

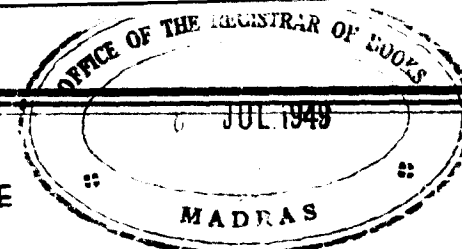
The Indian Veterinary
Journal

1949. March.

VOL. 25. NO. 5

5L
KZM2, N24
N49.25.5
9838

115



THE

MADRAS

INDIAN VETERINARY JOURNAL

PUBLISHED BI-MONTHLY

(THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION)

26, WALLAJAH ROAD, MOUNT ROAD P. O., MADRAS-2 (S. INDIA)

Vol. XXV

MARCH, 1949

4654

No. 5

bovine metritis...

After prolonged clinical trial **PROPAMIDINE—M & B** Intra-Uterine Injection is now available as a form of therapy offering an encouraging ratio of success in sub-acute and chronic metritis in cows.

Administration is by uterine catheter, and from two to three fluid ounces is considered adequate in most cases. Treatment may be repeated at 48-hour intervals, the usual course consisting of three injections. More complete information relating to Propamidine—M & B Intra-Uterine Injection will be supplied by our Veterinary Department on request.

SUPPLIES:—Bottles of 26-fluid ounces



manufactured by **MAY & BAKER LTD.**

JL

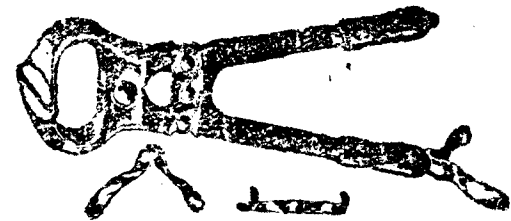
distributed by **MAY & BAKER (INDIA) LTD.**

KZ M2, N24
N49.25.5

79838

NEW STOCK ARRIVED.

Burdizzo Castrators with Patent Cord-Stop at Jaws.



Beware of Imitations.

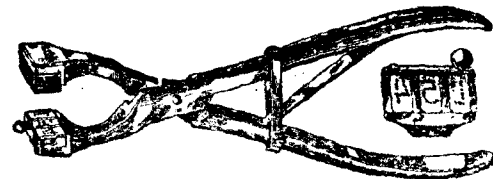
Do not be misled by spurious makes.

Dr. Burdizzo's Bloodless Castrator for the Castration of Bulls, Horses, Sheep, Dogs, Pigs, etc., is the only Castrator guaranteed to be of perfect manufacture, built up to a standard not known to price.



Burdizzo Tattooing Forceps.

Official Marker of many Cattle Breeding, Sheep Breeding and Horse Breeding Farms and Cow Testing Associations. With Interchangeable letters and Numbers for marking Cattle, Sheep, etc.



Nickel-plated, three space: in tin box. The usual set consists of 3 space-forceps, 2 set of Figures, complete Alphabets, and Tattooing ink.

Further particulars on request from:

Dr. PANGAL'S VETERINARY INSTITUTE,

Representatives and Distributors,

26, Wallajah Road, Mount Road, P.O.,

MADRAS 2, (S. India)

When writing to advertisers, please mention this Journal.

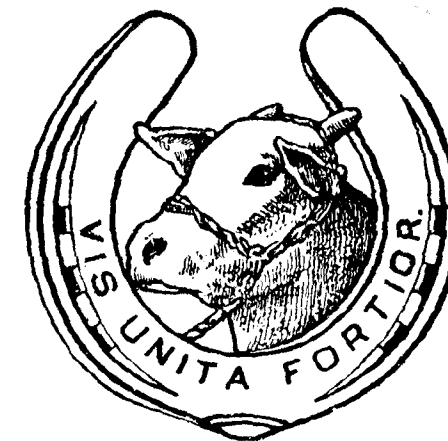
Bi. Monthly

March 1949

No. 5

THE INDIAN VETERINARY JOURNAL

(The Journal of the All-India Veterinary Association)



Editor:

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

Veterinary Surgeon, Madras.

Office: 26, Wallajah Road, Mount Road, Madras 2, (S. India)

NOTICE

The Indian Veterinary Journal

A Bi-monthly Record of Veterinary Medicine and Surgery
Devoted to the Cause of Veterinary Profession.

PUBLISHED FOR THE ALL-INDIA VETERINARY ASSOCIATION

EDITOR:
P. SRINIVASA RAO, G.M.V.O.

SUBSCRIPTION:

For members of the profession and students:—Rs. 4 or 6s. 8d. per annum including postage, in advance. Re. 1 or 1s. 8d. per part.

For others (Institutions, etc.):—Rs. 8 or 13s. 8d. per annum in advance, or Rs. 2 or 3s. 4d. per part.

1. Original Articles, Clinical Notes, Society Reports and Notes on interesting cases are invited. Contributors of Original Articles will receive 10 Copies of their papers free if wanted.

2. All Editorial Communications, Reports and Books for Review and Exchange should be addressed to the Editor.

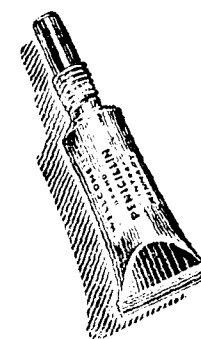
3. All contributions should be sent to the Editor. Contributors are requested to sign their contributions. All communications must be authenticated by the name and address of the writer whether intended for publication or not.

4. Members who do not receive the Journal regularly, or who find it wrongly addressed, are requested to communicate their correct address to the Editor at once. Non-receipt of a particular issue should be intimated before the receipt of the subsequent issue. If not those copies will be charged for.

1149. 25-5.



FOUR POINTS IN FAVOUR



20,000, 50,000 AND
100,000 UNIT-DOSE
TUBES

- No risk of cross-infection
- Ease of administration
- Maximum effect—no wastage
- No interference with milk yield

For the treatment of
STREPTOCOCCAL BOVINE MASTITIS

'WELLCOME' BRAND PENICILLIN INTRAMAMMARY INJECTION (VETERINARY)



BURROUGHS WELLCOME & CO. (The Wellcome Foundation Ltd. incorporated in England) LONDON
AND COOK'S BUILDING, HORNBY ROAD, BOMBAY

When writing to advertisers, please mention this Journal.

WE ANNOUNCE THE INTRODUCTION OF
UREA SULPHAZIDE OINTMENT

5%

For topical use in infected wounds, ulcers, burns etc. Urea Sulphazide ointment contains Sulphanilamide, Urea and Azo dye chemical compound. The combination is therefore most suited to give a therapeutic effect of each ingredient enhanced by synergism.

NOT FOR EYE AFFECTIONS

Obtainable in one ounce containers ready for immediate use.

UNION DRUG CO. LTD. CALCUTTA.

T'Phones :
Cal. 1159,
Cal. 4975.

285, BOWBAZAR STREET
CALCUTTA

T'Gam :
"Benzolic"
Cal.

ENTERO-QUINOL

(IODOCHLOROXYQUINOLINE)



Specific for all forms of Amoebiasis and other intestinal infections.

It is chemically 5 Chloro 7 Iodo 8 Oxyquinoline, practically odourless, tasteless, and insoluble in water.

Tubes contain 20 tablets 0.25 grm. each.



EAST INDIA PHARMACEUTICAL WORKS LTD.

TOLLYGUNGE : CALCUTTA

When writing to advertisers, please mention this Journal.

The Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

Vol. XXV

MARCH, 1949

No. 5

CONTENTS

I. Original Articles

The Morphology and Development of the Spermatozoa of the Stallion and the Jack.—By C. Krishna Rao, B.V.Sc., M.S. (Calif.), Madras. ...	305
The Affecting Temperature Records of Domesticated Animals in Health.—By N. S. Sankaranarayanan, G.M.V.C., Mukteswar. ...	310
Artificial Insemination of Poultry.—By Aniya B. Kar, M.Sc., Ph.D. (Edin.) Calcutta. ...	318
Observation on the outbreak of the so-called Obscure Sheep-Disease at the Livestock Research Station, Hosur, in 1946-47.—By Bertie A. D'Souza, B.V.Sc., Madras. ...	321
Serum Phosphatase Activity in Sheep, Part 1.—By K. N. Govindan Nair G. A. Sastry and K.T.K. Nambiar, Madras. ...	331
Evaluation of Nutritional Status.—By C. Venkatesa Rao, B.V.Sc., Madras. ...	337

II. Editorials

Kylasamier ...	343
Kylasamier—A Memoir ...	345
Retirement—Sri M. R. Subramania Sastry, G.B.V.C. ...	348
Returned from Abroad :— ...	350
K. S. Shetty, G.M.V.C., Ph.D. (Edin.). ...	350
Lient. C. Krishna Rao, B.V.Sc., M.S. (Calif.). ...	351
PERSONAL :— ...	352
Sir Frank Ware ...	352
K. Anthony, G.M.V.C. ...	352
Sri A. M. Muthappa, G.M.V.C. ...	352

III. Clinical Articles

A case of Anthrax in a Dog.—By M.S. Das, B.Sc., M.R.C.V.S. Calcutta. ...	353
Bovine Mastitis in Bihar.—By R. B. Prasad, G.M.V.C., P.G. Bihar. ...	356
Rabies in MongOOSE.—H.M. Dhatia, L.V.P. Dagshai, Simla. ...	364
Sulphanilamide—Its use in Foot & Mouth Disease among Cattle.—By P. C. Bhuyan, G.M.V.C. Assam. ...	366
<i>Cysticercus Cellulosae</i> —Their incidence in canines.—By Krishna-murthy B.V.Sc. Madras. ...	367
Irgafen—A New Sulphonamide for Veterinary Practice.—By Capt. G.A. Sastry, B.V.Sc. Madras. ...	371

CONTENTS—(contd.)

IV. Association News	
The Bombay Veterinary Medical Association—27th Annual General Conference—14th and 15th April 1949, ...	373
V. College News	
Madras Veterinary College—Results of Final Diploma Examination, March 1949, ...	373
Bengal Veterinary College—Results of Final Diploma Examination, 1948-1949, ...	374
VI. News	
New Trypanocide Discovered, ...	374
VII. Correspondence	
Annual All-Coorg Cattle Show,—By our correspondent, ...	377
Sewage for Increasing Milk Production,—By M. V. Pilla, G.B., V.C., Madras, ...	378
VIII. Extract	
Use of City Sewage for Cultivation—Experiment to be made near Vandalur, ...	379
IX. Review	
Pregnancy Diagnosis Tests:—By A. T. Cowie, B.Sc., M.R.C.V.S., Ph. D. 1948,—A Review, ...	381

THE INDIAN VETERINARY JOURNAL

VERY FEW COPIES OF BACK VOLUMES AVAILABLE

Apply Immediately to Avoid Disappointment.

Rs. 4 Per Volume.

Re. 1 Per Issue.

STANES MINERAL MIXTURE

Stanes Sterilised Fine Bonemeal for Cattle

The only Tonic at low prices with high tonic value. Prevents diseases due to deficiency in CALCIUM and PHOSPHORUS. Largely used by all the Agricultural Research Stations in Madras, and by the Veterinary Departments.

Sold in bags of 14 lbs., 28 lbs. for supply in the Madras Presidency.

For further particulars Apply to:—

T. STANES & CO., LTD.,
COIMBATORE

When writing to advertisers, please mention this Journal.

THE INDIAN VETERINARY JOURNAL

Plate No. 15

Vol. XXV, No. 5

THE INDIAN VETERINARY RESEARCH INSTITUTE, MUKTESWAR

FIRST BATCH POST GRADUATE (BIOLOGICAL PRODUCTS) CLASS 1948-49



Left to Right:

Standing:—S. K. Das, (Bengal,) B. N. Sahoo, (Orissa,) H. B. Lohoni, (Rajasthan,) K. G. Sastry, (Madras,) S. Sewa Singh, (Patiala and East Punjab,) R. L. Kaushal, (Madhya Bharat) and V. S. Deo, (Bombay.)
Sitting:—C. Seetharaman, J. M. Lal, Dr. H. N. Ray, Major S. C. A. Datta, (Director), V. R. Rajagopalan and M. K. Sreenivasan.

THE MORPHOLOGY AND DEVELOPMENT OF
THE SPERMATOZOA OF THE STALLION
AND THE JACK



FIG. 1
Stallion Spermatozoa from the head
of the epididymis $\times 720$.
(Reduced half.)



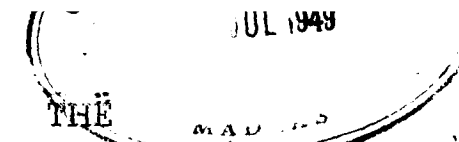
FIG. 2
Jack Spermatozoa from the tail of the
epididymis, $\times 720$.
(Reduced to half.)



FIG. 3
Ejaculated stallion spermatozoa, $\times 1350$.
(Reduced to half.)



FIG. 4
Ejaculated jack Spermatozoa, $\times 1500$.
(Reduced to half.)



Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

Vol. XXV

MARCH, 1949

No. 5

Original Articles

THE MORPHOLOGY AND DEVELOPMENT OF THE SPERMATOZOA OF THE STALLION AND THE JACK *

By

C. KRISHNA RAO, B.V.Sc., M.S. (Calif.) †
[Received for publication 10th October 1948]

CONTENTS

1. Introduction
2. Materials and Methods
3. Results
4. Discussion and Summary
5. Bibliography

Studies on the cytology of the spermatozoa of farm animals and observations on the morphological and physiological changes that sperm undergo during their passage through the epididymis are comparatively rare. Recent work [Rao and Hart, 1948 (a) ; Rao and Hart, 1949 (a) ; Rao and Berry, 1949 (b)] has demonstrated that the cytoplasmic drop is intimately associated with sperm maturation. These workers have also shown that the cytoplasmic cap is a common characteristic of spermatozoa from all birds and of the male reproductive tract in a number of farm animals. While we are essentially ignorant of the role of these processes in sperm physiology, they might be of considerable importance in sperm maturation and in other vital processes. Since the demonstration by Mc Clean and Rowlands (1942) that the luzzure hyaluronidase is capable of dispersing the cells of the corona radiata of the ovulated ovum, considerable attention has been focussed on this enzyme. Although the spermatozoa are known to be capable of secreting hyaluronidase, it has not been established as regards the specific region of the sperm cell involved in this secretory process. Spermatozoa are highly specialized cells capable

* This work was done at the Texas Agricultural and Mechanical College, College Station, Texas, U. S. A.

† Superintendent, Livestock Research Station, Kurukuppi, Toranagallu, P. O., Bolarly District, Madras Presidency.

of independent existence outside the animal body for a considerable length of time under suitable conditions. These cells have their various parts differentiated for specific functions. The head is believed to be a rather inert carrier of chromosomes, while the connecting piece and the chief piece of the tail contain the cytochrome system (Zittle and Zitin, 1942) associated with sperm metabolism. The posterior centriole is regarded as the locomotor centre of the sperm (Popa, 1930; Marza, 1930), while the chief piece constitutes the actual propelling mechanism and by its bilateral lashings brings about locomotion. The cytoplasmic drop possibly plays a part in sperm maturation particularly in the development of the connecting piece as suggested by Rao and Hart [1948 (a)] and Rao and Berry [1949 (a); 1949 (b)].

Blow (1945) reported the occurrence of *galea capitis* in the bull and stallion sperm, which he states might disappear during their long stay in the epididymis. This structure apparently corresponds to the cytoplasmic cap. The occurrence of sperm with cytoplasmic drops in large numbers in the semen of the stallion and the jack is rather unusual. The work of Rao and Hart [1948 (b)] and Rao and Berry [1949 (a); 1949 (b)] has brought to light certain important findings in the face of which, a reorientation of our ideas is necessary as regards the role of the accessory secretions in sperm physiology. These workers find that, while the sperm from the tail of the epididymis in the bull and the boar exhibit no motility, sperm obtained from the same region in the ram, the buck and the male Bambar sheep show active motility.

This work was undertaken to find out the role of the cytoplasmic drop in the development of the stallion and the jack sperm and whether the sperm of these species have the cytoplasmic cap. It was also intended to study the state of activity of the sperm from the different regions of the male reproductive tract.

