosis rodentium-type III*, but suggesting more as an intermediate form of *Pestis-rodentium* group. Singh (1938) stated that he isolated *Pasturella pseudo tuberculosis rodentium-type III*, as well as a fungus of the *Actinomyces* group. Investigation conducted in Assam during the years 1939-41 on this disease showed that 'in many cases the materials were sterile and in a few of those where there was growth of organisms, it was found to be non-pathogenic. It has also been stated that in none of these cases organisms described by Raymond, Holmes, Sheather or V. K. Iyer have been isolated'. (Gopalakrishnan 1939, 1941 and a communication from the D.V.S. Assam, 1947),

#### Clinical description of the disease

The clinical symptoms of Bovine Farcy described in France, Gaudelope, Mauritius and Kenya, appear to be more severe than the chronic insidious type of the disease recorded in India.

From the nature of the disease, the type of lesions and the etiological factors described, it is apparent that the bovine farcy caused by a streptothrix (Nocard) appears to be distinct from the chronic type of Bovine Lymphangitis in India caused by a bacillus.

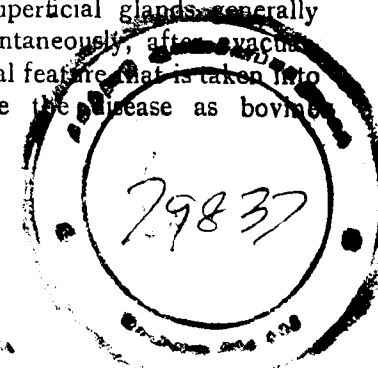
The disease noted in the Madras province is a chronic suppurative lymphadenitis and lymphangitis characterised by slow formation of local abscesses in the lymph glands, especially, the superficial ones in the early stages, with the involvement later on of the adjoining lymphatics. Lesions of suppurative nature have also been described in other organs in the later stage of the disease in rare cases, as in lungs, feet, joints, internal lymph glands, especially in those animals that succumb to the disease after a protracted course.

Holmes (1908) described in all the cases investigated by him an indolent ulcer at the region of the neck, usually described as "Calcutta Sore", but no such persistent ulceration was recorded in any of the cases at Madras during the past 25 years. The first apparent symptom of the disease is the appearance of a nodular enlargement of one or more of the superficial lymph glands, especially the prescapular or the precrucial. The nodule is generally firm and painless, without any signs of acute inflammation at the region of the gland. The animal will not evince any marked disabling constitutional disturbances at this stage. These symptoms are different from those of the bovine farcy, as described by Couzin, of having a hot, painful, oedematous swelling at the local region and of a general hyperthermia (Daubney). It may be pointed out that, in none of the cases on record in the Madras Presidency, a thermal reaction has been noticed in the disease.

As the condition progresses, the nodule gradually increases in size, softens and fluctuates. If the gland is considerably enlarged, lameness of the particular limb may be noticed at this stage. The abscess ruptures discharging generally a soft, thick, whitish and caseous pus. Later on, abscesses of varying sizes may be noticed in the surrounding tissues and along the course of the superficial lymphatics and then in the deeper lymph glands and lymphatics. Instances of bud abscesses appearing in centrifugal direction from the affected gland have also been recorded.

Usually the general condition of the animal is not much affected. The disease remains localised involving the superficial glands, generally the prescapular or precrucial, and may heal spontaneously, after evacuating the suppurative materials. It is this general feature that is taken into consideration by some authors to describe the disease as bovine lymphadenitis.

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In some animals, however, the disease may progress further and the animal gradually loses condition and becomes much emaciated. Symptoms of respiratory distress characterised by paroxysmal cough and dyspnoea have also been noticed in some cases. The hooves of the animals may gradually spread out, overgrow and may even have an upturned appearance. As the disease still progresses, the animals may become so much emaciated and weak as to be unable to get up, develop several bedsores, and finally succumb after a protracted course.

An interesting case of such advanced type of this disease has been described by Viswanathan (1942), where one of the bullocks of the Madras Corporation gave suspicious reaction to Tuberculin test but subsequent post-mortem revealed no tubercle bacilli, but only lesions of Bovine Lymphangitis in an advanced stage. One of the college bullocks also had such an insidious disease during the year 1946.

#### Pathogenicity of the disease

During the past 25 years, materials from 2,833 cases suspected for this disease have been examined at the Bacteriology Laboratory, Madras Veterinary College. Classification of the specimens received during each year is made in the following table according to species, sex and age.

TABLE I

*Showing classified list of specimens received during each year.*

| Year       | Bullocks | Buffaloes | Cows Calves Etc. | Total |
|------------|----------|-----------|------------------|-------|
| 1923-'24   | 22       | 1         | 4                | 27    |
| 1924-'25   | 20       | —         | 4                | 24    |
| 1925-'26   | 36       | 2         | 3                | 41    |
| 1926-'27   | 42       | 2         | 5                | 49    |
| 1927-'28   | 73       | 1         | 4                | 78    |
| 1928-'29   | 37       | 2         | 8                | 47    |
| 1929-'30   | 42       | 4         | 14               | 60    |
| 1930-'31   | 61       | —         | 8                | 69    |
| 1931-'32   | 92       | 2         | 21               | 115   |
| 1932-'33   | 84       | 4         | 15               | 103   |
| 1933-'34   | 108      | 2         | 13               | 123   |
| 1934-'35   | 103      | 5         | 60               | 168   |
| 1935-'36   | 126      | 3         | 40               | 169   |
| 1936-'37   | 114      | 4         | 44               | 162   |
| 1937-'38   | 154      | 8         | 45               | 207   |
| 1938-'39   | 171      | —         | 42               | 213   |
| 1939-'40   | 173      | 1         | 14               | 188   |
| 1940-'41   | 186      | 9         | 35               | 230   |
| 1941-'42   | 171      | 8         | 36               | 215   |
| 1942-'43   | 103      | 5         | 29               | 137   |
| 1943-'44   | 60       | 5         | 30               | 95    |
| 1944-'45   | 47       | 1         | 9                | 57    |
| 1945-'46   | 50       | 1         | 5                | 56    |
| 1946-'47   | 63       | —         | 18               | 81    |
| 1947-'48   | 89       | 8         | 25               | 119   |
| Total      | 2,227    | 75        | 531              | 2,833 |
| Percentage | 78.60%   | 2.65%     | 18.75%           |       |

It will be noticed from the above table that the disease has not been recorded in any species except bovines. 97.35% of the cases recorded belonged to the bubaleen species while the rest 2.65% of the cases were from the taureen species. It will also be evident that 78.6% of the cases were male stock, mostly working bullocks, the youngest animal recorded being a heifer 9 months old. This factor is very important in view of its significant effect on the utility of the animals.

Nocard described that sheep are also susceptible to the disease, but the investigation conducted on Infectious lymphangitis in ovines in Madras Presidency revealed in most cases only gram-positive diphtheroids 'Corynebacterium ovis' (Viswanathan 1940).

#### Occurrence of the disease

The disease has been recorded throughout the Presidency although it appears to be more common in the southern districts. Sporadic cases have been recorded in all the districts.

In order to study whether there is any seasonal incidence of the disease as suggested by V. K. Iyer (1926), the figures available for the past 25 years of the specimens received have been tabulated by month in the following table: Vide page 254.

It will be noticed from the table that the disease occurs in this presidency throughout the year. Although the number of specimens obtained from different regions of the province may not be a correct index of the intensity in the seasonal variations of this disease in a particular region, yet the total number obtained for the whole province can be used to study seasonal fluctuations for the entire province.

The usual procedure to study seasonal variation in time-series is to eliminate the trend-values from the monthly averages with the help of a suitable curve and prepare seasonal indices. But the annual totals seen from the table indicate no definite trend. This, however, can be explained by the fact that the figures are compiled from specimens received at the Madras Veterinary College from the field staff, and these again depend on various other factors besides the intensity of incidence of the disease. As such, the monthly averages are utilised to prepare seasonal indices since they are obtained by averaging figures for 25 years and so can be taken to be free from residual variations.

Indices of monthly variations have been compiled (Vide Table III) and a graph showing the seasonal intensity has been drawn (Vide page 255). From the graph it will be noticed that the disease shows a sudden increase in the month of January and maintains a fairly high level upto May, after

TABLE II  
Monthly figures of specimens examined during 1923—1948.

| Year     | June | July | August | September | October | November | December | January | February | March | April | May | Total |
|----------|------|------|--------|-----------|---------|----------|----------|---------|----------|-------|-------|-----|-------|
| 1923-'24 | 3    | 4    | 2      | 1         | 2       | 3        | 2        | 1       | 5        | 2     | 1     | 1   | 27    |
| 1924-'25 | 2    | 1    | 2      | 4         | 6       | —        | 1        | 5       | —        | —     | —     | 3   | 24    |
| 1925-'26 | 1    | 1    | 12     | 6         | 2       | 4        | 2        | 3       | 2        | 4     | 4     | 2   | 41    |
| 1926-'27 | 4    | 2    | 6      | 6         | 4       | —        | 3        | 3       | 1        | 4     | 5     | 11  | 49    |
| 1927-'28 | 6    | 3    | 7      | 12        | 3       | 9        | 5        | 6       | 8        | 3     | 7     | 9   | 78    |
| 1928-'29 | 7    | 1    | 3      | 4         | 3       | 2        | 4        | 5       | 4        | 4     | 4     | 5   | 47    |
| 1929-'30 | 1    | 7    | —      | 8         | 3       | 8        | 4        | 6       | 6        | 7     | 5     | 5   | 60    |
| 1930-'31 | 4    | 4    | 8      | 3         | 4       | 3        | 3        | 8       | 6        | 7     | 6     | 13  | 69    |
| 1931-'32 | 10   | —    | 5      | 6         | 12      | 7        | 18       | 15      | 11       | 18    | 8     | 8   | 115   |
| 1932-'33 | 4    | 2    | 10     | 6         | 12      | 5        | 7        | 12      | 9        | 13    | 15    | 5   | 103   |
| 1933-'34 | 10   | 10   | 12     | 5         | 8       | 10       | 6        | 8       | 13       | 16    | 12    | 13  | 123   |
| 1934-'35 | 14   | 8    | 19     | 10        | 10      | 10       | 6        | 20      | 22       | 17    | 14    | 18  | 168   |
| 1935-'36 | 15   | 13   | 15     | 11        | 13      | 21       | 8        | 12      | 9        | 20    | 18    | 14  | 169   |
| 1936-'37 | 16   | 12   | 13     | 14        | 15      | 9        | 8        | 9       | 16       | 15    | 21    | 14  | 162   |
| 1937-'38 | 27   | 19   | 16     | 16        | 14      | 18       | 16       | 23      | 15       | 11    | 14    | 18  | 207   |
| 1938-'39 | 8    | 13   | 14     | 18        | 11      | 22       | 26       | 19      | 31       | 19    | 14    | 18  | 213   |
| 1939-'40 | 9    | 9    | 7      | 17        | 13      | 18       | 20       | 17      | 19       | 16    | 25    | 18  | 188   |
| 1940-'41 | 11   | 15   | 29     | 20        | 13      | 18       | 20       | 17      | 19       | 16    | 23    | 19  | 230   |
| 1941-'42 | 20   | 26   | 16     | 16        | 17      | 19       | 9        | 25      | 15       | 23    | 18    | 11  | 215   |
| 1942-'43 | 15   | 13   | 13     | 10        | 11      | 14       | 7        | 10      | 5        | 17    | 11    | 11  | 137   |
| 1943-'44 | 10   | 7    | 4      | 4         | 17      | 12       | 16       | 10      | 5        | 8     | 5     | 11  | 95    |
| 1944-'45 | 11   | 3    | 3      | 7         | 11      | 5        | 2        | 5       | 3        | 4     | 2     | 1   | 57    |
| 1945-'46 | 8    | 5    | 2      | 4         | 2       | 4        | 4        | 7       | 4        | 3     | 5     | 8   | 56    |
| 1946-'47 | 3    | 4    | 4      | 3         | 15      | 3        | 3        | 6       | 18       | 6     | 5     | 11  | 81    |
| 1947-'48 | 12   | 9    | 8      | 10        | 5       | 3        | 13       | 4       | 18       | 7     | 18    | 12  | 119   |
| Total    | 231  | 191  | 230    | 219       | 216     | 235      | 210      | 259     | 264      | 259   | 260   | 259 | 2,833 |

SEASONAL VARIATION.