Materials and Methods

The material obtained for this investigation was rather meagre, owing to the difficulty of obtaining the reproductive tract of these two species. The testes from two stallions, 3 to 4 years old were obtained by castration and two jacks, 6 to 8 years old were also castrated to obtain their testes. These materials were handled within one and half hour after removal and stored at 45° F for further examination, as and when necessary. The actual techniques employed for obtaining material from the different regions of the male reproductive tract and the method of examination are too stereotyped to require special mention, since they have been described in detail in earlier papers. The staining methods employed were the same as described in a previous paper [Rao and Berry, 1949 (c)]. This work is an extension of similar work done with other species to the stallion and the jack.

Results

The following results are presented although the available data is inadequate to allow definite conclusions to be drawn, in view of the fact that this work throws new light on sperm physiology and fills a gap in this field.

Development of the stallion and the jack sperm:—

The head of the ejaculated stallion sperm, when viewed in the on-flat position is broadest in the middle and gradually tapering toward both extremities; the anterior end is rounded off and the posterior end, which is also rounded has a depression or socket for the attachment of the neck. In the on-edge position it is flattened from side to side and of about the same thickness as the connecting piece. The cytoplasmic cap appears to be absent from the sperm and sperm with cytoplasmic drops are rare in normal stallion semen.

In preparations from the stallion testes, the majority of the sperm are found to have the cytoplasmic drop in any of the following locations — 1. surrounding the posterior half of the sperm head, 2. round the neck region and 3. at the anterior end of the connecting piece. The drop, when situated at the first two regions, presents the appearance of an irregular mass and such sperm usually possess a filiform connecting piece. When the drop is located at the anterior end of the connecting piece, it is in the form of a compact globular mass and such sperm usually have a connecting piece of normal development, although this may occasionally be tortuous. In smears stained with Weigert's iron hæmatoxylin and safranin [Rao and Berry, 1949 (e)] the sperm head takes a light black colour (acidic reaction), while the cytoplasmic drop and the rest of the sperm take a brownish colour (basic reaction). The majority of sperm from the head of the epididymis have the cytoplasmic drop at the anterior end of the connecting piece and the proportion of sperm with posterior drops increases as we go down the body of the epididymis. In the tail of the epididymis most of the sperm do not have the drop and sperm with anterior drops are rare in this region. No structure comparable to the cytoplasmic cap could be found on the testicular or epididymal sperm.

The ejaculated jack sperm resembles the stallion sperm very closely, both morphologically and structurally. They present the same staining reaction as the stallion sperm, when stained with Weigert's iron hæmatoxylin and safranin. The development of the jack sperm and the position of the cytoplasmic drop on the sperm, follows the same pattern as that described for the stallion. No evidence of the cytoplasmic cap could be found.

Development of motility in the stallion and the jack sperm:—

The testicular sperm from the stallion and the jack show very poor motility when diluted with warm 0.9% saline and maintained at 100°F.,

movement being restricted to mere lashings of the tail with very little progression. Sperm from the head and the body of the epididymis exhibit a more active type of movement but maximal motility cannot be induced even after providing optimal conditions. Material obtained from the tail of the epididymis and vas deferens and immediately examined under the microscope reveals maximal sperm motility, with the formation of waves and eddies. This eddy formation will also be distinctly visible to the naked eye, when a drop of the material from the tail of the epididymis is placed on a clean glass slide and observed. The use of an ordinary magnifying glass would yield convincing results. Addition of warm normal saline or any other isotonic solution greatly accentuates sperm movement. Material obtained from the testis and the upper part of the epididymis is very viscous and of an albuminoid consistency, while material from the tail of the epididymis and vas deferens is of low viscosity and watery in consistency.

The types of motility exhibited by the stallion and the jack sperm are similar to those described for other species and the mechanism of locomotion is essentially the same. When motility is maximal the sperm assumes the on-edge position. No rotation of the sperm on their long axis could be observed, since this type of movement would meet with considerable resistance, the sperm head being flattened from side to side. However, an occasional sperm might show this type of movement at times.

Discussion and Summary

The pattern of development shown by the spermatozoa of the stallion and the jack follow the same lines described for the spermatozoa of the bull [Rao and Hart, 1948 (a)], the ram, the buck, the male Barbary sheep [Rao and Berry, 1949 (a)], and the boar [Rao and Berry, 1949 (b)]. No structure corresponding to the cytoplasmic cap could be noticed. The absence of the cytoplasmic drop from the majority of the sperm from the tail of the epididymis is probably the result of active sperm motility *in vivo*. The persistence of this drop on other sperm from the same region can be explained by the fact that the very high sperm concentration in this region does not permit free movement, which is further restricted by the partial clumping of sperm. The descent of the drop appears to be through a process of aging of the sperm and thus bears relationship to physiological maturity. Sperm may be regarded to have attained maturity, when the drop reaches the posterior end of the connecting piece. This cytoplasmic drop apparently represents the remnants of the cytoplasm of the spermatid, differentiated for some specific function at present unknown. The drop is probably concerned with the development of the connecting piece.

The spermatozoa of the stallion and the jack from the testes and the upper part of the epididymis show only poor motility even after providing optimal conditions probably due to immaturity coupled with the high sperm concentration and the high viscosity of the secretions. The demonstration

of active motility by sperm from the tail of the epididymis may be due to the combined effect of physiological maturity, low viscosity and lower sperm concentration. In the light of the above findings the function of the copious amounts of accessory secretions at the time of ejaculation in these species is not clear. The views of Milovanov (1934) regarding the anabiosis of sperm in the tail of the epididymis and the dynamic action of the accessory secretions in initiating sperm motility are the time of ejaculation are no longer tenable. In the stallion and the jack, the accessory secretions serve to increase the bulk and thus render the urethral contractions more effective (Walton, 1933) and at the same time further reduce viscosity and sperm concentration, thus accentuating sperm motility. That the accessory glands are not essential for fertility was amply proved with the boar (McKenzie, Miller and Banguess, 1938). However, the accessory secretions may have other functions in sperm physiology at present unknown.

BIBLIOGRAPHY

1. Rao, C. K., and Hart, G. H. *Am. J. Vet. Res.* **9** : 117-124, 1948 (a)
2. Rao, C. K., and Berry, R. O. In print 1949 (a)
3. " " " " " " 1949 (b)
4. McClean, D., and Rowlands, I. D. *Nature*, **150** : 627, 1942.
5. Zitelö, C. A., and Zitin, B. *J. Biol. Chem.* **144** : 93-114, 1942.
6. Pöpa, G. T., *Proc. 2nd Int. Congr. Sex. Res.* (London) 1930 : 103-110, Oliver and Boyd.
7. Marza, V. *Proc. 2nd Int. Congr. Sex. Res.* (London) 1930, 103-110, Oliver and Boyd.
8. Blow, E. *Skand. Veterinartidskrift*, 779-789, 1945.
9. Rao, C. K., and Hart, G. H. *Am. J. Vet. Res.* **9** : 286-290, 1948 (b).
10. Rao, C. K., and Berry, R. O. In print 1949 (c)
11. Milovavov, V. K., *Abst. in An. Br. Abst.* **2** : 403-405, 1934.
12. Walton, A., "The technique of artificial insemination (with introductory chapter)," *Imp. Bur. An. Gen.* Edinburgh, 1933 : 1-56 Oliver & Boyd.
13. McKenzie, F. F., Miller, J. C., and Banguess, L. C., *Res. Bull. Ms. Agric. Expt. Sta.* No. 279 : 1-123, 1938.

The author wishes to acknowledge his thanks to Dr. R. E. Berry for his help and guidance in carrying out this investigation.

THE AFFECTING TEMPERATURE RECORDS OF DOMESTICATED ANIMALS IN HEALTH*

By

N. S. SANKARANARAYAN, G.M.V.C.,

I. V. R. I., Izatnagar.

The normal temperature of an animal is the heat of the animal body in the normal state of health, as measured by a clinical thermometer and expressed usually in fahrenheit scale. It is constant for healthy individuals of a particular species, under normal metabolic activity of the body, but it varies with the increased or suppressed metabolism caused by disturbances in the normal physiological functions. Normally, the body maintains this temperature constant, through the agency of the circulating blood. In the absence of any disease, variations in the normal temperature may be due to the temporary disturbances caused to the animal body of sudden changes of environments, such as heating or cooling the body by physical means. In order to have a correct idea of the temperature of an animal, it is essential to know the factors likely to influence it.