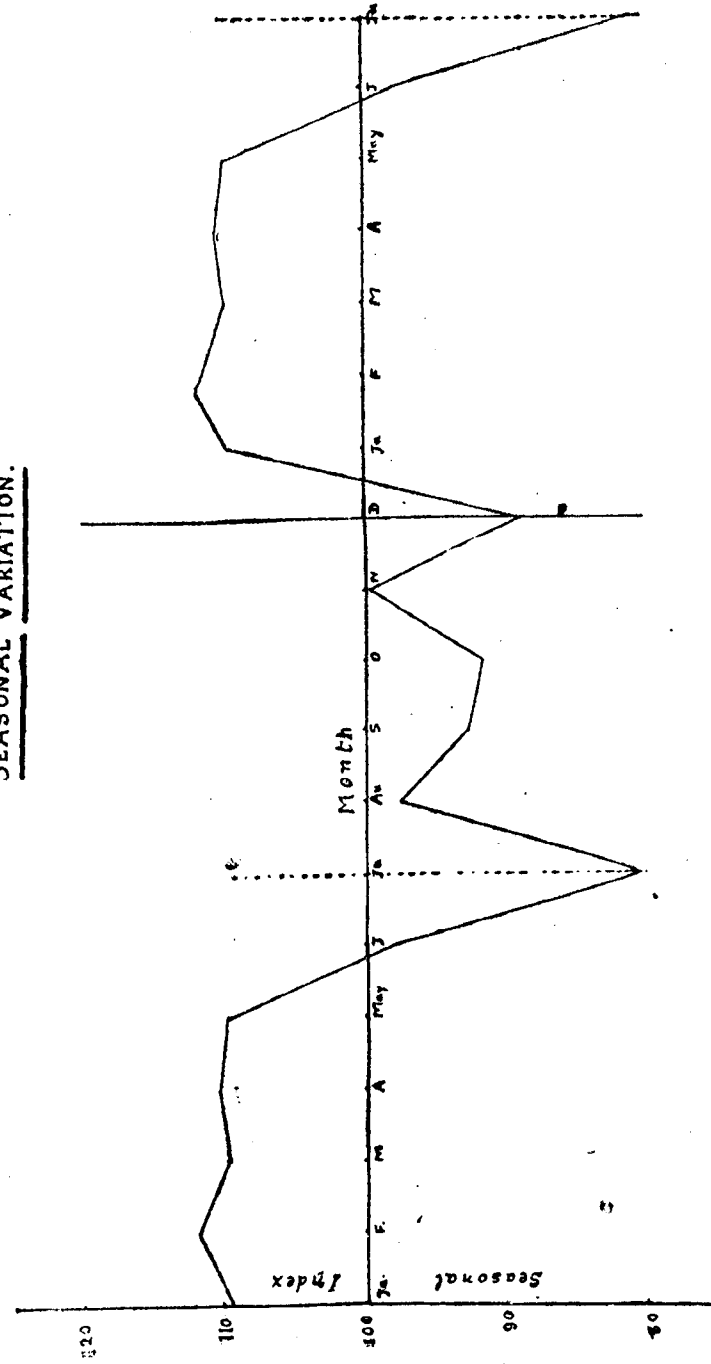


TABLE III  
Showing Seasonal Indices

| Months    | Totals | Index  |
|-----------|--------|--------|
| January   | 259    | 109.7  |
| February  | 264    | 111.8  |
| March     | 259    | 108.7  |
| April     | 260    | 110.1  |
| May       | 259    | 109.7  |
| June      | 231    | 97.8   |
| July      | 191    | 80.9   |
| August    | 230    | 97.5   |
| September | 219    | 92.8   |
| October   | 216    | 91.5   |
| November  | 235    | 99.6   |
| December  | 210    | 88.9   |
|           | 2,833  | 1200.0 |

which there is a steady fall reaching the lowest point in July. During the remaining months of the year, the index reveals a fluctuation about the average.

The seasonal pattern noted in this analysis will not agree with the report published by V. K. Iyer (1926), and will not coincide with the breeding season of ectoparasites. Further, it may be stated that the study of seasonal fluctuations attempted by V. K. Iyer is based on the total figures of three outbreaks using the figures themselves, whereas the analysis conducted here is based on seasonal indices compiled from figures for a period of 25 years.

It is rather difficult to explain the exact causes for the seasonal pattern recorded in this analysis. Madras Province being so vast in area with different climatic regions and varying agricultural practices and types of animals, the seasonal fluctuations noted for the entire province is the cumulative effect of a complexity of factors that are rather difficult to specify. Nevertheless, this analysis indicates certain seasonal incidence of the disease that has to be investigated in detail with special reference to various regions of the province having similarity in climatic conditions and agricultural practices. Since the months from February to June, when the disease is noted at the maximum, happen to be the period when the draught animals are put to maximum agricultural work in most parts of

the province, the seasonal variation may be suggestive of the nature of infection. It has already been specified that the disease is mostly prevalent in working bullockes in the southern districts.

Many of the reports received suggest only a sporadic nature of the disease: a few, however, indicate an outbreak of the malady. Regional study of the disease in selected areas will be more useful to arrive at definite conclusions about its seasonal nature.

#### Etiology of the disease

Out of the 2,833 specimens examined, 1082 cases (about 38.2%) revealed Pasturella organism of the type described by V. K. Iyer. Although they have been noticed only in a small percentage of cases, still, the nature of the disease, the type of the lesions and the difficulties in obtaining suitable materials for examination and isolation of the organism must be taken into consideration. As described before, the disease is characterised by a chronic suppuration with extensive necrosis and caseation of the tissues. In well developed abscess the central caseous material is almost devoid of any bacterial flora with the organisms noticed only in the peripheral zone and at this stage the affected animals are usually brought for treatment. It has been noticed that in about 10% of the cases, the pus was highly caseous and almost sterile. This will indicate how the organisms may be missed unless suitable materials are collected. It should also be taken into account that the organisms are very delicate and die very quickly. As such, pus swabs, containing little of suppurative materials if dried up will not be useful for examination.

Again, open abscesses are frequently infected by secondary organisms which flourish and out-grow the slow-growing organisms of bovine lymphangitis. The difficulties in isolating these organisms, which have been mostly overcome now, might have been one of the factors for a high percentage of negative cases before. Further, it is always necessary to leave a certain margin between clinical diagnosis and laboratory findings.

If, inspite of the above drawbacks, the organisms have been detected in 38.2% of the specimens examined, it clearly indicates that these organisms must have some significance to the disease. It is worthwhile here to note that in none of these cases a fungus has been isolated and the organisms of the pasturella type have here been recorded in the pus corpuscles. A preliminary investigation is being conducted to study the significance of organisms and this will be recorded separately.

#### Mode of infection

Controvertial statements have been published regarding the mode of infection of the disease. As already pointed out, the predilection for

infection limits itself generally to the superficial lymph glands draining the cutaneous areas of the body, mainly the prescapular and the precrural. Although V. K. Iyer (1925) has specified that the precrural gland is more commonly involved than the prescapular, still, from the available records it appear to have an almost equal predilection to both the glands. Further, the animals are brought for treatment only at a late stage of the disease where these glands, either on one, or, on both sides are involved. It may not be even infrequent when the cases are brought at a later stage with the other lymph glands involved.

Raymond (1908) states that 'the disease appears to originate through the infection of wound,' and, in the eleven cases he investigated, 'a wound of some kind, generally a yoke gall, was present'. Raymond further states that the lesion was sometimes a simple abrasion, or at others, an important sore, which in some cases was complicated by a considerable tumefaction of the parts and lameness. It would appear from the description given by Raymond (1908) and Holmes (1909) that 'the infection primarily starts through wound infection following a yoke gall or sore in the region of the neck or hump, and from such primary seats of infection, the 'disease spreads and affects the nearest superficial gland.'

V. K. Iyer (1926), discussing the mode of infection, eliminated the other routes such as ingestion or inhalation judging from the nature of the disease and the lesions. 'In case of alimentary infection the lymph glands of the abdominal viscera should be affected, but, in none of the cases recorded so far, any abdominal lymph glands have been mentioned to show any suppurative lesions'. 'If the portal of infection is by inhalation the mediastinal and the bronchial glands would have to be affected long before the superficial glands are involved. But these glands have not shown signs of suppuration even in those animals that showed affection of the lungs.' (V. K. Iyer 1926). Lesions of bronchial and mediastinal lymph glands have been recorded only in very rare cases.

As pointed out by V. K. Iyer, 'the only possible conclusion is that infection in this disease arises through some method or other which simulates artificial inoculation of the causal organism. Such methods of infection usually occur either (a) through an abrasion or wound existing in a healthy animal and coming directly or indirectly in contact either with the soil or any other material previously infected with natural excretions, wounds or abrasions containing the causal organisms; or (b) through transmission of infection by an intermediate agency.

V. K. Iyer (1926), assuming that the disease has a seasonal incidence coinciding with the breeding season of suctorial insects, has suggested that cattle lice may act as intermediate agencies drawing parallel from human plague. Besson (1913) suggested that the disease may be transmitted by ticks through their bite.

#### Experimental work conducted to study the role of ticks in the transmission of the disease

Taking into consideration that ticks are more commonly seen on the body of the cattle than lice, the following experiments were conducted to study whether they have any role in the transmission of the disease.

Besides suppurative materials, live ticks were obtained from animals suffering from the disease from the field staff. A detailed bacteriological examination was conducted with the suppurative materials and the organisms of the type described by V. K. Iyer were isolated in these cases. Live ticks were triturated with normal saline and an uniform emulsion was made. The material was injected subcutaneously into a guinea-pig and the reactions were recorded. Eight such specimens received from different parts of the Madras Presidency have been examined so far. The ticks were identified as *Hyalomma aegyptium* in six cases and *Boophilus annulatus* in the other two cases. While causative organisms could be recovered from the suppurative materials, not even a local abscess was noticed in the guinea-pigs that were inoculated with tick emulsion. It would appear from these experiments that ticks have little significance in the transmission of the disease. With the description of a filarid worm, *Stephanofilaria assamensis*, as the causative agent for 'hump sore' in Assam by Pande (1935, 1936), it was suggested by some that a helminth of that type may be responsible for the transmission of the disease. But Gopalakrishnan (1942) has described that, in none of the cases of bovine lymphangitis he had studied, filarid worm could be seen. From the clinical description of 'hump sore' (Pande, 1935), it would appear that that disease is entirely different from bovine lymphangitis. Further histopathological study of lesions of bovine lymphangitis (details of which will be published separately) indicate no helminthic infestation, the lesion being characterised by marked necrosis and caseation with a surrounding narrow zone of cellular infiltration consisting mainly of neutrophils with an outer zone of fibroblasts. Eosinophilic infiltration characteristic of helminthic infestation has not been noticed around the nodules.

Since it has been established by Nocard (1888), that bovine farcy is transmitted by wound inoculation and, in view of the reports of Holmes (1908) and Raymond (1909), it is necessary to further investigate the mode of infection. Judging from the nature of infection in acute forms of pasteuriosis in bovines, the contention that these organisms are very delicate, and the chances of their survival in the soil and causing infection are very small, appears to be not very convincing.

Obviously it is necessary that a systematic investigation should be conducted on the etiology of the disease and its mode of transmission which will go a long way in combating the disease in this presidency.

A preliminary investigation has been conducted on some of these aspects, the detailed report of which will be published later.

### Summary

A brief historical survey of bovine lymphangitis and allied conditions has been made with particular reference to the incidence of this disease in India. The inadequate nature of the published records of this disease in India and the contradictory opinions expressed about its etiology has been pointed out showing the necessity for a detailed investigation. A brief study of the general features of this malady in Madras Presidency has been attempted with the help of the available records at the Bacteriology laboratory of the Madras Veterinary College from 1923 to 1948. Out of the 2,833 cases on record, 38.2 percent of the specimens showed organisms of the Pasturella group simulating the type described by V. K. Iyer. The apparent low percentage of the laboratory findings has been discussed. The disease is more common in the bubaleen species, 97.35% of the cases recorded being in them, while 2.65% were in the taureen species. 78.6% of the cases on record were male stock, mostly working bullocks. This aspect of the disease is very significant in view of its importance to the utility of the animals for draught purpose. The disease is recorded in almost all the districts of the Madras Presidency, but appears to be more common in the southern parts. Sporadic cases have been more frequently recorded throughout the year than outbreaks of the disease. Indices of monthly variations have been compiled and a graph showing the seasonal intensity has been drawn and discussed. A brief review of the contradictory opinions expressed regarding the mode of infection has been made. Eliminating the other methods of infection, transmission through wound inoculation, or by intermediate agencies, like ticks or lice, has been considered. Experiments to show that ticks have no significance in the transmission of the disease have been briefly described. The question of a filarid worm like *stephanofilaria assamensis* acting as an intermediate agency has also been discussed. It has been shown that bovine farcy caused by streptothrix (Nocard) is entirely distinct from bovine lymphangitis existing in Madras province.

Although this disease has been recorded in the Madras Presidency as early as in 1909, it is evident that there are several aspects of this malady which require intensive investigation.

### ACKNOWLEDGEMENTS

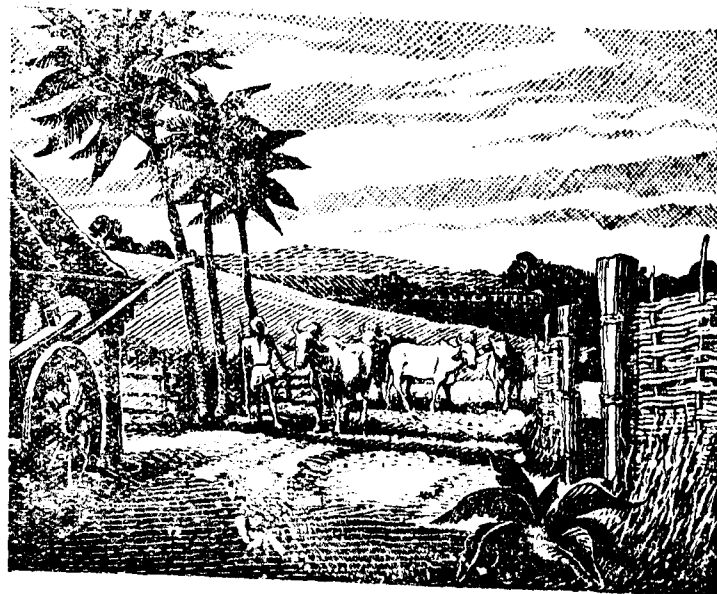
I wish to record my deep sense of gratitude to Sri S. V. Mudaliar, G.M.V.C., Principal, Madras Veterinary College, for the help and encouragement he has given me in preparing this short paper.

I am deeply indebted to Sri K. S. Nair, G.B.V.C., M.R.C.V.S., D.T.V.M. Director of Animal Husbandry, Madras, for the keen interest he has been evincing throughout the investigation of the disease.

I wish also to acknowledge to Mr. T. J. Hurley, O.B.E., M.R.C.V.S., D.V.S.M., L.V.S., Director of Animal Husbandry (on leave), for the kind encouragement he has given me to conduct an independent investigation.

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# THE Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

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No. 4

## Editorial

### OURSELVES

We have great pleasure in informing our readers that, with the completion of this Volume in May 1949, the *Indian Veterinary Journal* completes Twenty Five Years of its career. These twenty five years have been a remarkable period in the history of the Veterinary Profession in India in more ways than one. We, therefore, propose to bring out the issue of July 1949 as a SPECIAL SILVER JUBILEE NUMBER to commemorate the occasion. We are hoping that that Number will, with the co-operation of one and all, contain informative articles on the various aspects of our Profession, review our progress retrospectively and also plan our future in the present changed conditions, not only in this country but all over the world. Progress should be, and has been, our watchword all along and we hope that, as in the past, so in the future, this Journal will mirror the needs of the profession and of the country in all aspects of Veterinary Science.

### MECHANISATION OF AGRICULTURE

At the recent session of the Economic Commission for Asia and Far East (ECAFE) held in Lapstone, Australia, several delegates from Asia strongly criticised a U.N. Food and Agricultural Organisation (FAO) report commending mechanisation of Agriculture. The criticism was strongest from the Philippine delegate who expressed his views in the following words: "Much money has been wasted in the Philippines through the importa-

tion of American machines. Mechanisation should not be introduced in densely populated agricultural areas". The delegate from Laos was equally forcible in condemning mechanisation of agriculture and he 'maintained that mechanisation had caused increased unemployment and poverty in heavily populated agricultural areas. This warning of the delegates in the ECAFE session is very timely and we do hope that this warning is taken note of by the people in this country who often proclaim mechanisation of Agriculture as the panacea of all our ills.

Agriculture in this country is a very old profession—far older than in any other country—and 'it is being practised on traditional lines in which lie deep scientific principles'. Many of these practices were once pooh-poohed as being wasteful and unscientific but, latterly, there has been a growing appreciation of these agricultural methods. In particular, the dependence of Agriculture on livestock, or, rather their close intimacy to their mutual advantage, is getting greater appreciation. Our country is a fairly well populated country: in fact, there are people who think that it is densely populated. Unemployment is very great and it has been a constant endeavour of the Government to find ways and means of getting these people properly habilitated. If, at this stage, mechanisation is to be introduced in Agriculture, the country's economy will be upset tremendously, and it will bring ruin to many, many a people. Of course machines may be useful for bringing waste land under cultivation, especially where such lands are in large blocks; but, when once they have been reclaimed, mechanical cultivation must cease, because the starvation of the land from want of adequate manuring will only get intensified. As one very aptly put it, Machines do not void manure: they only void noxious fumes and pollute the healthy air of the countryside. Machines drive away cattle from farms and with it the best of manures, *viz.*, farm-yard manure. These are factors which should be seriously considered by the Government and others before any money is spent on importing costly machinery. In a country like ours where small holdings are the rule, and extensive holdings are only very rare, where practically all the cultivable lands are long under cultivation, mechanisation is not the answer to our low yield from agriculture. The correct

answer is to understand and appreciate the extreme dependence of our agriculture on livestock and improve the latter to better the former. Cattle are essential as the chief motive power behind the plough and as the Master Fertiliser for all our agricultural operations: they are also essential for the production of the essential protective foods so necessary for supplementing the cereal diet of the mass of the people. And, therefore, all our energies and money should be spent in improving the livestock of the country for increasing the yield from the land with an eye to a greater calorific diet for the people. This aspect of the production drive for increased foodstuffs has been well brought out in his Presidential Address by Rao Bahadur R. Swaminathan, B.A., G.M.V.C., at the Provincial Veterinary Conference held at Madras in October last and which we published in our last issue. In a detailed and close survey, Rao Bahadur Swaminathan has shown the way to a correct approach to the Grow More Food campaign and has very well emphasised the great dependence of Agriculture in India on the health and well-being of the livestock. As he put it very aptly, Development of Livestock is nothing more and nothing less than the Development of Agriculture and we earnestly hope that this point will be borne in mind by the Government in all their plans for increased food production.

#### Late Dr. G. D. BHALERAO.

It is with a heavy heart that we have to write this obituary note about Dr. G. D. Bhalerao, Officer-in-charge, Section of Parasitology of the Indian Veterinary Research Institute, Mukteswar. Little did we realise that this would happen so soon after what we wrote of his achievement, in the September 1948 issue of this *Journal*. In his death which took place at Izatnagar in the early hours of the 4th December 1948, Science in India and the world has sustained a great loss.

Dr. G. D. Bhalerao was born at Wardha on the 10th December 1897. After obtaining his Master's degree from Nagpur, he obtained his D. Sc., from Allahabad. He proceeded

to the United Kingdom in 1934 and obtained the Ph. D., of the London University in 1936. He was awarded the D. Sc., of the same University in 1941.

He started his career as a lecturer in Helminthology in the Rangoon University. Then after a period of service in the Nagpur University, he was drafted, in 1928, as Helminthologist at the Indian Veterinary Research Institute where he has worked ever since. At the time of his demise, he was officer-in-charge, Section of Parasitology. He officiated for sometime during 1947 as the Director of the Institute.

He applied himself assiduously to Medical and Veterinary helminthology, and as a systematic helminthologist, he came to be regarded as an outstanding international personality. He has published about 100 papers in Indian and Foreign Journals and several of his contributions have found place in text books. His book "Helminthic Parasites of Domesticated Animals in India" removed a long-felt want by Veterinary students and teachers in India. He had the honour of being commissioned to write on *Trematoda* in the Fauna of British India Series. He had also the honour of contributing articles to the Jubilee and commemoration volumes published in various countries in honour of eminent scientists.

Dr. Bhalerao was elected twice, in consecutive years, as President of Sections of the Indian Science Congress—in 1947 as the President of the Sections of Medical and Veterinary Sciences and, in 1948 as that of the Section of Zoology and Entomology. He served as a member of various scientific bodies of the I.C.A.R. and of the Government of India. He presided over the Helminthological Committee of the Indian Council of Agricultural Research. He served on the Editorial Board of the Great English-Indian Dictionary. He was the Founder-President of the Research Workers Association of the Indian Veterinary Research Institute.

He was deputed in 1936 to attend the Sixth World's Poultry Congress, at Leipzig and he attended, on invitation, the Fourth International Congress on Tropical Medicine and Malaria at Washington in 1948.



LATE DR. G. D. BHALERAO, Ph.D., D.Sc., (Lond.),  
Parasitologist,  
Indian Veterinary Research Institute, Mukteswar,  
Who died on 4-12-1948



LATE MR. G. N. ROY CHAUDHURI, G.B.V.C.,  
General Secretary,  
West Bengal Veterinary Medical Association,  
Who died on 7-1-1949

He was a man of amiable disposition and took keen interest in the social activities of the Institute.

We tender our heartfelt condolence to the members of the bereaved family.

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**The Late Mr. G. N. ROY CHAUDHURI, G.B.V.C.**

We deeply regret to record the sad demise of Mr. G. N. Roy Chaudhuri at Calcutta on the 7th January 1949. The details of this sad event are not yet to hand. But the first news itself has drowned us in unspeakable grief. For he was a pillar of our profession in India. We have known him for very nearly quarter of a century. Who can ever forget all the invaluable services rendered by him to the All-India Veterinary Association, in its very early days? He was one of those devoted pioneers who laboriously built up brick by brick and watched with great care the raising of that great edifice, the All-India Veterinary Association and founded this *Journal* as well.

It was at the Second All-India Veterinary Conference held at Lucknow in March 1924, that the question of starting this *Journal* was first mooted. With characteristic eloquence, he supported the idea whole-heartedly and even went so far as to say that he would shoulder the responsibility of editing the Journal on behalf of the Bengal Branch, if no other Province was willing to undertake, what then appeared to be a hazardous occupation. But the Conference called upon Madras to undertake the work. In accepting the mandate on behalf of Madras Mr. Mudaliyar (now Rao Sahib T. Vinayaka Mudaliyar) recognising the depth of support the proposal received through the eloquence of Mr. Roy Chaudhuri said that as long as there were men of unquestionable loyalty of the type of Mr. Roy Chaudhuri in the profession, the running of a journal was not going to present many difficulties. Such was his passion for work on behalf of the profession.

Coming from a family of medical men in Calcutta, Mr. Roy Chaudhuri was eminently suited to the profession of the healing art and his 'bed-side' manners with his canine patients

were a delight to watch. He commanded a vast canine practice in that metropolitan City and was much respected. In 1930, when the new Veterinary College in Bihar was opened at Patna, he was taken on the College on a contract basis. After the contract period was over; he went back to Calcutta and it did not take him long to gather and rebuild his dismantled practice.

He had a touch of that famous Bengal school of oratory to a degree unknown in the Veterinary world. Rao Sahib T. Vinayaka Mudaliyar, himself a speaker of no mean order, when once asked to speak at a Conference after Mr. Roy Chaudhury, raised a deafening applause when he said "I consider it a calamity to follow such an accomplished speaker as Mr. Roy Dhaudhury". Such were his powers of eloquence! Others dreaded to speak after him. It was a treat to hear him speak. He was a prominent and popular figure at our Conferences in the early days.

As a friend he was generous to a fault. We have lost a valued friend and a much honoured professional colleague. We offer our heartfelt condolences to the members of the bereaved family.

The West Bengal Veterinary Medical Association is evidently taking steps to perpetuate his memory. We need hardly say that every member of the profession will respond cheerfully and generously. May his soul rest in peace!

### Late Dr. G. N. Roy Chowdhury G.B.V.C.

(A Memoir)

Sri G. N. Roy Chowdhury graduated from the Bengal Veterinary College, Calcutta in the year 1910. He was a contemporary of late Dr. R. V. Pillai of Madras and late Dr. S. K. Sipa, Professor of Surgery, Bengal Veterinary College.

Late Dr. Roy Chowdhury, after qualifying from the Bengal Veterinary College, accepted service in the Civil Veterinary Department, Bengal, but soon gave up the job and decided to set up private practice in Calcutta. His talents were promptly discovered particularly in the field of Surgery. He rose to great eminence as a successful veterinarian and earned great popularity among all classes of people. His clientele covered a wide range among both the European and Indian community where he established a lucrative practice.

He was one of the pioneers in initiating the All-India Veterinary Conference in Calcutta in the year 1921.

He was for about six years Professor of Surgery in the Behar Veterinary College, Patna, from 1930. While at Behar Dr. G. N. Roy Chowdhury founded the Society for the Prevention of Cruelty to Animals at Patna, under the direct patronage of Her Excellency Lady Wheeler, the wife of the then Governor of Behar. During his stay in Behar Dr. Roy Chowdhury was acclaimed as the foremost practitioner in Canine Surgery. During the Behar earthquake, he rendered invaluable service in raising funds for relief work.

On his return to Calcutta from Behar in 1936, Dr. Roy Chowdhury continued his private practice and rose to great eminence.

During the 2nd world war, he rendered valuable services in organising A. R. P. for animals in the Calcutta area and suburbs.

Dr. Roy Chowdhury contributed a number of original articles on different subjects allied to Veterinary Science in various journals.

As a man Dr. Roy Chowdhury was universally liked by all for his very pleasant manners, beaming cheerfulness and humorous talks. As a speaker his brilliant and captivating speeches in public and social functions were a treat to listeners both on account of his gifted deep voice and the depth of knowledge of human nature.

He was the life and soul of the Bengal Veterinary Medical Association, where he remained as its General Secretary till his last days.

Not only the Province, but Veterinary profession at large in India has lost an outstanding personality—a void which is hard to fill for years to come.

Dr. G. N. Roy Chowdhury breathed his last on the morning of 7th January 1949 in his Calcutta residence at Rash Behari Avenue. The members of the Veterinary Medical Association and students and staff of the Bengal Veterinary College carried the byre and performed the last rites on the banks of holy Ganges. Wreaths were placed by Major J. M. Lahiri, Principal, Bengal Veterinary College and also on behalf of Sri P. C. Bannerjee Asstt. Director, the Bengal Veterinary Association and a number of other student organisations with which he was connected for a life time.

The Bengal Veterinary College and the Head Office of the Civil Veterinary Department, West Bengal, were closed for the day as a mark of respect to the great soul.

At the time of death Dr. Roy Chowdhury was aged 62. He is survived by four brothers, wife, two sons, one daughter and a host of friends and relatives to mourn his loss. His eldest brother Kai Bahadur Dr. U. N. Roy Chowdhury is one of the famous Surgeons of Calcutta.

We offer Our sincerest sympathies and condolences to the bereaved family.

## Clinical Articles

### CANINE ECZEMA—ITS TREATMENT WITH T. C. F. WHOLE LIVER EXTRACT SUPPLEMENTED WITH VITAMINS B. & C.\*

By

M. S. GANAPATHY, C.M.V.C., B.V.S.C.,

*Assistant Lecturer in Medicine, Madras Veterinary College.*

Eczema is a commonly occurring skin disease in dogs. It has been defined as an inflammatory affection of the skin, non-contagious in nature, and often limited to a single region of the body. It is characterised by the appearance of very small vesicles with a serous discharge, desquamation of epithelium and superficial excoriations. It may be acute or chronic, dry or weeping and raw or crusted. In most cases it assumes a chronic course with a tendency to secondary invasion by bacteria. Some of the forms have been found to be very refractive to treatment at times.

The causes of this disease are said to be not well known. However, mention could be made here that most of the cases have been put down as due to internal causes such as those occurring in association with indigestion, helminthic infestations, and renal diseases. Sometimes it is also said to be due to nervous causes and defective innervation. The accumulation of dirt and cutaneous parasites as lice, fleas, ticks, and harvest bugs and chemical irritants are also said to be some of the external agents responsible for the production of this disease. A condition simulating Eczema may also be produced by the presence of various acari giving it a contagious nature.