A batch of newly arrived calves, about 1½ years old, were placed under observation with daily temperature record before they were passed as healthy. As they were not used to handling or temperature record, certain amount of difficulty was felt in the beginning in recording temperature properly, and many of them gave variable figures during subsequent repetitions. These variations were found to be due to different lengths of thermometers introduced into the rectum, greater the length pushed in, the higher the record. To find out the exact length of the instrument which should be introduced in order to get the constant temperature generally accepted as the normal for the species, temperature of the animals were recorded for a week by passing into the rectum,

1. the bulb of the thermometer alone,
2. half the instrument and
3. full length except a small portion to hold it.

The instrument used was an ordinary human clinical thermometer (German red star brand) previously tested for accuracy. The week's average under each animal was tabulated as follows.

* Paper read at the Indian Science Congress, held at Patna in the year 1948,

TABLE I

No. of Calves	Av. Morning Tem.			Difference		Av. Evening Tem.			Difference	
	Bulb	Half	Full	1 & 3	2 & 3	Bulb	Half	Full	1 & 3	2 & 3
11	96.5	98.0	99.2	2.7	1.2	97.5	99.7	101.3	3.8	1.6
12	96.6	97.9	99.7	3.1	1.8	97.3	99.7	100.6	3.3	0.9
13	95.9	97.1	98.4	2.5	1.3	97.6	99.6	101.2	3.6	1.6
14	95.1	96.4	97.5	2.4	1.1	96.9	98.5	100.1	3.2	1.6
15	96.1	97.0	98.9	2.8	1.9	97.1	99.3	100.5	3.4	1.2
16	95.4	96.6	97.5	2.1	0.9	97.0	98.4	100.3	3.3	1.9
17	96.2	97.8	99.4	3.2	1.6	96.9	98.4	100.1	3.2	1.7
18	95.7	96.9	98.2	2.5	1.3	97.0	99.5	100.5	3.5	1.0
19	95.5	97.0	98.8	3.3	1.8	97.0	98.7	101.2	3.4	1.7
20	96.7	98.1	99.1	2.4	1.0	97.7	100.2	100.4	3.5	1.0
21	95.7	97.3	98.6	2.9	1.3	97.1	98.9	100.7	3.6	1.8
22	95.8	97.0	98.4	2.6	1.4	97.8	99.5	100.8	3.0	1.3
23	96.7	98.8	100.2	3.5	1.4	97.9	99.7	101.3	3.4	1.6
24	95.9	97.8	98.9	3.0	1.1	98.1	100.0	100.8	2.7	0.8
25	95.3	96.4	97.8	2.5	1.4	96.9	98.2	99.8	2.9	1.6
Av.	95.9	97.3	98.7	2.8	1.4	97.3	99.2	100.6	3.3	1.4

Table No. 1 reveals wide variations in the three sets of figures, with a difference of about three degrees between the first and third and about 1.5° between the second and third. Since the correct temperature of an animal in health or disease is the maximum temperature recorded by a standard and accurate thermometer, the first two figures are false and the third which is the maximum, is correct. Although the third figure agrees with the accepted normal temperature for the species, it is possible to assume from the results of the test that a fourth or fifth set of figures may be obtained if the instrument is pushed farther and farther into the rectum. Different lengths of a long fahrenheit thermometer used in incubators were introduced into all the buffalo calves and readings taken. As the mercury column in this instrument automatically falls down to that of the atmospheric temperature as soon as it is removed from the animal, readings were taken with the thermometer in situation. After a certain length of the instrument had gone in, since no change in the readings was noticed even when it was pushed farther, the readings were taken with the minimum length of the thermometer inside the animal, necessary to record the maximum temperature. These figures, though slightly higher than the maximum figures obtained with the ordinary thermometers, could be considered for practical purposes as almost agreeing with the latter as seen in Table II.

The differences between the figures obtained with the two kinds of thermometers range from 0.2 to 0.6 with an average of 0.3 and out of the thirteen animals under test the figures of only two animals agreed and in no case the clinical thermometer recorded higher than the incubator one,

TABLE II

Maximum Temperature records with the ordinary clinical and incubator Thermometers.

B. Calves	Clinical Thermo.	Incubator Thermo.	Diff.
1	99.0	99.3	.3
2	100.6	100.8	.2
3	99.0	99.6	.6
4	98.2	98.5	.3
5	100.0	100.0	Nil
6	98.6	99.0	.4
7	98.2	99.4	.2
8	99.6	99.8	.2
9	99.8	100.0	.2
10	100.2	100.2	Nil
11	100.0	100.2	.2
12	99.4	99.6	.2
13	99.2	99.8	.6
Av.	99.4	99.7	.3

which only shows the inadequacy of the human clinical thermometer for veterinary use.

The same experiments were repeated with ponies, hill bulls, cows, calves, sheep, goats and dogs, in fact all the animals available in the experimental sheds and considered healthy as far as the temperature record was concerned. Temperature was recorded for a week or three days in some and the averages from each group are given in Table III.

TABLE III

Temperature record using variable lengths of Thermometers.

Temperature Record Using Air Thermometer													Remarks.
Animals	No. of Animal	Average Temperature.									Diff.		
		Morning			Diff.		Evening						
		Bulb	Half	Full	1 & 3	2 & 3	Bulb	Half	Full	1 & 3	2 & 3		
Ponies	6	98.2	99.2	99.8	1.6	0.6	98.2	99.1	99.8	1.6	0.7	Av. of 5 days	
Cows	3	96.9	99.7	100.8	3.9	1.1	96.6	99.3	100.7	4.1	1.4	" 7 "	
Hill Bull	3	97.0	100.3		3.9	0.6	98.4	100.9	101.5	3.1	0.5	" 5 "	
Calves	3	97.8	100.2	100.9	3.1	0.7	98.6	99.9	101.3	2.7	1.4	" 7 "	
Sheep	4	101.2	102.2	102.8	1.6	0.6	101.7	102.5	103.1	1.4	0.8	" 7 "	
Goats	4	99.2	101.2	102.1	2.9	0.9	99.7	101.4	102.4	2.7	1.0	" 5 "	
Buffaloes	4	98.3	100.4	101.7	3.4	1.3	98.2	100.4	101.5	3.3	1.1	" 7 "	
Dogs	3	100.2	100.6	101.2	1.0	0.6	100.1	100.5	101.4	1.3	0.9	" 7 "	

The results show that to record the temperature of animals correctly with an ordinary human clinical thermometer, the whole length of the instrument should be introduced into the rectum, and if available a veterinary thermometer should be preferred.

In Table III, it is remarkable that the difference in the records of buffalo calves is not constant for the animals; thus, the difference is much less in ponies and dogs and much more in cattle including buffaloes. The factor contributing to the greater difference in cattle is not exactly known unless it be the loss of body heat at the posterior part of the rectum due to the constant opening of the anus for more frequent defecation and the semisolid consistency of the cattle faeces; in dogs the number of defecations is always restricted to once or twice in the day and hence the difference between the first and third figures is always found to be the lowest. The fact of lowering the temperature by opening the rectum is also proved to a certain extent from the following experiment.

It is not uncommon among non-technical people to introduce the index finger into the rectum along with the thermometer in order to pass over obstructions to the instrument from faeces or muscular action of the bowels. This procedure exposes the interior to the external atmospheric temperature to a certain extent and is likely to reduce the temperature of the posterior part of the rectum. In order to find out how far the true record was affected by this factor, temperature was taken of different animals, first with the full length of the instrument alone, and then followed by the instrument and finger after an interval of about five minutes. The finger was used only while introducing the thermometer and it was withdrawn as soon as the instrument was placed in position. Table IV gives the temperature records with and without the use of fingers. The record obtained by introducing the finger is lower in all cases. The difference, although negligible in certain classes of animals, is sufficient to show that among the contributing factors to false records, use of finger is also one.