The incidence of cases of eczema at the canine clinic in the hospital attached to the Madras Veterinary College works out on an average to about 14 percent of the total number of medical cases admitted annually (about 4,000). It can easily be inferred from this figure that eczema forms one of the common complaints prevailing among dogs in the City of Madras. Though it is said that eczema is a disease occurring in the summer season, it has been observed in this hospital all through the year, the number of cases, of course, being comparatively more in summer. Further, all breeds of dogs have been seen to be affected equally with a tendency for a greater prevalence among hairy breeds like Cockers, Retrievers, Alsations etc. Numerous cases of eczema were treated in this institution and most of them responded to the usual treatment with the application of skin dressings, ultra-violet radiation, arsenic therapy, etc. Yet, there had been a fair number that were not amenable to any of the above treatment or even specific treatments as detailed against each case in the tabular statement appended. Of these, fifteen obstinate cases were

\* Read at the 8th Provincial Veterinary Conference, Madras Veterinary Association, held in Sept. 1948.

tried with T. C. F. Crude Liver Extract supplemented with Vitamins B. & C. in the course of the last two years and the results of the treatment are shown in the statement.

Almost all the cases manifested more or less similar clinical signs except a few stray cases which showed only pruritus. The common symptoms observed are:— Falling off of hairs; signs of intense irritation as indicated by scratching with the paw, rubbing against hard objects or biting the affected parts; appearance of raw surfaces particularly in the region of the loins, croup-tail, inside the thighs and axilla; and development of tiny vesicles, the exudate from which became dried up and encrusted in some, while in others it was oozing from the surface giving rise to a peculiar offensive odour. In none of the cases, the cause of irritation could be traced to the presence of any ectoparasites, such as lice, fleas, or ticks. Examination of faeces, skin scrapings and urine was also made wherever necessary with a view to eliminate the possibility of helminthic infestations, acariasis or kidney affections being the exciting cause. The results of the examinations have been negative in all.

The treatment was generally started with an oleaginous purgative and the animal was put on a low protein diet with green vegetables and rice or on what the animal was accustomed. Except for the addition of Cod Liver oil and malt extract in the food, no other patent condition powder as Bob Martin's, Shirley's etc., was allowed to be used during the trial with liver extract. In most of the cases tried so far, the usual routine and known specific treatment for eczema having failed to effect a cure, treatment was resorted to with the Crude Liver Extract with Vitamins B. & C. supplied by the Teddington Chemical Factory Ltd., Bombay. The dose employed was 2 to 3 c.c. according to the severity of the case and the condition of the patient. It was repeated at intervals of 2 or 3 days taking into consideration the condition of the animal. The route adopted was the deep intramuscular route at the gluteus or biceps femoralis muscles. Usually, a course of 6 injections extending over a period of 16 to 21 days was found to give very good results. No untoward reaction of any kind was noticed at the seat of injection, nor was there any systemic disturbance produced by these injections. However, the individual needs had been found to vary. Milder cases have shown complete recovery even after 3 or 4 injections (vide item No. 4, 7 and 14 in the statement). Some severe cases required a larger number of injections. It could be seen from the statement that the apparent relief shown by some of the cases (item 3, 5 and 13) was only temporary and had resulted in a recurrence of the disease after varying periods. Such cases had to be treated with a further course of 3 to 4 or 5 injections before they gained their normal coat and vigour. Out of the 15 cases tried with the extract so far, except for the 3 cases (items 8, 9 and 10 whose results are not known), the remaining 12 cases have resulted in total recovery. It is therefore needless to emphasize about the efficacy of this preparation in the treatment of obstinate cases of eczema in dogs and it is worth being tried on a larger and wider scale by every Veterinary Practitioner.

Before concluding this paper, I should like to discuss how this product can be so very effective in such obstinate cases when other drugs have failed to produce the desired effect. I am doing this with a view to bring home to the minds of my colleagues the rationale of the treatment with this product. It is to be assumed that low vitality of the patient with associated disturbance of the haemopoietic system and low resistance to infection are the chief factors concerned in the production of such eczematous condition. If this is accepted, the value of the treatment is automatically established. Each c. c. of the Liver Extract supplied by the Company is said to contain a good proportion of haemopoietic principles available in 25 grms of fresh liver. In addition, it is also said to contain synthetic vitamins of the B complex group viz. Thiamin hydrochloride, Riboflavin and Pyridoxine besides Nicotinic acid, Folic acid, Ascorbic acid (Vitamin C) and Calcium pantothenate, the pH of the preparation being so stabilised as to give a maximum stability to vitamin C in the combination. Vitamin C is recognised to be essential for haemopoiesis in a great variety of anemias and it appears to influence all the stages of cellular development in the bone marrow which ultimately results in the production of normal red cells. The vitamin B complex in the preparation, supplying the deficient haemopoietic factors, is probably responsible for improving the absorption of amino acids from the small intestines. All these naturally tend to produce a rapid increase in the number of erythrocytes causing blood regeneration, an early recovery from the general debility and a speedy improvement in the general tone and well-being. When once the normal health and vigour are restored, the contributory factors such as gastro-intestinal derangements, nutritional deficiencies with their associated weakness and emaciation and the skin lesions evidently caused by the absorption of toxins from the gastro-intestinal tract get eliminated. I am therefore inclined to believe that the healing up of ulcers, the production of good glossy coat and the elimination of pruritus and foul odour from the skin, and a change in the general condition of the patient are thus produced by the T. C. F. Whole Liver Extract with Vitamins B. & C. Anyhow if periodic blood counts of the patients treated had been carried out before and during treatment with this preparation, it would have greatly enhanced the value of this paper. Unfortunately for want of time, I could not do this. I propose to carry this out during my further trials with the preparation.

My thanks are due to Sri M. R. Subramania Sastry, Lecturer in Pharmacology, who guided me and gave valuable help in the treatment in some of the early cases. My thanks are due to the Principal, Sri S. V. Mudaliar and to Mr. Bertie A. D'Souza, Lecturer in Medicine, for their encouragements and suggestions in preparing this paper and to Messrs. W. T. Suren & Co., Ltd., who supplied me with samples of T. C. F. Crude Liver Extract supplemented with Vitamins B. & C.

Table showing the results of treatment of cases of Eczema in dogs with "T.C.F. Crude Liver Extract" with Vitamins B. & C.

| Case No. | Kind of animal, breed, age & sex | Previous History                                                                                                                                                                                                                                                                                                                                                                                                       | Diagnostic methods adopted                                                       | Dose given & route of administration                                          | Duration of treatment | Results | Remarks |
|----------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------|---------|---------|
| 1 3253   | Dog, terrier, aged 3 years       | Intense and continuous pruritis; treatment previously with:—<br>(a) A course of 6 injections of 5 c.c. each of a 10% Cal. Gluconas intravenously on alternate days—no effect, and<br>(b) 6 injections of 2 c.c. each Siolan intramuscularly on alternate days, again with no effect                                                                                                                                    | Faeces—<br>No. ova of parasites<br>Urine—No. abnormality                         | 2 c.c. of the drug was given intramuscularly at intervals of 2 days           | 16 days               | Cured   |         |
| 2 3329   | Dog, Alsatian, aged 2½ years     | Scratching & biting all over the body; presence of diffuse, raw, eczematous patches here and there;<br><br>Was given—(a) 6 exposures of ultraviolet radiation;<br><br>(b) 6 x 10 c.c. of 10% Cal. Gluconas as in case No. 3253;<br><br>(c) 6 x 2 c.c. Siolan as in case No. 3253, and<br><br>(d) 6 injections of 10 c.c. each of a 10% solution of Calcibronat (Sandoz) intravenously on alternate days—with no effect | Faeces<br>No ova of parasites<br>Urine—No abnormality<br>Skin Scrapings Negative | 6 injections of 3 c.c. each were given intramuscularly at intervals of 3 days | 21 days               | Cured   |         |

|        |                                 |                                                                                                                                                        |                                                                                  |                                                                                                                             |                       |                                                                |
|--------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------|
| 3 3598 | Dog, Alsatian, aged 3 years,    | Intense pruritis; was treated with<br>(a) Siolan as in 3253, and<br>(b) 6 daily injections of 2 c.c. each of Acetylarsan subcutaneously—with no effect | Faeces—No ova of parasites<br>Skin scrapings negative                            | Only 5 injections of 3 c.c. each were given at intervals of 2 days                                                          | 13 days               | Had a temporary relief but recurred again after 10 days        |
| 4 3705 | Dog, Dalmatian, aged 2 years,   | Scratching; skin rashes present over the body with a few raw patches of eczema on the ear; no special treatment was tried,                             | Faeces<br>No ova of parasites<br>Skin scrapings negative<br>Urine—No abnormality | A Second course:<br>4 injections of 3 c.c. each were given<br><br>Only 3 injections were given as in 3329                   | 11 days<br><br>9 days | Cured completely<br><br>Cured                                  |
| 5 3773 | Bitch, Alsatian, aged 3½ years, | Weeping eczema on the satifle; was given a course of auto-vaccine with no relief                                                                       | do                                                                               | 6 injections of 3 c.c. each were given 1/m at 2 days intervals                                                              | 16 days               | Showed only temporary relief. Recurred again in a month's time |
| 6 3877 | Dog, Alsatian, aged 4 years,    | Only pruritis present, No special treatment was tried                                                                                                  | do                                                                               | A second course consisted of 3 injections at 3 days intervals<br><br>Liver Extract was given as in the first course in 3773 | 9 days<br><br>16 days | Cured completely<br><br>Cured                                  |

Table showing the results of treatment of cases of Eczema in dogs with "T.C.F. Crude Liver Extract" with Vitamins B. & C.

| Serial No. | Kind of animal breed, age & sex   | Previous History                                                                                                                                                                                      | Diagnostic methods adopted                                                      | Dose given & route of administration                                 | Duration of treatment | Results                                                                        | Remarks |
|------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|---------|
| 7 3883     | Dog, Alsatian aged 3 years        | Scratching all over the body. Treatment with:—<br>(a) Ultra-violet radiation as in 3329,<br>(b) A course of Siolan as in 3253, and<br>(c) A course of Acetylsarsan as in 3598—<br>with no improvement | Faeces No ova of parasites.<br>Skin Scrapings negative.<br>Urine No abnormality | Only 4 injections were given at 2 days interval                      | 10 days               | Cured                                                                          |         |
| 8 3936     | Dog, Terrier aged 2 years         | Pruritus, with patches of alopecia                                                                                                                                                                    | Faeces No ova of parasites.                                                     | 3 injections were only given at 2 days intervals                     | 7 days                | Discontinued; results not definitely known as the case was not seen afterwards |         |
| 9 4182     | Bitch, Bull Terrier, aged 3 years | Constantly scratching; diffuse raw patches on the body; had a course of 4 injections, each of 2 c.c of Colloidal Calcium with Vitamin D s/c. No improvement noticed                                   | Faeces No ova of parasites.<br>Urine—No abnormality. Skin Scrapings Negative    | Only 2 injections of 3 c.c each were given at the interval of 2 days | 4 days                | Discontinued; results not known                                                |         |
| 10 428     | Dog, Terrier aged 4 years         | Furunculosis all over the body; No specific treatment was given                                                                                                                                       | Faeces—No ova of parasites. Skin scrapings negative                             | As in above                                                          | 4 days                | —do—                                                                           |         |

|         |                                         |                                                                                             |                                                  |                                                                                                                    |                    |                                                                                  |                                                                                                |
|---------|-----------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 11 4317 | Dog, Terrier aged 4 years               | Pruritus, with foul odour from the body                                                     | Faeces No ova of parasites. Urine—No abnormality | As in 3329                                                                                                         | 21 days            | Cured                                                                            |                                                                                                |
| 12 4403 | Dog, smooth-haired terrier aged 4 years | Diffuse, eczematous condition of the skin with intense pruritus                             | —do—                                             | 9 injections of 3 c.c each at 2 days interval                                                                      | 25 days            | Cured but recurred 2 months later and was cured with simple external application |                                                                                                |
| 13 644  | Dog, Alsatian aged 2 years              | Scratching                                                                                  | —do—                                             | 4 injections of 2 c.c each at 2 days interval<br>A Second course of 5 injections of 2 c.c each at 2 days intervals | 10 days<br>13 days | Cured but recurred after 2 months<br>Cured completely                            |                                                                                                |
| 14 1227 | Dog, Terrier aged 8 years               | Coat rough; Haemorrhagic spots on the abdomen; Mucous membrane pale; General condition poor | —do—                                             | 5 injections of 2 c.c each at 2 days interval                                                                      | 13 days            | Cured—Coat and general condition improved well                                   | In addition to the Liver extract the animal was put on a course of Haematonics & bitter tonics |
| 15 1497 | Dog, Cocker spaniel, aged 3 years       | Constantly scratching                                                                       | —do—                                             | As in 3253                                                                                                         | 16 days            | Cured                                                                            |                                                                                                |

# FOWL CHOLERA—SOME INTERESTING FEATURES IN A SUB-ACUTE OUTBREAK

BY

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*Disease Investigation Officer, West Bengal, Calcutta.*

It is well known that in any outbreak of Fowl Cholera, the micro-organisms responsible for the malady are demonstrable microscopically in varying concentrations either in the blood streams or from smears prepared from heart blood, liver or spleen. But it seems possible that under certain conditions the organisms may not be demonstrable and that the liver lesions *viz.* pin-point, minute, greyish, 'necrotic' foci, which are characteristic *post-mortem* features, may also be totally absent in the initial stages.

The report described below gives an illustration of the above. It would also be seen as if both the conditions, *e.g.* recovery of bacteria from the internal organs and the presence of 'necrotic' foci on the liver, are in some way inter-related, in as much as both the features were together absent in the early stages of this outbreak and were noticeable only when the disease had taken a more or less protracted course.

**History:**—The history, in brief, was that sometime early in May 1948, the management of a Poultry Farm situated about 10 miles away from Calcutta reported that three of their birds died after a short period of illness within the previous five days and that five more birds had subsequently been affected.

**Investigation:**—The Farm was visited within 3 hours after receipt of the information. It appeared to be very well organised with an efficient staff and run under modern concepts of housing, feeding, management, etc. There were about 20 pens housing pedigree adult stock of imported variety but it was reported that the disease had so far been confined to only 5 pens, mainly due to segregation, isolation and disinfection. After the first three casualties which took place in rapid succession—the illness lasting for only a period of from four to twenty-four hours—some 5 fresh birds were affected since the previous evening. The total number of birds in the 5 pens were 79 and the mortality so far were 3, with 5 more affected. The 3 dead birds were already disposed of, but, unfortunately, not in the proper way.

**Clinical Features:**—The symptoms generally observed were:—Temperature 108.4° to 110° F., extreme dullness, sitting on the hocks, head drawn in towards the wings dribbling of watery mucus from the nostrils and mouth, difficult respiration in some, marked by frequent gaping for breath accompanied sometimes with rattling sound; diarrhoea yellowish—white or sometimes greenish in some but not in all cases; comb cyanotic in a few cases, others pale and anaemic; increased thirst, almost a constant feature amongst all. Wet blood smears of all of them proved negative.

The five sick birds were collected and brought to the Laboratory for further examination. Three died during the night and the other two also died next morning at about 8 o'clock.

**Post-mortem features:**—Nothing significant was observed in the *post-mortem* lesions, except acute helminthiasis in three birds. The proventriculus in one bird showed some petechiae, and the liver of another bird was slightly enlarged with nutmeg appearance: beyond these, nothing unusual was noticed in the other organs of the birds.

Smears prepared from the heart blood, liver and spleen of the five birds proved negative.

**Biological Test:**—About 2 c.c. of a 10 per cent emulsion prepared from the liver and spleen of an affected bird and triturated with N. S. S., were injected subcutaneously into a healthy fowl. The latter showed no sign of ill-health after 24, 48 or 72 hours and was found in perfect health even after two weeks.

The farm was re-visited after two days and the following mortality figures were available up to that date.

|                                            | Pens Affected |       |    |     |      |
|--------------------------------------------|---------------|-------|----|-----|------|
|                                            | I             | III   | V  | IX  | XX   |
| Total Number of birds in the pen.          | 13            | 14    | 12 | 19  | 21   |
| Number of casualty in the respective pens. | 1             | * (1) | —  | (1) | (11) |

(\* Figures in bracket show death. Without bracket indicate affected)

From the above figures, it would be noted that, in course of 9 days, 13 birds had died and one was sick in a flock of 79 birds—thus giving a mortality rate of 16.25%. For all practical purposes, the outbreak seemed to be well under control as a result of the rigid measures of segregation, disinfection and disposal of carcasses by burning: it did not spread to other pens. The disease, however, continued unabated into the already affected pens and in three weeks, about 30 birds had died. *Post-mortem* examination was continued systematically and were conducted on 25 birds without any noticeable lesions. Films prepared from heart-blood and spleen constantly proved negative. Later on, however, in some of the birds autopsied latterly, conditions of general septicæmia became more and more noticeable. The liver in some of these showed minute, pin point, 'necrotic foci'. Examination of films prepared from heart blood of two birds showed in one, a few and, in the other, fairly numerous organisms indistinguishable from *Pasteurella avicida*. It may also be stated here that the temperature of the affected and isolated birds, fluctuated between 108°F and 110°F, and that the course of the disease had become generally

prolonged to three days and in some instances nearly a week. The general condition of some of those advanced cases had become very poor-emaciated, cachectic with prominent keel bone.

**Biological Test:**—About 1 c.c. of heart blood was aspirated through a sterile syringe directly from the heart of one of the fresh carcasses and injected subcutaneously into a healthy fowl. It died within 24 hours and *Pasteurella avicida* organisms were recovered from its heart and liver. On culture, the bacilli showed irregularity of form. They were gram negative. Short rods and ovals were seen and they showed polar staining. Some were like micrococci.

**Control measures:**—As a prophylactic measure, Bovine H. S. Serum and vaccine were employed by the s. s. method at the rate of serum 5 c.c. and vaccine 1 c.c., to each bird.

The result of inoculation into about 25 birds was most satisfactory, as the disease was controlled almost immediately. There were only 2 deaths in the post-inoculation period observed for two weeks. *Post-mortem* examination of one of these birds showed macroscopic lesions of chronic type of fowl cholera; films prepared from heart blood and liver, however, were negative.

**Conclusion:**—It is obvious that the outbreak was a sub-acute type of Fowl Cholera, which baffled diagnosis in its early stages owing to the non-detectability of the causal organisms and the absence of pathological lesions. Only during the later stages of the outbreak were these present and enabled a correct diagnosis and appropriate treatment.

## THE CONTROL OF SURRA IN HORSES AND CAMELS OF JODHPUR STATE

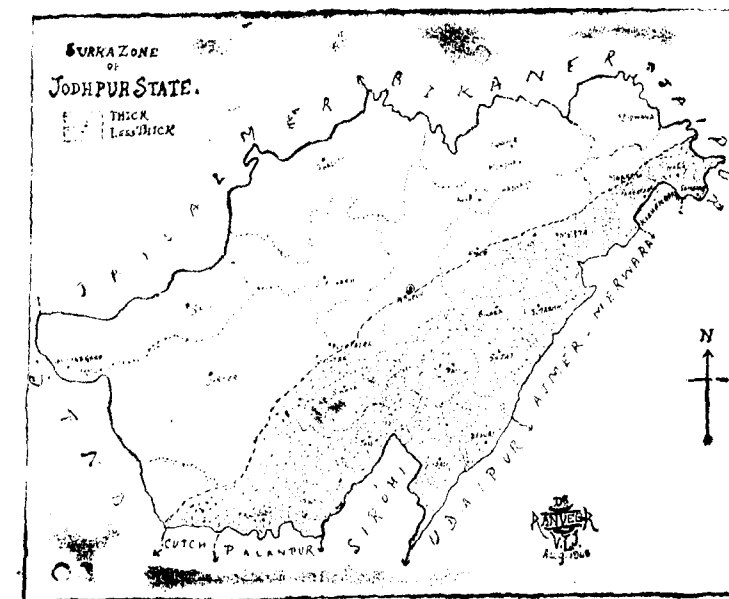
BY

DURGA DAN,

Director, Animal Husbandry Department,  
Government of Jodhpur.

The State of Jodhpur comprises 36,120 square miles of Rajputana country bounded on the north by Jaisalmer and Bikaner; on the south by Udaipur, Sirohi and Palanpur States; on the east by Jaipur, Ajmer and Merwara; and on the west by the Pakistan frontier. The State is divided into two main geographical parts (i) the Thar in the west belonging to the Great Indian Desert with an average annual rainfall of five inches, and (ii) the south-eastern foothill region bounded by the jungle clad Arevelli Hills in which an average yearly rainfall of thirty inches in an area of poor drainage quickly produces extensive marshes each year with the onset of the monsoon. The

insect vectors of surra, principally Tabanidae are, therefore, confined almost exclusively to this tract. It was only when extensive manoeuvres of mounted troops during the late war moved large bodies of animals from east to west that cases of surra were reported from the western areas of the State.



Trypanosomiasis of camels ('Tibarsa') and horses has for many years been a problem of grave economic concern in the eastern region of Marwar, with a population of 1, 26, 262 camels and 25, 832 horses, the owners of which suffered heavy financial loss before the advent of modern chemotherapeutic control measures. The pre-war Bayer preparation Naganol was superseded at the outbreak of the late war by the Imperial Chemical Industries preparation 'Antrypol', which, although reported as very successful by the Director, Indian Veterinary Research Institute, Mukteswar, and the Principal of the Punjab Veterinary College, was entirely reserved for the military requirements on the north-east Assam-Burma frontier where some 30,000 horses and mules were engaged in operations. Surra began to spread at an alarming rate in the absence of an adequate preparation to control it, many stables and herds being completely wiped out by the disease, especially during the heavy flooding of the southern districts of Marwar during 1944-45. The State Veterinary Department was forced to resort to the old and unsatisfactory treatment by antimony compounds, with little success, until the Director of Veterinary Services, G.H.Q., was able to release to us the badly needed 'Antrypol' in small quantities. The Imperial Chemical Industries later came to our aid with a constant supply so that we were able to convene our staff for a plan of campaign against the disease under the direction of the late Maharaja, who had, throughout, taken a deep and personal interest in this problem.

Our survey of the disease incidence showed conclusively that success in our object could be attained only by division of the affected territory into smaller zones which could be covered in turn by independent teams of workers equipped with motor transport. Three such teams were raised and each provided with a very large amount of 'Antrypol' with which all camels and horses in the affected zones were treated compulsorily, prophylactically or therapeutically as required. Camels were given 5 Gms. intravenously and horses 3 Gms. to 4 Gms. according to body weight. This was admittedly a somewhat rough dosage computation but the measurement weight formulae were not then available. A single injection was usually sufficient in camels though in very advanced cases a second or third dose was given to guard against a possible relapse. A curious effect was the rapid improvement in general skin lesions in camels undergoing 'Antrypol' treatment, probably as a result of the improved bodily condition when freed from Surra. Horses were given three doses. Urticarial swellings, sometimes of a large size, were noticed in a small percentage of horses during treatment, usually subsiding within 24 hours. Occasionally, however, the swelling of the throat and neck caused distress and one death was reported. Donkeys and mules, on the other hand, showed no such symptoms though they are known to be usually more susceptible; Symptoms of central paralysis in advanced cases of Surra do not respond to any known treatment, and 'Antrypol' is no exception to this rule. Nevertheless, despite the relatively slight disadvantages experienced 'Antrypol' has proved itself, beyond all doubt, to be highly efficacious. In the past two years 5,880 horses and 25,115 camels have been treated in the Surra zones of Marwar, and though much remains to be done it is now simply a question of finding the additional staff and transport required to carry 'Antrypol' control of the disease to every threatened area.

A certificate of 'Antrypol' injection issued to each animal owner acts as a check on the control of shifting animal populations. These certificates must be produced on demand and afford added security to breeders and dealers. The possession of a certificate also allows the animal to be taken through the restricted Surra free zones, e.g., Sardarsamand Stud Farm, the best in Marwar, around which an area of 10 miles radius is prohibited to uncertified animals.

The large potential areas of infection in Jodhpur State, the dispersal of the animal population, and the shortage of staff all make the total eradication of Surra a formidable task but we have proved that Surra can be, and has been, effectively controlled to a very small fraction of the huge losses it formerly caused each year throughout the south-eastern regions of this State. 'Antrypol' is now in plentiful supply and the question of staff expansion and transport is under consideration. In the meantime those field workers concerned with the control of Surra have sound cause for satisfaction in what has already been accomplished in implementing probably one of the largest civil Surra control schemes in the history of Indian Veterinary Medicine.

## Association News

### MADRAS VETERINARY ASSISTANT SURGEONS' SERVICE ASSOCIATION

Proceedings of the Annual Conference held at the Madras Veterinary College, Madras on the 24th, 25th and 26th December, 1948.

First day, Friday, the 24th December, 1948.

The Conference commenced at 10 A.M. in the beautifully decorated Swarajya Memorial Hall. The following delegates and members from various district Associations were present:—

|                               |                             |
|-------------------------------|-----------------------------|
| 1 Sri V. S. Alwar             | 24 Sri P. L. Narayana Rao   |
| 2 „ G. A. Sastry              | 25 „ T. A. Natarajan        |
| 3 „ R. A. Balaprakash         | 26 „ T. Narayanan           |
| 4 „ G. Balasubramanian        | 27 „ S. Narayanaswamy       |
| 5 „ N. Balasubramanian        | 28 „ V. Panduranga Rao      |
| 6 „ L. Balakrishna Iyer       | 29 „ L. Ramaswamy           |
| 7 „ S. K. Balakrishnan        | 30 „ R. Raghupathi Reddy    |
| 8 „ R. Boomalingam            | 31 „ M. Ranganathan         |
| 9 „ T. B. Balagurunathan      | 32 „ P. S. Rajulu           |
| 10 „ K. P. Damodaran Nair     | 33 „ V. Rathnasabapathy     |
| 11 „ S. Damodaran             | 34 „ B. Sambamurthy         |
| 12 „ M. S. Ganapathi          | 35 „ P. Srinivasan          |
| 13 „ Haider Miah Sahib        | 36 „ S. Srinivasa Rao       |
| 14 „ D. Jayaraman             | 37 „ M. V. Sankaranarayanan |
| 15 „ G. V. Kalyanasundaram    | 38 „ S. Sundaram            |
| 16 „ A. S. Krishnamurthy      | 39 „ G. Venkataratnam       |
| 17 „ J. Krishnamurthy Vasanth | 40 „ C. K. Velayudhan Nair  |
| 18 „ D. Krishnamurthy         | 41 „ K. Venka Reddy         |
| 19 „ M. Muthugopal            | 42 „ R. Veeramani Iyer      |
| 20 „ M. Madhava Rao           | 43 „ D. A. Victor           |
| 21 „ K. T. K. Nambiar         | 44 „ C. Venkateswara Rao    |
| 22 „ E. R. Nagarajan          | 45 „ K. Venkataraman        |
| 23 „ A. Narayanan             | 46 „ L. Venkatachalam       |

The following visitors attended the meeting:

1. Rao Sahib K. Kailasam Iyer, 2. Sri S. V. Mudaliar, 3. Sri K. N. Govindan Nair, 4. Sri D. Mariappa, 5. Sri M. Narayana Menon, 6. Sri M. S. Rajendram, 7. Sri C. Krishna Rao, 8. Sri V. J. Balasundara Das, 9. Sri E. Tulasiram Singh, 10. Sri V. Venkatanarayanan, 11. Sri C. Bharadwajan;

12. Mr. T. John, 13. Sri K. S. Krishnappa, 14. Sri P. N. Krishnan, 15. Sri L. S. P. Sarathy, 16. Dr. V. S. Rishi, 17. Sri R. Ramanujam, 18. Mr. C. T. Peter, 19. Sri M. Chandra Menon and students of the Madras Veterinary College.