TABLE IV

Temperature Record with and without the use of finger

Animals.		Morning.			Evening.		
		Without Finger.	With Finger.	Diff.	Without Finger.	With Finger.	Diff.
Hill bulls	125	100.6	100.4	0.2	101.8	101.6	.2
"	178	101.8	101.2	0.6	102.0	101.8	.2
"	180	101.2	101.0	0.2	102.6	102.4	.2
"	222	101.4	101.2	0.2	102.8	102.4	.4
Pony	347	99.6	99.0	0.6	99.0	98.8	.2
"	344	99.6	98.4	1.2	99.4	99.0	.4
"	331	99.0	98.2	0.8	99.2	98.2	1.0
"	350	99.6	98.6	1.0	99.4	98.6	0.8
"	392	99.0	98.0	1.0	98.4	97.0	1.4
H. Calf.	17	102.4	102.0	0.4	-	-	-
"	61	100.8	99.6	1.2	-	-	-
"	69	101.0	100.2	0.8	-	-	-
"	83	100.6	99.0	1.6	-	-	-
"	71	102.4	101.6	0.8	-	-	-

This practice, besides exposing the rectum to atmospheric temperature, is also likely to induce peristalsis followed by defecation and lowering of temperature before record. However, the use of finger could easily be

avoided by greasing the instrument with vaseline or oil. It is a good practice to keep a small wide mouthed bottle filled with oil with a small quantity of cotton wool kept immersed at the bottom and the thermometers kept inside for ready use.

The effect of exposing the animal to sun

The buffalo calves arrived on 2—11—41 from a station 16 miles off. They arrived at 4 p.m., after having travelled in the sun for about 18 hours. As soon as they arrived at Mukteswar as a routine procedure their temperature was recorded before allowing them inside the sheds. All the calves showed 104°-105° temperature though grazing and ruminating like healthy animals. After an hour, their temperature was again recorded and by this time in every case the temperature had come down to normal. It is likely that either the solar heat or muscular exertion or both might have contributed to this temporary pyrexia in the animals. The following experiments were carried out to find out how far exposure to the sun without muscular exertion affected the normal heat of healthy animals. 15 buffalo calves were tied down in batches in the sun on different days from 10 a.m. to 2 p.m. Table No. V shows the temperature records along with the variations and the maximum and minimum temperatures on the respective days as recorded in the local observatory.

TABLE V

Buff Calf No.	10 A. M.	2 P. M.	Diff.	Recorded in observatory.	
				Maximum.	Minimum.
	10-11-41				
11	99.6	104.0	4.4	64.1	45.7
12	98.4	103.6	5.2		
13	98.6	102.8	4.2		
14	99.0	105.0	6.0		
	11-11-41				
15	100.0	103.0	3.0	64.7	46.4
16	99.0	103.0	4.0		
17	99.6	104.6	5.0		
18	98.8	104.0	5.2		
	12-11-41				
19	98.6	103.0	4.4	64.6	45.7
20	98.2	102.6	4.4		
21	97.8	102.4	4.6		
22	98.2	102.0	3.8		
23	99.4	102.0	2.8		
24	98.0	102.0	4.0		
25	98.4	101.0	2.6		
Average.	98.8	103.0	4.2	4.2	

The temperature of every calf had risen by 4° on an average by exposure in the sun for 4 hours. It would seem from the results of the experiments that the temperature increase is at the rate of one degree per hour of exposure to sun according to which records from animals exposed may be corrected to the actual figure. The maximum and minimum

figures for the day as recorded in the observatory did not seem to influence the body heat. But on 12—11—41, the animals did not show as much rise as on previous days and it is not known what factor actually contributed to such variations. However it is clear that the temperature recorded after exposure of animals to sun is not a correct figure.

A four hours exposure to sun did not produce any derangement in the system except the rise in temperature and increased thirst. Temperature was again recorded about an hour after they were tied in the sheds, when it was found to be normal in all animals as observed on the day they arrived. The animals therefore regained the normal heat due either to an hour's stay in the shed or to the water consumed. A stay inside the sheds does not normally affect temperature records and hence an investigation into the effect of watering on the true record was undertaken.

Temperature was recorded at 3 p.m. of the eleven buffalo calves and one buffalo without exposing them to the sun previously. They were given water *adlib*, and five minutes after, temperatures were taken again. From the records given in Table VI, it is evident that watering just before taking temperature had not appreciably lowered the body heat; only in two animals the decrease is marked.

TABLE VI

B. Calf No.	3 P.M.	After 5 minutes.	Difference.
11	99.0	99.0	-
12	100.6	100.0	0.6
13	98.2	98.0	0.2
14	99.0	98.6	0.4
15	98.8	99.0	-
16	97.0	97.0	-
17	99.6	99.0	0.6
18	98.0	98.0	-
19	99.2	99.0	0.2
20	98.6	99.0	-
24	99.0	99.0	-
Buff.	101.0	100.8	0.2

The experiments were repeated on buffaloes and hill bulls with temperature records one hour after watering.

TABLE VII

Animals.	Temperature before.	Temp. after one hour.	Diff.
Buff. 1.	99.2	98.0	1.2
2.	100.2	99.0	1.2
3.	102.0	100.2	1.8
4.	100.4	99.2	1.2
5.	101.0	100.8	0.2
H. B. 1.	101.0	100.2	0.8
2.	99.2	98.4	0.8

The figures in Table VII show great variations from those of the previous experiments. In this case the difference between the initial record and that obtained one hour after watering is more marked and all the animals showed a reduced temperature. In comparing the two records, it is evident that the effect of watering is not immediate but prolonged and continues even after an hour. It would be of interest to know how long the effect of watering lasts and when the animal regains the normal heat after it. The test was repeated on different animals and temperature record was made every half an hour till the instrument recorded the initial figures or the temperatures before watering. Along with the other animals one buffalo, which was not given water at all, was also placed as control in the test to compare the results obtained after watering. The figures are tabulated and graphed below.

TABLE VIII
Temperature Record after watering.

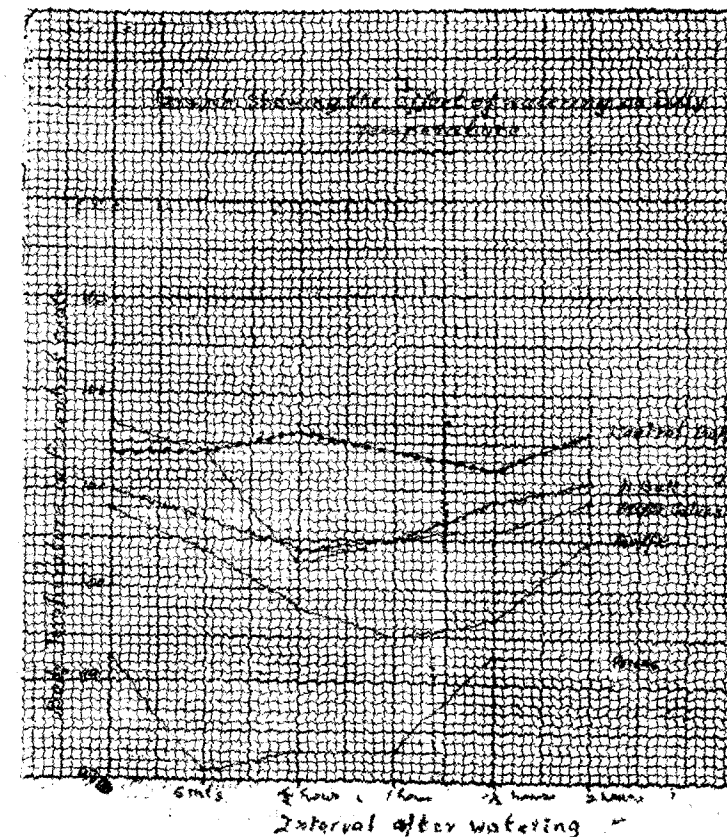
Animals.	Before water- ing Av.	5 mts. after Av.	1 hour after.	1 hour after.	1 1/2 hour after.	2 hours after.	No. of animal.
Ponies.	99.3	98.1	98.2	98.3	99.3	99.3	4
Hill Bulls.	101.0	100.7	100.4	100.5	100.9	101.1	5
H. Calves.	101.7	101.4	100.3	100.5	100.6	100.9	3
Buffa.	100.8	100.4	99.5	99.5	99.7	100.5	4
Control Buff.	101.4	101.4	101.5	101.4	101.2	101.6	1

The above figures represent the average temperatures of the respective species of animals under test. It is observed from the table that the buffaloes and heifer calves, in comparison with the control animal, have lost more than one degree in their body temperature. The maximum effect of watering is seen for the first half to one hour and the effect continues for two hours.