The Hon'ble Sri H. Sitarama Reddy, Minister for Industries, Government of Madras on arrival was received and introduced to the distinguished visitors and then conducted to the dias. Sri A. Narayanan was then proposed for the presidential chair. The chief guest and the president were garlanded amidst great cheers.

The proceedings began with the singing of the National Anthem "Janaganamana" by Sri G. Kannamani, student of the Madras Veterinary College.

Sri V. S. Alwar, Secretary of the Association, welcoming the gathering made the following speech :—

Hon'ble Minister, Distinguished visitors and colleagues,

On behalf of the Managing Committee of the Madras Veterinary Assistant Surgeons' Service Association, I deem it a great pleasure to extend to you all a cordial and hearty welcome to this conference. It is a matter of congratulation for ourselves in having the Hon'ble Minister for Industries admit us to inaugurate this conference. Hon. Sri Sitarama Reddy is not new to the Veterinarians of this Province. As an enlightened agriculturist who realises the vital role of the Veterinarian in relation to his livestock he has been all along in constant touch with the members of our profession. Besides, he is well known to us since the glorious chapter of the transfer of the livestock section from the Agricultural Department to its rightful and natural owner—the Veterinary Department. He had been intimately connected with the Provincial Livestock Improvement Board and a number of Cattle Shows which are some of the many proud achievements of the Animal Husbandry Department. Hence the presence of such a distinguished personage amidst us is indeed an inspiration for us. I welcome the present architects of the Animal Husbandry Department whose presence here is a sure indication of their keen interest in the activities of our Association and is a source of immense encouragement for us. We are extremely gratified to see such a large number of delegates and members hailing from Vizagapatam to Tirunelveli, which reveals the strength of our organisation and the keen interest evinced by the members in its activities.

May I take this opportunity to inform the Hon. Minister that this Government recognised association which has been functioning for the past 26 years represents the entire cadre of Veterinary Assistant Surgeons of the Animal Husbandry Department and has district branches in almost all the districts of our province. We strive to discuss in our periodical

meetings the various problems confronting the profession as well as the service besides bringing the members of the service to closer collaboration. Professional matters of topical interest are being discussed and interesting professional articles are being published regularly. We wish to record the sympathetic consideration that the Government as well as the Head of our department are bestowing on the various resolutions passed and suggestions made by us from time to time and we hope to receive similar treatment in the future also.

On such an important occasion as this, it is but essential to review some of the problems that face us and our department.

### 1. NUTRITIONAL PROBLEMS

In a predominantly agricultural country as ours, the wealth of the nation depends mainly on the cultivable lands and the domestic animals, since livestock and agriculture are the two fundamental national industries. Confining ourselves only to the cattle population which is the mainstay of agricultural operations, even though their population is estimated to be about one-fourth of the world's total, even in the pre-war slump days, their condition was deplorable, due to many factors of which the most important one was mal-nutrition. But now we are all witnessing the further deteriorated condition of these animals when the food-stuffs have become scarce and the prices of the available ones have gone up by several times beyond the reach of the ordinary man, may he be an agriculturist of the rural part or a milkman in the urban area. The cattle in the rural areas somehow subsist on the available straw, whereas the cow in the urban area does not get even that. This state of affairs will definitely retard the food production drive, whether it be of cereal products or of milk. The Government will be doing a great service if it counteracts this state of affairs by easing the cattle food situation and thus making them available to livestock owners at reasonable prices. Such a timely help will greatly augment the agricultural operations and the milk supply. All of us know that the available roughages as straw and hay are not sufficient for our cattle population. Out of the commonly used concentrates as groundnut-cake, cotton-seed and bran, the most valuable nutritious nitrogenous product as the groundnut-cake is not easily made available as cattle feed, whereas the major part of its production has been switched over as manure. The drive of the Animal Husbandry Department to introduce and popularise the cheap and indigenous sterilised bone meal as a mineral supplement to the rations of animals is at times handicapped by the non-availability of the stuff. Besides these, the average ryot does not realise the correct and economic principles of feeding. To remedy these shortcomings, I would like to suggest the following which have been often stressed by the senior officers of our department.

- (i) All the available grazing areas should be completely tapped and made accessible and available for cattle grazing.

- (ii) Preparation of silage and hay should be popularised and the Department itself should undertake the work in forest lands and other available Government areas.
- (iii) Growing of fodder crops in cultivable waste lands, should be encouraged and if need be, compelled.
- (iv) All the available groundnut-cake should be diverted solely as cattle feed and the same made available to the ryots through the agency of the Animal Husbandry Department.
- (v) The prices of concentrates should be controlled and they should be made available to the cattle owners at reasonable prices through the agency of Cooperative societies, fair price depots and Veterinary Institutions.
- (vi) Scientifically constituted rations by the Department with the readily available concentrates in the shape of mixed cakes or bricks may conveniently be made available through the Animal Husbandry Department, whose officers can thus get in contact with the cattle owners and advise them on the sound and economic principles of feeding.
- (vii) The Veterinary Assistant surgeons should be made the inspecting authorities of such cattle feed depots to ensure the supply of good foodstuffs at the controlled rates, and
- (viii) The Government should themselves start bone-meal factories to supply this cheap but efficient mineral supplement.

## 2. MEAT INSPECTION

In all the advanced countries the inspection of meat by the veterinarian is obligatory before it is released for sale. Thanks to the efforts of the Director of Animal Husbandry, most of the Municipalities in this Presidency are utilising the services of the Veterinary surgeons for this work, but still there are a considerable number of slaughter houses which do not utilise the services of the only competent personnel—the veterinary surgeon. Whatever may be their excuse, it is high time that in the interest of Public Health, the inspection of meat and slaughter houses by the Veterinarian is made compulsory on the part of the local bodies.

## 3. DEVELOPMENTAL PLANS.

The Director of Animal Husbandry had placed a very modest easily workable post-war development plan before the Government which readily got the acceptance of the authorities. But many of the proposals are kept in abeyance for want of specially qualified personnel. As far as the basic knowledge is concerned, I have no hesitation to declare that the veterinary graduate of this college compares favourably with anyone of his counterpart qualified in any

other part of the world. (cheers) But we will have to admit that the facilities for higher technical training is limited in our country. Realising this, the Central as well as many Provincial and State Governments have deputed a large number of Veterinary graduates abroad for advanced studies. But the story is different in our province. You may be surprised to learn that only four from this Department have so far gone abroad. For any developmental activity, the need for highly trained staff is imperative. Hence I request the authorities to depute a large number of Veterinary graduates of this Department for advanced studies who will have to play a vital role in the future set up of the Department. The need for a Central Research Institute in the South was pressed in the recent Provincial Veterinary Conference and I may suggest that the Serum Institute at Ranipet and the Livestock Research Station, Hosur Cattle Farm can be profitably and usefully developed into Veterinary and Livestock Research Institutes respectively. Whatever may be our developmental aims and plans, the important factor is the creation of a nucleus of highly specialised staff which cannot be obtained unless a large number of Veterinary graduates are deputed in different branches of Veterinary Science and Animal husbandry to the scientifically advanced countries.

## 4. TOURING WORK.

Another handicap which stares our Department is the shortage of personnel and this factor is keenly felt whenever any further activity or expansion is thought of. But it should be realised that for a few more years to come this problem will be getting more acute. Hence it is essential that the existing qualified personnel will have to be employed in the best manner possible. Though some may not agree with me, I venture to suggest and thus echo the feelings of my colleagues that the touring billets will have to be closed straight-away, to give place to rural Veterinary dispensaries. The present itinerating staff will have to stay at their head-quarters and thus be of help to the needy who go over to them for advice and help. By this proposal I do not mean the complete stoppage of touring work. Whenever contagious diseases break out, the Veterinary Assistant surgeon will be at the spot to control the same. This proposal will only put an end to the systematic tour even in the absence of outbreaks of contagious diseases. Thanks to the pioneers of our Department, the era of propaganda is over and we are sufficiently popular with the ryots. The investigation of hidden diseases can also be successfully tackled. If the authorities feel hesitant to take this bold step, I request them to try this experiment in at least a few districts and complete the process gradually. In the meanwhile, I wish to press one of our repeated requests consistently turned down by the authorities. The work of the Touring Veterinary Assistant Surgeon, entails him to keep with him a large number of officeboxes, dealwood cases and bone-meal bags. All these definitely occupy considerable space of his living quarters. Besides this, he has to receive a large number of callers in his professional capacity. For all these, the proper and just procedure should be the

provision of an office for him. If the Government finds it difficult to provide one such, the concerned officer should be paid atleast a definite amount as the office rent allowance so that he may be able to look for a bigger house to accomodate his office.

#### 5. SECOND CLASS LANGUAGE TEST.

I will be failing in my duty if I do not refer in my address about the question of the second class language test, the passing of which is obligatory on the Veterinary Assistant Surgeon to earn his increment. Second class language test was introduced at a time when the Veterinary Assistant Surgeons, of a particular language area were not in sufficient numbers for the posts in that area which led to the transfer of some from the other linguistic districts. Since its introduction, a large number of us have passed the test. Moreover, it can now be found that the officers of each linguistic area are sufficient to man the respective regions. The Government also is deprecating the transfer of officers to far off places. Hence, I request the the authorities to give earnest consideration to this matter and abolish the second class language test. Such a step will be gratefully appreciated by the Association since it will redress the grievences of a considerable number of members who are put to a lot of suffering by the penalising clause which followed this compulsory test.

Finally, I wish to affirm that whatever may be our difficulties and hardships we shall strive to serve the common man and the Government to the best of our abilities and thus raise the status and popularity of the profession before the eyes of the public.

Before concluding my address, I appeal to my colleagues to contribute their mite with a smiling face to the memorial fund of the Father of the Nation and thus derive the satisfaction that he too has done his best to perpetuate the memory of the Greatest Man of the World. "Jai Hind"

The Honble Sri H. Sitarama Reddy then declared the conference open with an extempore address, in the course of which he said that not being a Veterinarian himself, he could not possibly be of any assistance to them in solving the technical side of their problems. But he had one distinct advantage of being able to look at their problems objectively. As a member of the Provincial Livestock Improvement Board and the Indian Council of Agricultural Research and as one who comes from a family of agriculturists, he was naturally interested in the upkeep and development of livestock. He considered the work of the Animal Husbandry Department as of supreme national importance, as livestock formed one of the basic needs of national life along with Agriculture as the Secretary had pointed out earlier. It was true that India had the reputation of having quite a large percentage of animal population of the world. In spite of the fact that Hindus were worshipping the cow, the treatment of cattle was anything but complementary. He was sure that

with the new ideas that the members of the Association would be able to instil into the minds of every villager, greater attention would be paid to the upkeep of the animals than hitherto. Unfortunately, in some urban areas, the animals were only looked upon as commercial products. Attempts had been made by the Government of India in collaboration with provincial Governments to salvage the dry cows in urban areas. He hoped full use would be made of such assistance to see that the cattle we have, were preserved.

Forecasting a great future for the Veterinarians in this country, the minister reminded them of the great interest evinced by the Government of India in developing good breeds of cows and bulls so as to augment the yield of milk per cow and the capacity of the bulls to do farm work. He was sorry to say that the best Ongole breed was today found not in India but in America. It was for the Veterinarians to set this matter right and see that India's cattle wealth was restored to its pristine glory and in this endeavour a wide field of work by way of research and experiment lay before them. He spoke of the good work he had seen in respect of Kangayam breed in the Coimbatore district. He was glad the Association was devoting its attention to this aspect of work in addition to discussing service problems. He congratulated the Association for its keen interest in the professional matters by their discussions and reading of papers.

The Minister was glad to note that the era of propaganda was now over and the people had begun to appreciate the services rendered to society by the Veterinary profession. This was a good augury and he hoped the profession will take advantage of this good will. Mutual cooperation between them and the public would be productive of great good. If they did their work with a sense of service, love and devotion there would be a satisfactory response from the public and this mutual association would go far to remove some of the service difficulties. Unless they took a sense of pride in their work they could not give their best.

Referring to the question of making more cattle feed available, the Minister said that he intends to ask the Livestock Research Section to conduct experiments and find out if the cotton seed would prove a nutritive cattle feed even after the extraction of the oil from it. Already he was told that not only the cotton seed retained all its nutritive value after the extraction of oil, but that the oil would itself be fit for human consumption. One view was that this oil when refined was much superior to all other oils. It would be necessary for the Veterinary Department to conduct a few experiments in this regard.

Referring to the suggested utilisation of the groundnut cake solely as cattle feed which is now being used on a large scale as manure, the Minister could not say what the reaction of the officers of the Agricultural Department would be, if it was diverted as a cattle feed. The Agricultural Department wanted it for the Grow More Food campaign to increase the yield per acre. It

determining the use and distribution of such articles the Government had to reconcile the conflicting demands and view the subject from all angles and aspects of the problems facing them. If the members of this profession realised the difficulties of the Government they would not ask for the groundnut cake to be distributed solely as cattle feed.

Sri. A. Narayanan, the President addressed the meeting as follows.

The Hon'ble Minister, Friends and Gentlemen,

I am deeply conscious of the honour you have done me to-day in proposing me to preside over this Conference and I thank you very much for giving me an opportunity to meet and exchange ideas with such a large number of professional brothers.

First of all, allow me to extend my hearty welcome to you all to this Conference—a body which represents men in service, who have joined in the effort to improve and preserve our livestock and enrich the country. To those who through exigency of public service or for unavoidable reasons have not been able to be present, I express my sympathy.

We are extremely grateful to the Hon'ble Minister for Industries for having kindly consented to inaugurate the Conference in spite of his heavy engagements and important duties. His presence here to-day will enable us to apprise him of our needs in our work in the field of Animal Husbandry and Veterinary Science.

I should initially like to recall the memory of the members of the profession the lucid and concise presentation of the Animal Husbandry problems confronting us to-day, in the speech delivered by Mr. T. J. Hurley, the Director of Animal Husbandry in the last year's Conference and I cannot but emulate the lead given by him on that occasion.

We are conscious of the increased responsibilities devolved on us for augmenting the tempo of agriculture and food production in the New Free India. As at present our country is importing foodstuffs from abroad at an enormous cost and it is for us and those engaged in agricultural work to devise ways and means to enable the people in this country to produce enough for themselves and for export. The Central Government under the able guidance of the Food Minister have fully realised their responsibility in producing food and feed India's teeming millions. Unless the Provinces keep pace with its fast moving centre and work in collaboration and co-ordination, there is bound to be dislocation and disorder in backward regions. We have entered a new era after a bitter struggle for freedom devolving on us the work of construction and development in our departmental activities. Our profession will have to play an important part socially and economically in this new set up, for the economic development of country. It is imperative that we should realise our responsibilities and the hard task ahead of us and equip ourselves fully and shoulder the burden, and it would not be out of place here if I quote

Mr. Hurley "Human nature being what it is, it is very easy for all of us to fall into the ordinary routine way of carrying on and if we all do that then the Department carries on in a routine way with the result that there is no progress and instead of advancing we should start retreating".

The duties devolved on the modern Veterinarian are varied and many. In addition to his primary duties of improving and increasing the livestock and its products such as milk, butter, ghee, poultry, meat and wool, and protecting them against the ravages of enzootics, he has a great obligation to discharge in the matter of human health and nutrition. In order to put more efficient work, an atmosphere for research and thirst for knowledge should be created and facilities provided for men pursuing different aspects of the Veterinary and Animal Husbandry Sciences to come together so that the students may get a chance to develop a spirit of fellowship. It is observed that much of water-tight compartments are created in the administration of technical institutions such as Medical, Agricultural, Engineering and Veterinary, which is harmful and detrimental to the development and growth of mutual intercourse amongst men engaged in the study of different sciences and technology. Such close contacts will go a long way to make these people realise their shortcomings and desire to improve.

There is plenty of room for research and investigation in the Veterinary and Animal Husbandry activities as the entire outlook in the modern livestock production has completely changed and the need for scientific study of problems in Animal Husbandry is felt keenly day by day. Although the Post-war Reconstruction plans and Schemes are of an exploratory nature and limited scope, yet it is possible to demonstrate how the desired improvements can be effected if scientific methods are applied in animal breeding, milk production, animal nutrition, management of pastures, poultry units and the development of small animals. To ensure success of these developmental plans the most important factors are joint effort and hard work of our professional men.

In such advancing times the Veterinarian and those engaged in Animal Husbandry work cannot afford to stand aloof. Best available talents from among the Veterinary Graduates should be recruited for research work in Animal Nutrition, Genetics, Dairying and associated technological studies. These men through their investigation and researches should be able to help the profession in preserving animal health, increasing the fertility of livestock, producing more milk and increasing the productivity of wool, eggs, etc.

Coming to the food problem the most important one is milk. Milk is an indispensable item in the diet of infants, expectant and nursing mothers, invalids and many adults. In a predominantly vegetarian community, it is a necessity to give a balanced diet. Hence adequate supply of pure milk is a matter of public concern particularly to urban dwellers. Hence, produce more

milk should be our slogan at a time when strenuous efforts are made to grow more food. This to a small extent is solved by the formation of Co-operative Milk Supply Societies in the Province and they supply milk and its products to the people. Milk, butter, ghee and butter-milk are the chief products that are sold. All these I regret to say are neither free from contamination nor adulteration. It is high time that the Government brings out a legislation for the regular and periodical inspection of the animals milking in such societies by the veterinarians to ensure supply of uncontaminated milk and its products to the people.

Well, Friends, I need not very much dwell upon the prophylactic side of treatment in combating the ravages of enzootics, which is the daily routine of our touring staff. The existing itinerating staff is not sufficient to cope up with the work. The appointment of Stockmen Compounders is not adequate. In this connection, I should like to say a word about them. They should be either stockmen to assist the Veterinary Assistant Surgeons in the field or compounders for the hospitals and dispensaries. These dual purpose men are in no way helpful to the Veterinary Assistant Surgeons and thanks to the Government for abolishing this course and replacing it with training of Veterinary and Livestock Inspectors, who I hope when they come out will be of real help to the itinerating staff who could in turn devote more attention towards investigation of hidden diseases and other important livestock problems.

There is ample evidence in Sanskrit literature that a system of cattle treatment was in existence in ancient times. There are many people in the villages who know something of the cattle diseases and practise the Veterinary Art mainly with indigenous drugs. In many cases they are very efficacious. It is open to the members of this Association to collate the prescriptions of these people, to test their efficiency and investigate into their properties, to utilise their knowledge of chemistry for making standard preparations of such indigenous crude drugs as are found to contain curative properties and to make a scientific use of their research in this direction in a variety of ways. I am glad to say that the Government have already taken the initiative in this direction and I hope it will be of immense help to our profession. In any case, I am sure that familiarity with the indigenous method of cattle treatment will enable our Veterinary Graduates to win popularity by pouring new wine in old bottles, that is by administering their medicines in the right Indian manner.

The hostile attitude of the general public towards the department which manifested itself at its inauguration encountered by the pioneers of this department has almost completely changed and the masses are more and more getting to appreciate its benefits. I hope it would become complete in the course of few years by the assiduous efforts of the members of this Association.

It is highly regrettable to note that the Government turned down the suggestion of this Association to entrust the inspection of hackney carriage animals by Veterinarians. I am sure you will all agree with me when I say that there is none more qualified to do this work than a Veterinarian; in the interest of these dumb animals and that of the safety of the travelling public, I venture to urge the Government to reconsider their decision in this matter.

There is at present a shortage of Veterinary personnel to cope up with the enormous work of the department and to tide over this difficulty I would strongly suggest that those under sixty who have already retired but are otherwise physically fit should be re-employed as a temporary measure. In the retired list to-day there are several such men whose accumulated knowledge and experience over a long period of professional career can be profitably utilised at this juncture.

On the subject of Veterinary Education, I would strongly plead for the revival of the Post-Graduate Course at the Veterinary College, which unfortunately was discontinued during war period, to keep the staff abreast with the advancing times.

The bulk of Veterinary Profession are members in service. There is no scope for private practice. On an occasion like this, it is not possible to avoid treading on service questions. I should like to make a few observations on the revised scales of pay. While appreciating fully the financial difficulties of the Government, I cannot but bring to their notice that the recent revision of pay without taking into consideration the full period of service of personnel has worked detrimental to the interests of senior men in service who have to stagnate on account of the graded system. There is, therefore, a necessity to revise the pay once again to better the lot of such men who are affected.

Before I conclude, I would like to say a few words to my friends in the profession. You have a great responsibility to discharge and each one of you should endeavour to equip yourself by further studies and keen observations in the field so that you will enhance your reputation and add to the efficiency of the service to which you belong.

I once again thank the chief guest for kindly accepting our invitation to open this Conference.

Messages wishing the conference a success were received from Sri L. S. Parameswara Iyer, G.M.V.C. the First Secretary of the Association and Rao Bahadur R. Swaminatha Iyer, B.A., G.M.V.C. (Retired Principal, Madras Veterinary College).

Sri D. Krishnamurthy, Treasurer, then proposed a vote of thanks to the Minister and the visitors. He thanked also Messrs. W. T. Suren & Co., Ltd., the distributors for Teddington Chemical Factory products for bringing out the printed programme booklet of the Conference.

After the departure of the chief guest and the visitors, the Subjects committee was elected, which met at 2-30 P.M. and drafted the resolutions to be placed before the General Body.

With this the first day's session was over.

*Second day, Saturday, the 25th December, 1948.*

The proceedings commenced at 9-30 A.M. with Sri A. Narayanan in the chair. Besides the members, Rao Sahib K. Kilasam Iyer, Sri S. V. Mudaliar (Principal) and the gazetted staff of the Madras Veterinary College, Veterinary staff of the Corporation of Madras and Sri K. S. Krishnappa of May & Baker, (India) Ltd., were present on special invitation.

The following professional papers were read and discussed :—

- (1) Serum Phosphatase Activity In Sheep : Part I: By Messrs. K. N. Govindan Nayar, G. A. Sastry and K. T. K. Nambiar of the Department of Physiology, Madras Veterinary College.
- (2) Pharmacology of Surgical Antiseptics and Disinfectants: By Sri V. Ratnasabapathy, Veterinary Research Unit, Madras Medical College.
- (3) Incidence of Canine Rabies in the City of Madras: By Sri M. S. Ganapathy, Department of Medicine, Madras Veterinary College.
- (4) Fodder problems in the Nellore District: By Sri C. Venkateswara Rao, Department of Hygiene, Madras Veterinary College.
- (5) Some aspects of infestation of Cysticercous cellullisae: By Sri D. Krishnamurthy, Department of Pathology and Bacteriology, Madras Veterinary College.
- (6) Role of Vitamin 'E' in Post Abortion Prolapse of the Uterus: By Sri B. Sambamurthy, Vizagapatam Circle.
- (7) An Introduction to Homoeopathy and its applicability in Animal Practice: By Capt. G. A. Sastry, Department of Physiology, Madras Veterinary College.
- (8) Blood groups in Sheep : Part I: By Messrs. K. N. Govindan Nair, G. A. Sastry, K. T. K. Nambiar Department of Physiology, Madras Veterinary College.

*Third day, Sunday, the 26th December, 1948.*

The Annual General Body Meeting was held at 12 noon with Sri A. Narayanan in the chair. The Secretary presented the proceedings of the last annual general body meeting and the same was recorded. The report of the managing committee for the year 1948 was read and recorded. The action of

the managing committee accepting the revised instructions received from the Government for the recognition of Service Associations was ratified. Several resolutions bearing on the profession and the service conditions were moved and passed.

The following office bearers were elected for the year 1949 :—

|                                          |     |                        |
|------------------------------------------|-----|------------------------|
| <i>President</i>                         | ... | Sri R. Veeramani Iyer  |
| <i>Vice-President</i>                    | ... | Lt. S. K. Balakrishnan |
| <i>Secretary</i>                         | ... | Capt. G. A. Sastry     |
| <i>Joint Secretary</i>                   | ... | Capt. P. S. Rajulu     |
| <i>Treasurer</i>                         | ... | Sri M. Ranganathan     |
| <i>Members of the Managing committee</i> | }   | Sri V. S. Alwar        |
|                                          |     | Capt. M. Muthugopal    |
|                                          |     | Sri D. Krishnamurthy   |
|                                          |     | „ S. Damodaran         |

After a general discussion about the activities of the Association, the President in his concluding remarks stressed about the importance of a well organised Association. He appealed to all the Veterinary Assistant Surgeons to enroll themselves as members. He pleaded for the formation of district Associations in all the districts.

Sri T. Narayanan, on behalf of those from the districts thanked the Managing Committee for the excellent arrangements made. The outgoing Secretary then proposed a vote of thanks and thanked the Principal, Gazetted staff and the students of the Madras Veterinary College, the Warden and the Assistant Warden of the Madras Veterinary College Hostel, members of the Managing Committee, the secretaries of the district Associations, individual members and Rao Sahib K. Kailasam Iyer.

CAPT. G. A. SASTRY, B.V.Sc.,

*Secretary.*

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THE ALL-INDIA VETERINARY ASSOCIATION  
THE INDIAN VETERINARY JOURNAL

*Receipts and Payments for the year ending 30th June 1948.*  
(Volume XXIV).

| To OPENING BALANCE:                                                           |      | Rs.  | A.    | P.   |
|-------------------------------------------------------------------------------|------|------|-------|------|
| Fixed Deposit                                                                 | ...  | 4000 | 0     | 0    |
| Cash in hand                                                                  | ...  | 325  | 10    | 2    |
| Subscriptions                                                                 | ...  | 4326 | 10    | 2    |
| Advertisements                                                                | ...  | 6844 | +     | 3    |
| Reprints                                                                      | ...  | 1526 | 8     | 0    |
| Bank Interest                                                                 | ...  | 23   | 0     | 0    |
|                                                                               | ...  | 120  | 0     | 0    |
| <b>Note :—</b> Honorarium for Vol. XXIV has not yet been drawn by the Editor. |      |      |       |      |
| By Printing charges including blocks                                          |      |      |       | 550+ |
| " Postage                                                                     | ...  | 1385 | 10    | 8    |
| " Salary of typist with bonus                                                 | ...  | 910  | 0     | 0    |
| " Rent                                                                        | ...  | 480  | 0     | 0    |
| " Furniture (Two Almirahs)                                                    | ...  | 327  | 0     | 0    |
| " Typewriter repairs                                                          | ...  | 115  | 0     | 0    |
| " Stationery                                                                  | ...  | 55   | 8     | 0    |
| " Audit fees                                                                  | ...  | 25   | 0     | 0    |
| " Bank charges                                                                | ...  | 1    | 14    | 0    |
| " Closing Balance:                                                            |      |      |       |      |
| Fixed Deposit                                                                 | 4000 | 0    | 0     |      |
| Cash in hand                                                                  | 36   | 1    | 10    |      |
|                                                                               |      | 4036 | 1     | 10   |
|                                                                               |      | Rs.  | 12840 | 6 5  |

Examined and found correct.