It is remarkable that ponies are cooled down within 5 minutes of watering, whereas in cattle it takes about half to one hour for the water consumed to have its full effect on the body heat. Considering the higher rate of pulse in ponies, the circulation of blood also is correspondingly quicker. This factor along with the uncomplicated digestive tract in horses is likely to contribute to the quicker effect of watering. Similarly the ponies regained normal temperature earlier than the cattle perhaps due to the same reasons. The buffaloes and heifer calves on the other hand lost more heat than the other animals and even after two hours they had not completely regained the original temperatures. This may be due to the larger quantity of water consumed by these animals.

From the above, it is clear that the temperature recorded after watering is not the correct one unless it is taken two hours after watering in cattle and after one hour in horses.

GRAPH



Conclusions

1. To record the temperature correctly of animals, if the ordinary clinical thermometer is used it should be introduced in its full length leaving only a portion sufficient to hold it with two fingers.
2. Introducing the index finger along with the thermometer reduces to a certain extent the rectal temperature.
3. Temperature recorded after exposure of the animal to the sun is not true. At least one hour's rest in the shade should be given before the correct figure is obtained.
4. Watering reduces the temperature to an appreciable extent and the effect of watering lasts for at least two hours in cattle and about one hour in horses. So the temperature should be recorded at least two hours after watering in cattle and after one hour in horses.

Acknowledgment

The author wishes to express his thanks to Mr. M. K. Srinivasan, Veterinary Officer, I. V. R. I., Mukteswar for kind permission to use the animals on the experimental side. Mr. J. F. Shirlaw, Officer-in-charge Pathology & Bacteriology Section gave valuable guidance, for which the author feels highly obliged.

ARTIFICIAL INSEMINATION OF POULTRY

BY

AMIYA B. KAR, M. Sc., Ph. D. (Edin).*

Department of Poultry Husbandry, Cornell University,
Ithaca, New York, U.S.A.

Introduction

Artificial insemination in the fowl, as in cattle, can be used for scientific as well as for practical purposes. Among the first advantages that could be pointed out is the possibility of extending our knowledge of the biology of sex, reproduction and of the sperm of the domestic fowl. From the practical point of view, however, the use of this technique in the breeding of poultry may have the following advantages.

- (1) The reproductive capacity of old tested males can be extended to a much greater number of females than in normal copulation.
- (2) It will be possible to obtain hatching eggs even if the birds are kept in cages, as in the case of the battery management, or if, for some unfavourable circumstances, the males do not naturally mate.
- (3) It will be possible for the poultry breeder to make crosses in breeds that differ so much in size as to make natural copulation almost impossible.

Artificial insemination in the fowl is quite practical, and the technique is simple and easily learned. However, the collection of semen as well as the use of it must always be done with the strictest observation of the method of technique. In this article a description of the simple technique of artificial insemination followed in this University will be given in the hope that it might be of use to the practical poultry breeder as well as to the scientific workers in India.

Management of the cock

Since it is almost impossible to obtain semen artificially from a cock that is running with hens it is essential to separate the male bird from the females and also from other cocks. It is preferable to keep the cock in an individual cage for about 3 or 4 days before attempting to secure semen from him. There

* Now at the Department of Zoology, University of Calcutta.

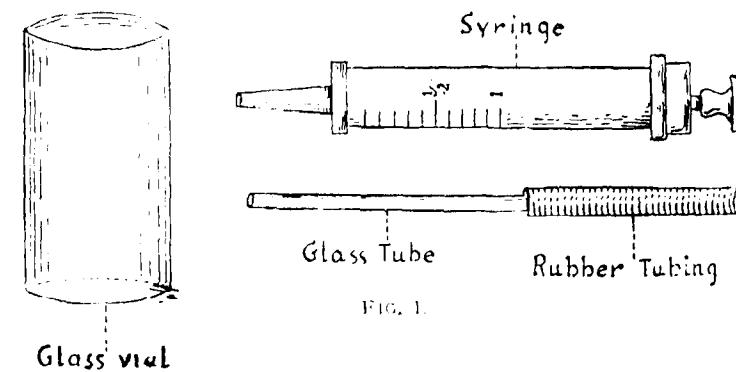
ARTIFICIAL INSEMINATION OF POULTRY

FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

ARTIFICIAL INSEMINATION OF POULTRY



FIG. 5.



FIG. 6.



FIG. 7.



FIG. 8.

ARTIFICIAL INSEMINATION OF POULTRY

319

is every possibility of the semen being contaminated with faecal matters, particularly in a bird with loose droppings. It is therefore necessary, that the bird should be fed with food in dry form. Further, to ensure the prevention of contamination of the semen by faeces we have found that it is a good practice to trim the feathers round the vent quite short with a pair of scissors. To obtain a good yield of semen it is of utmost importance that the cock should be trained and handled daily for a period of 4—5 days before the actual operation.

The equipment for artificial insemination

The equipment for artificial insemination in poultry consists of (1) a glass vial for collecting the semen (2) an insemination syringe with a glass tube attached to it by means of a piece of rubber-tubing (Fig. 1). Both ends of this glass tube should be rounded over a flame to prevent any injury to the oviduct, a most delicate organ of the hen. With the aid of the glass tube it is possible to deposit the semen much deeper inside the oviduct than with the short-nosed syringe. We have found that this deeper deposition of the semen gives better results.

The collection and yields of semen

Although it is possible for one man to collect semen from the cock, we have found that this procedure can be carried out in a more efficient manner by two people. One person should remove the cock from the coop and hold it on the palm of his hand, grasping the thighs of the bird loosely with the fingers. He can either sit down on a high stool and rest his hand with the bird on his lap (Fig. 2), or he can stand and place one foot up on a low stool resting his thigh (Fig. 3). It is essential that the man holding the cock should handle it gently so that it remains relaxed during the entire procedure of semen collection. He should then start massaging the cock along the back stroking from the middle region and coming down to and around the tail. The massaging should be done firmly and quickly. In the meantime the man who is to collect semen should be ready with the clean vial and stand to the right of the man holding the bird (Figs. 2 and 3). The vial is grasped by the basal portion of the thumb and the fore-finger of the right hand leaving the ends of these two fingers free to stimulate by gently massaging the soft part of the abdomen between the two pelvic bones. Within a very short time after the beginning of stimulation the cock will protrude its rudimentary copulatory organ and then the semen collector should grasp the vent anterior to the sphincter muscle and squeeze inward with thumb and the first finger of the left hand (Fig. 4). This squeezing operation should start as soon as the male protrudes its rudimentary copulatory organ and it should be repeated two or three times until no more semen is obtained. The semen is collected into the vial which is held just below the lower lip of the vent. Occasionally in a new male there may be a drop or two of blood noticed with the semen. But such contamination will not harm the semen sample, however, it indicates that this male should be handled carefully until this tendency has been overcome.

The yield of semen per male is extremely variable, some cocks will produce 2 c.c. of semen per handling while others will yield as little as 0.2 c.c. per handling. Generally speaking a yield of semen ranging from 0.5-1 c.c. per handling may be considered satisfactory, specially when daily collections are made.

Insemination of the hen

Insemination of the hen is a quick and simple job, but here again it is necessary to have two men for the operation. The person holding the hen should grasp her firmly by the thighs with his left hand, and then use his right hand in everting the mouth of the oviduct. The thumb of the right hand should touch the dorsal region of the vent, and then pressure should be exerted inwardly by the fingers and palm of the right hand in the abdominal region so that the mouth of the oviduct protrudes (Figs. 5 and 6). It is important that a firm hold on the thighs be maintained during the entire operation of insemination, because if the bird struggles with her oviduct protruding permanent injury may be done to this delicate organ. When the oviduct is protruding, the glass tube attached to the syringe is inserted inside the oviduct to a depth of about an inch. After this operation, the abdominal pressure is gradually reduced and the oviduct is allowed to return to its normal position (Figs. 7 and 8). Immediately afterwards the semen which has previously been drawn inside the glass tube is injected. After insemination the syringe with its attached glass tube is withdrawn. It is preferable to inseminate the hens late in the afternoon when the chances of encountering a shell egg in the shell gland portion of the oviduct at the time of insemination are small.