20, Thambu Chetty Street,  
Madras 1.  
1st January 1949.

K. GOPALAKRISHNA RAO,  
Registered Accountant & Auditor.

**THE UNITED PROVINCES ANIMAL HUSBANDRY  
STOCKMEN'S ASSOCIATION**

The second Annual Conference of the Association was held on the 10th and 11th October 1948 in the D. A. V. College Hall, Lucknow. There was a large gathering of members and visitors.

Shri R. L. Kaura, M.B.E., B.V.Sc., M.R.C.V.S., Director of Animal Husbandry, United Provinces, presided and Shri S. M. S. Zaidi, Acting Chairman of the Reception Committee read an address of welcome in Urdu. A Hindi poem of welcome was recited by Shri Balram Singh Visharad.

The General Secretary Shri J. P. Saxena read the annual report. He narrated the various measure taken for improving the status of the Stockmen in the United Provinces, who numbered 500 now, and whose recruitment still continued. The grievances of the Stockmen in regard to their pay and prospects were put up to the Government for redress. Special stress was laid on the fact that while a compounder—a IV class Government servant with middle class education and 3 months technical training—was given a grade of Rs. 45 to Rs. 100/–, the Stockmen—a 111 class Government servant with middle class education and 6 months technical training—was given a grade of only Rs. 30/– to Rs. 65/–. This was quite unfair and the Government was earnestly urged to correct this recommendation of the Pay Commission.

The Conference passed a number of resolutions for the better utilisation of the services of the Stockmen and their future prospects in the Department and requested a grade of Rs. 75 to Rs. 100/– for them. It also suggested starting of fodder stations and distribution of fodder through the agency of Stockmen.

With the election of office-bearers, the Conference concluded a successful session.

Gabhana, Aligarh Dt. }  
10-11-48.

J. P. SAXENA.

**MADRAS VETERINARY ASSOCIATION**

**Proceedings of the Managing Committee Meeting held on 5-12-48.**

The First Managing Committee Meeting was held on 5-12-48 in the Library Hall, Madras Veterinary College. Sri K. S. Nair, G.B.V.C., M.R.C.V.S., D.T.V.M., presided.

The statement of receipts and expenditure for the eighth Provincial Veterinary Conference held on 24, 25, 26th September 1948 presented by the Treasurer was adopted.

The following were elected as office-bearers unanimously :—

Secretary ... Sri. G. Venkatratnam, B.V.Sc.

Treasurer ... P. Srinivasan B.V.Sc.

G. VENKATRATNAM,  
Secretary,

#### WEST BENGAL VETERINARY MEDICAL ASSOCIATION

Proceedings of the condolence meeting in memory of late Sri G. N. Roy Choudhury, G.B.V.C. late General Secretary of the West Bengal Veterinary Medical Association held on 9.1.49.

Prof. Sri M. S. Das was proposed to the chair by Sri Bhadury. Sri. C. C. Das Gupta and Sri P. K. Bose Seconding Prof. Sri M. S. Das presided.

The following official resolutions were moved and adopted :—

1. The Veterinary profession in Bengal are shocked to hear the sad news of the demise of Sri G. N. Roy Choudhury on the 7th January, 1949. He was an eminent practising Veterinary Surgeon in this country and also the Hony. General Secretary of the Bengal Veterinary Medical Association for the last eight years.

This Association therefore records with profound sorrow the great loss and conveys its sincerest sympathies and condolences to the bereaved family.

2. This Association resolves that necessary funds be raised for perpetuating the memory of late Sri G. N. Roy Choudhury in a suitable manner and a strong sub-committee be formed to work out the plans and details of the G. N. Roy Choudhury memorial fund.

The following were elected Members of G.N. Roy Choudhury Memorial Sub-Committee :—

1. Major, J. M. Lahiri, Principal Veterinary College, Belgachia, Calcutta, *President*.
2. Sri P. C. Bannerjee, Asstt. Director of Veterinary Services, West Bengal.
3. „ M. S. Das, Professor, Bengal Veterinary College, Calcutta.
4. „ B. K. Das, 56 Chowringhee, Calcutta.

5. „ C. C. Das Gupta, Supdt. Veterinary Services, Head quarters West Bengal, Calcutta.
6. „ P. C. Sen Gupta, Lecturer, Bengal Veterinary College, Belgachia Calcutta, *Treasurer*.
7. „ S. K. Bhadury, Disease Investigation officer, West Bengal, Secretary West Bengal Veterinary Medical Association, Ex-officio *Secretary*.
8. „ S. K. Bhadury, Convenor.

S. K. BHADURY,  
*Secretary,*

W. B. V. M. Association.

#### Proceedings of the G. N. Roy Choudhury Memorial Sub-committee.

The G. N. Roy Chowdhury Memorial Sub-committee decided at its meeting held on the 22.1.49, under the Chairmanship of Major J. M. Lahiri that

- (1) A photograph and synopsis of career of late Dr. Roy Chowdhury be sent to the Editor, *Indian Veterinary Journal* as desired by the Editor, for publication in the January issue of the Journal.
- (2) An appeal may be issued to all members of Veterinary profession in Bengal and outside the province to contribute to the G. N. Roy Chowdhury Memorial Fund.
- (3) A special prize, preferably a silver medal, termed and inscribed "The G. N. Roy Chowdhury Memorial Prize" be awarded to the best student of the final year class in Surgery of the Bengal Veterinary College.
- (4) An appeal for funds may be issued to private donors.

S. K. BHADURY,  
*Secretary,*

Bengal Veterinary College  
Belgachia,  
The 24th January 1949

West Bengal Veterinary Association,  
Calcutta.

## College News

### EAST PUNJAB CAMP VETERINARY COLLEGE, HISSAR

#### Admission Notice

Applications on the prescribed form obtainable from the Principal's Office, for admission to the East Punjab University B.V.Sc. Course, will be received till 24th January 1949. Admission will take place on Wednesday, the 2nd of February 1949, when candidates who are eligible will be interviewed by a Board appointed for the purpose at 10 A.M.

Minimum qualification required is Intermediate, Science Faculty (Medical Group), pass or its equivalent.

Fees for bonafide residents of East Punjab and those who were residents of West Punjab and N.W.F.P. prior to partition of the Province, and have since settled in East Punjab, at :

|                   |     |           |                    |
|-------------------|-----|-----------|--------------------|
| Tuition Fee       | ... | Rs. 120/- | per annum          |
| Athletic Fund Fee | ... | Rs. 12/-  | do.                |
| Breakage Fee      | ... | Rs. 12/-  | do.                |
| Library Fee       | ... | Rs. 10/-  | On admission only. |
| Total             |     | Rs. 154/- | per annum          |

are payable in advance on admission.

Thirty students from East Punjab and 30 from other Provinces and States will be admitted. Candidates from other Provinces and States, who should apply through their respective Governments, will pay a capitation charge of Rs 1200/- each per annum in addition to the normal tuition and other fees.

Sons of Officers of the Government of India in civil and military employ will also be considered for admission on merit irrespective of their domicile, provided the father of the candidate may be serving in the East Punjab at the time of submission of application.

MAJOR A. C. AGGARWALA,

B.Sc. Hons., M.R.C.V.S., A.I.R.O.,

Principal,

Camp Veterinary College, Hissar.

## News

### XIV INTERNATIONAL VETERINARY CONGRESS

#### PRELIMINARY ANNOUNCEMENT

**Object :—**The Object of the International Veterinary Congresses is the advancement of the science and practice of Veterinary Medicine and Surgery. To this end discussions are arranged on what are considered to be the most important scientific and practical questions of the day, with a view to their solution by a mutual interchange of opinions and personal experience.

**Programme :—**As it is considered that the present world food situation is the most important scientific and practical question of the day, the Congress Programme has been based on this theme. Every morning there will be a plenary session at which a paper will be presented by some person of world reputation on the veterinary profession's contribution to some aspect of world food production. Sectional meetings will be held in the afternoons. The programme for these is designed to cover a wide range of subjects, and whatever the speciality of any member of the Congress he should find papers of direct interest to him.

#### Executive Committee

|                             |     |                               |
|-----------------------------|-----|-------------------------------|
| <i>The President</i>        | ... | Sir Daniel Cabot              |
| <i>Vice-President</i>       | ... | Professor J. B. Buxton        |
| <i>Honorary Secretary</i>   | ... | Dr. W. R. Wooldridge          |
| <i>Honorary Treasurer</i>   | ... | Mr. G. N. Gould               |
| <i>General Secretary</i>    | ... | Mr. W. G. R. Oates            |
| <i>Organizing Secretary</i> | ... | Lt.-Col. J. A. Gordon Roberts |

to whom all communications should be sent at :—10 Red Lion Square, London, W. C. 1.

1. **Administration. Place of Meeting :—**The meetings will take place at the Central Hall, Westminster, and in Church House, Westminster, London, S. W. 1.

2. **Opening Date :—**The Congress is under the Patronage of His Majesty The King, and it is hoped that His Royal Highness The Duke of Gloucester, who is the President of the Royal Veterinary College and Hospital of London, will be able to open the Congress.

The first session will take place at 1000 hours on Monday 8th August 1949, and the Congress will last until Saturday 13th August inclusive. Registration of members will take place at Central Hall on Sunday 7th August from 2. p. m. (1400 hours) onwards. Certain social functions will take place on the evening of Sunday 7th August.

A detailed programme showing the times at which the General and Sectional meetings will take place, giving the names of speakers and titles of papers, will be published in the Official Programme to be issued later.

3. **Social Functions**:—Many official and other social functions will be held during the week of the Congress, at which delegates will be able to meet their confreres from other countries. Details of these functions will be notified in the Official Programme.

4. **Excursions**:—During the week 15th to 20th August visits will be arranged to places of interest to veterinarians such as:—Veterinary Research Stations, Veterinary Colleges, Abattoirs, Breeding and Racing establishments etc. Every effort will be made to show, and to give information about, the latest developments in veterinary research.

Tours will also be arranged to places of interest and beauty spots in the British Isles.

5. **Exhibition**:—An exhibition of the latest instruments, appliances, laboratory equipment, drugs, disinfectants, antiseptics, books etc., etc., will be arranged in premises convenient to the Central Hall. Admission to members will be free.

6. **Membership**:—Official invitations have been issued by His Majesty's Government to Foreign, Commonwealth and Colonial Governments requesting the sending of delegates to the Congress. Representation has been invited not only from Government veterinary departments, but also from Universities, veterinary schools and other interested bodies in every country.

In countries where there is a National Committee, application from prospective delegates for membership of the Congress should be sent through the Secretary of the National Committee. In countries where no National Committee exists, application for membership should be made direct to the Organizing Secretary, 10, Red Lion Square, London, W.C. 1. Applications where possible, should be accompanied by a remittance for the exact amount of the subscription in English Money. Cheques, Money orders, etc., should be made payable to the "XIV International Veterinary Congress". Names, titles and addresses should be clearly written, preferably in block letters.

In all cases *early* application for membership is requested.

7. **Subscriptions Ordinary Members**:—£4 (four Pounds) Sterling, which includes Congress badge, entertainments (except Congress dinner for which a charge will be made) and one copy of the full report of the Congress.

**Student Members**:—£1. 10s. (one pound, ten shillings) Sterling, which includes Congress badge, and the right to attend special meetings but does not confer the right either to speak or vote, or to receive a copy of the Congress report. The report may, however, be purchased separately at a price to be notified later.

**Associate Members**:—(Wives and families of members)—£1 (one pound) Sterling, which includes Congress badge, the right to attend special

functions which will be arranged for them and the use of special accommodation for social purposes.

8. **Travel and Accommodation**:—Messrs. Thomas Cook & son Limited of Berkely Street, London, W. 1. and the associated organisation of Cie Internationale des Wagons-Lits, have been appointed Travel and Accommodation agents to the Congress. These firms have agencies throughout the world and prospective members are strongly recommended to get in touch with one of these agencies without delay. Both, travel facilities from overseas and hotel accommodation in London, are extremely over-loaded and early booking is *essential*. Early application for bookings for the homeward journey is also essential.

The approximate London Hotel Charges are as follows:—

**High Garde Room** only (without bath) from 25s. to 37s. 6d. per day each person.

**First Class Room** only (without bath) From 20s. to 30s. per day each person.

**Second Class Room** only (without bath) from 17s. to 27s. 6d. per day each person.

(These charges are subject to fluctuation and are only given as a guide).

A limited number of very reasonably priced single room will be held available for members who, owing to the stringent currency regulations in force in their countries, will have a severely restricted allowance of money to spend in this country. Early application for these rooms is available and should be made to the Organizing Secretary.

All other applications for travel and accommodation should be made to the Travel Agents.

9. **Enquiries**:—All enquiries and communications should be addressed to Organizing Secretary, XIVth International Veterinary Congress, 10, Red Lion Square, London, W. C. 1. Telegrams and Cables:—CENTAURUM, HOLB, LONDON. Telephone Number:—HOLborn, 3584.

Dr. S. Datta, D.Sc., M.R.C.V.S., D.T.V.M., F.Z.S. (Edin.), F.N.I., Director, Indian Veterinary Research Institute, Izatnagar and Mukteswar, is confirmed in that post with effect from the 29th November 1948.

Mr. N. S. Sankaranaryanan, G.M.V.C., of the Indian Veterinary Research Institute, Mukteswar, has been appointed as Veterinary Investigation Officer, Ajmer (Rajputana).

Capt. N. G. Iyengar, Deputy Director of Livestock and Superintendent Civil Veterinary Department, Vindhya Pradesh, Rewa, has been nominated as a Member of the Faculty of Veterinary Science and Animal Husbandry of the Agra University for a period of three years.

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