It is recommended that each hen be inseminated with 0.1 c.c. of fresh undiluted semen. This dosage, when the samples of semen are fresh and free from contaminations, will give an average fertility of 90 per cent or more.

Acknowledgment

The author wishes to express his gratitude to Mr. Robb S. Gowe, M. S., (Cornell) for the help he received in the preparation of this article.

Explanation of figures

- Figure 1 Artificial insemination equipment for poultry.
- Figure 2 Method of holding the male bird at the time of semen and 3 collection.
- Figure 4 Collection of semen from the cockerel.
- Figure 5 Preparing the hen for insemination. Note the protruded oviduct and the method of insertion of the syringe.
- Figure 6 Enlarged view of figure 5.
- Figure 7 Insemination of the hen.
- Figure 8 Enlarged view of figure 7.

OBSERVATIONS ON THE OUTBREAK OF THE SO-CALLED OBSCURE SHEEP DISEASE AT THE LIVESTOCK RESEARCH STATION, HOSUR, IN 1946-47.*

By

BERTIE A. D'SOUZA, B.V.SC.

Superintendent, Livestock Research Station, Hosur.

(At present Lecturer, Madras Veterinary College)

The Livestock Research Station, Hosur, is on an altitude of 3,000 feet above m.s. level in Salem District. The climate is cool, mild and dry, March and April being the hottest, and December and January coldest months. The annual rainfall is about 30" and is spread mostly over months from August to November. The farm has an acreage of 1,860 and consists mainly of dry lands, the major portion of which is set aside under permanent pasture. A small area is under irrigated fodder crops such as Guinea grass, Napier grass, Lucerne and Berseem.

The soil is generally red gravel. The lay-out is a natural undulated one, as is peculiar to the whole taluk, and affords efficient drainage. The chief source of water supply is two tanks - Jegoor and Karnoor—within the farm, which receive all the storm water from the surrounding catchment area. As in the case of the farm, the whole taluk is noted for its tanks which are all connected in one form or other by feeding channels. When the Karnoor and Jegoor tanks are full, as they are after every rainy season, the adjoining shallow areas of about 20 to 25 acres are submerged in 1½ to 3 feet of water for a period of one-and-a-half months, sometimes a little longer. This waterlogged area dries off, as the water level in the main reservoirs recedes. The low lying areas permit the growth of abundant grass and maintain a fair grazing even in dry summer months. Sheep and cattle are watered in these tanks after grazing in the adjoining low areas. When grass is flush, it is cut and fed to stock.

Sheep as well as cattle are maintained and reared on the farm under conceivably ideal conditions of sanitation, hygiene and feeding. As a matter of fact, one can never expect any thing better any where else in the Presidency among livestock-owning ryots. Sheep receive good grazing for the major part of the year and it is further supplemented at nights with cut green grass, a couple of pounds each. The stalls or pens are provided with salt-licks. The water supply to the pens is clean and wholesome. Young suckling lambs get a supplement of skimmed milk, a practice which has been going on since the introduction of the sheep-breeding scheme. Veterinary aid is efficient and always available. Regular dosing of sheep against helminths is now an established routine. The flock of

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

rams is housed in the 'stud-lines' while the ewes are kept on the 'top stables', as these places are known. Both the flocks are grazed, fed and tended to by separate shepherds and on separate paddocks and are never brought or grazed together to prevent unauthorised matings. Sheep breeding has been practiced since 1924 and it is directed to selective breeding of pure Bellary sheep and cross-breeding with Bikanir rams in order to evolve a sheep with white fleece of good quality and better mutton-yield.

Records kept at the farm show a rise in the annual mortality of sheep since 1928. In 1946-47, the percentage was 28.85 mainly due to the periodic or seasonal manifestation of a so-called "obscure sheep disease". The disease generally broke out in September and continued upto December or even February.

On taking charge of the farm, the writer was requested by the Live-stock Development Officer to take energetic steps to control the disease and reduce the mortality in sheep. With this in view, the following measures were adopted, in addition to the other existing hygienic precautions. Assuming the disease to be of bacterial or viral origin, and presuming recovered animals to be carriers, all 'recovered' were marked out. In the same manner, all poor-doers were separated as potential dangers and, together with the 'recovered', a total number of 64 was auctioned. The total of the remaining healthy sheep, together with the March-April lambings, came to 201. The methods of grazing and pasture were changed and a regular rotation was indicated and adopted. 'For the optimum benefit to be derived from improved pastures with regard to nutrition and to the control of parasitism, a system of rotation which makes it possible to practice intensive stocking for a short period and then spelling to allow regeneration of pasture is ideal, (Ross). Certain paddocks as numbers 1 to 4, which were grazed for years together, were completely closed to grazing of sheep. In order to keep down the parasitic content of the flock, monthly dosing of sheep against helminths were adopted, using alternately copper sulphate and mustard, or copper sulphate and tobacco infusion and Phenothiazine. From the months of August-September, grazing was limited on the farm, as most of the paddocks were closed for hay-making and, of the few retained for grazing, one was the low lying paddock near Karnoor tank and Simpson well and the sides of the Simpson's Road.

The response to the above measures, seemed to be encouraging and the sheep were gradually flushing out. The usual months of the disease, *i.e.* September to October and November and most part of December, passed off uneventfully. It was then thought that the year would pass off with no disease and loss in sheep. But we were soon disillusioned. The disease broke out late in December.

The first prodromal symptom of the outbreak was noticed in 2 sheep on the evening of 24th December 1946, when they returned from grazing, in the nature of small flabby intermaxillary oedema. The numbers affected with such prodromal symptoms gradually increased day after day. The first death was among the early affected and took place on 1-1-1947. The number of deaths gradually increased. The highest death record in a single day was 10 and it was in the second week after the outbreak. 86.8% of the affected sheep succumbed to the disease. The course of the disease was on an average 6 to 10 days from the onset of the first clinical signs. The outbreak lasted from 65 to 70 days. (24-12-1946 to 10-3-1947).

The percentage of mortality was 28.85 in the total flock strength of 201 sheep on the farm.

Symptoms:—As mentioned above, the prodromal symptom in affected sheep was a small flabby intermaxillary oedema, which tended to increase in size day by day. It attained its maximum size, involving sometimes the face and cheeks, by the 4th to 6th day. There were no noticeable constitutional symptoms. There was absolutely no rise of temperature (average temperature recorded 102.4°), no lassitude, no unthriftiness or loss of appetite. In short, the affected sheep appeared normal except for the oedema during the first few days. The oedema increased in size in the evenings and and got reduced in the mornings. This feature bore little significance, because the increase in the day was gravitational, through sheep keeping their heads down while grazing, and the reduction over-night was due to rest. When the oedema was extensive, involving the face, breathing was stertorous or sniffling. This characteristic oedema, or bottle jaw, was noticed in 90 to 95% of the cases affected.

By the 4 to 6th day, or earlier, of the appearance of oedema, which was now full-sized, the affected sheep evinced definite signs of ill-health. While grazing, they frequently lay down with extended or stretched necks, but would soon get up on the approach of persons. The general malaise increased, but there was no rise of temperature. Signs of intermittent colic which increased in intensity were noticed, and by now, diarrhoea, acute and frequently foetid with decomposing blood, set in. The temperature fell below normal just before death which appeared to occur either from shock through severe and continuous colicky pains, or exhaustion from diarrhoea. A few sheep lay dead with their heads pointed towards the flank, an indication characteristic of animals in colicky pains. The whole course of the disease ordinarily ran through 6 to 10 days in the great majority of cases. About 4 sheep, mostly younger ones, showed no characteristic oedema or diarrhoea before death and the course in them was rapid and short. There were no distinct clinical symptoms in the affected sheep, to classify the disease into peracute, acute

or chronic. Seven of the affected sheep survived the epizootic. The survivors of the previous year were poor-doers but, in this outbreak, 7 sheep that were treated in the early stages responded well and recovered. Probably, the contrast was due to the efficacy of the helminthic treatment adopted this year. In the previous years, the recovered sheep continued to harbour the adult parasites and suffered from the after-effects of helminthiasis. Records have shown that sheep recovered from the previous year's out-break were susceptible to the disease and died of it in this outbreak. The question of immunity, therefore does not arise and it is in agreement with the nature of the casual agent responsible for the epizootic. The period of incubation appeared to be 40 to 50 days, or longer under natural conditions.

Post-mortem lesions :

The carcasses of sheep that died of the disease did not undergo early decomposition. Most of the carcasses were kept for a day or two before they were all fed to poultry without ill-effects. In all the dead sheep the post-mortem lesions were identical in young and old animals.

The sub-maxillary and mesentric lymphatic glands were oedematous and juicy. There was marked effusion of serous fluid in the peritoneum and pericardial sacks in a fair proportion of cases. *There was an acute gastro-enteritis affecting the pyloric portion of the abomasum and duodenum to a distance of 1½ to 2 feet with evidence of acute catarrh or diphtheritic enteritis and the presence of innumerable immature amphistomes partially embedded in the mucosa.* A square inch of the mucosa showed from 200 to 400 immature amphistomes. The liver in most cases showed signs of degeneration and early putrefaction but no marked increase in size. The gall bladder was distended with brownish green bile. The mucous membrane of the gall bladder showed no marked change of any significance. The other organs showed no marked abnormality.

Smears and other pathological material from dead sheep, and sheep destroyed in-extremis, examined by the Principal, Madras Veterinary College, the Disease Investigation Officer, Indian Veterinary Research Institute, Mukteswar, and the author showed no organisms of any specific kind. Buccal and bowel-washings from a few sheep exhibiting buccal ulcers, and material from affected organs triturated in saline, fed to a few cattle and healthy sheep by the writer, did not produce the disease even after a month. Blood and bacteria-free serous filtrate injected into rabbits and guinea-pigs by the Disease Investigation Officer, Indian Veterinary Research Institute, failed to produce any disease. The rabbits and guinea-pigs were retained on the farm by the writer for purposes of breeding and they have since increased in numbers. In the previous years, blood

transmission experiments on buffaloes for Rinderpest conducted by the Superintendent, Serum Institute, and, similar experiments conducted by the Veterinary Investigation Officer, Madras, on rabbits for Haemorrhagic septicaemia were said to have given negative results. The only identical lesions observed in all sheep dead, or destroyed in-extremis, consisted of gastroenteritis affecting the pyloric portion of the abomasum and duodenum to a distance of 1½ to 2 feet with evidence of acute catarrh and the presence of innumerable immature amphistomes partially embedded in the mucosa which could be seen by the aid of a lens. The same casual agent was identified from a sheep and a young bullock that was procured by the writer from a lot of affected stock in the neighbouring village "Sopati". In the farm, Kangayam heifer No. 538, which was condemned for John's disease, but was subsequently destroyed by the writer, exhibited identical lesions as in the carcass of sheep with immature amphistomes.

The report of the Director of the Indian Veterinary Research Institute, Mukteswar, on the specimens was as follows:

"Some showed a pure infection of *cotylophoran cotylophorum*. Some showed a pure infection of *gaströthylax crumenifer*, yet a few showed a mixed infection by both these parasites. The parasites collected from the rumen of the cow from the neighbouring village "Sopati" were found to be *cotylophoran cotylophorum* only. The immature forms collected from the abomasum and duodenum could not be identified but, from the identity of the adults, the immature forms cannot be different to these two".

Discussion:—A disease reported by the Disease Investigation Officer, Ajmer and Merwara under 'Intestinal Paramphistomiasis of sheep in Sindh, (1939)' appears similar to the disease in Hosur. Another condition described by S. V. Mudaliar (1944) in his paper on "Fatal enteritis in goats due to *cotylophoran cotylophorum*" seemed similar to the observation made by the writer. The symptoms and post-mortem lesions found in the cattle and sheep of Livestock Research Station, Hosur, and also in the sheep and cattle of neighbouring village, Sopati, were similar in all respects to the description of Acute amphistomiasis of cattle in Assam by Pande (1935).

Monnig (1937) states under *Cotylophoran cotylophorum* that heavy infection of immature forms of this type causes marked irritation of the intestinal mucosa resulting in diarrhoea. They also produce lesions of the mucosa and cause hæmorrhages into the intestinal lumen. Adult parasites are found in the fore-stomach and affected sheep are anaemic. As a result of anaemia, oedemas develop. Death is due to exhaustion resulting from diarrhoea. In Hosur, sheep were noticed to die in the course of acute colicky pains, evidently from shock through acute irritation and enteritis caused by amphistomes. A few sheep showed no diarrhoea or oedema, but only colicky pains followed by death.

In this outbreak, all the female stock (except 30 in-lamb ewes) and yearlings were grazed on the land adjoining Karnoor tank, around Simpson well and Simpson Road from 10th November 1946 to 20th November 1946. It is interesting to record that the outbreak of the disease this year was confined to these flocks. There was no disease among the flock of rams penned at the stud-lines, and among the 30 in-lamb ewes grazed elsewhere, throughout the entire course of the epizootic. The 30 in-lamb ewes, in spite of being penned at nights with the rest of the female stock, never contracted the disease. The yearlings were usually penned separately. This feature gave sufficient evidence to indicate the absence of contagious nature in the disease. Further, with the onset of the disease among the female stock on the top-stables, the whole flock was shifted to new surroundings and buildings in P. 16 "Military Calf-Shed". Still, there were no signs of abatement of the disease and the whole flock was being threatened. It was therefore decided not to graze the sheep at all. For over a month from 10-1-1947 to 17-2-1947, all the sheep of the affected flock were confined to the stalls, and hand fed with cut grass and concentrates. This step was adopted in order to eliminate the possibility of infection being taken up while grazing. Even this failed to produce any ameliorative effect on the spread of the epizootic. This fact further confirmed the view that most or all the sheep had already become infected and were in the incubative stage, thus accounting for the daily new cases. By now it was clear that the source of infection should have been the lowlying paddocks about the Karnoor tank, as in this area, the flock was more or less intensely grazed, prior to the outbreak of the epizootic; while the rest of the flock that were sent to graze in other areas were free from the disease. An approximate period of incubation was thus presenting itself.

Sheep, buffaloes and cattle also were affected. The disease in sheep generally assumed epizootic proportions while in buffaloes and cattle it was sporadic, occurring throughout the year. Eight young buffaloes manifested the same clinical symptoms and lesions as in sheep and died at varying intervals before the outbreak in sheep. At the time of this outbreak in sheep there were 4 young buffaloes and one white Kangayam heifer No. 538 showing the same clinical symptoms. It was possible that a good proportion of white cattle that were running down in condition with acute diarrhoea and intermaxillary oedema in the later stages were also infected with the same casual agent. The course of the disease when it affected cattle and buffaloes did not appear to be so acute as in sheep. In both cattle and sheep, young animals were more susceptible than adults, although very young lambs and rams did not contract the disease, presumably because they were not allowed to graze on infected low lying pasture, and not to any inherent increased resistance to infection.

In the case of sheep, there was no choice in breeds; all breeds—Bikanirs, Bellaries and Bikanir-Bellary crosses—were equally susceptible.

Shearing did not appear to have any predisposing influence on the disease, except that this process accidentally preceded the season when this epizootic broke out. For the matter of that, unlike the previous years, the first appearance of the present epizootic was noticed a month or two after the shearing. Both sheared and non-sheared sheep were victims to the disease when it broke out in the young flock that were not sheared. The factors that could be considered predisposing to the onset of the disease were the heavy rains resulting in the inundation of the paddocks. When the water receded after the rains and when sheep grazed in those places, then the disease broke out.

The epizootic in sheep commenced with or after the rains and floods and was definitely not confined to the livestock on the farm but appeared to be endemic to the whole taluk.

The grass blades collected by the writer from paddocks 30 and 45, and the shallow areas adjoining the tank where the affected flock were grazing showed a number of encysted cercaria. Some snails that were collected and dissected by the writer showed cercariae. These evidences leave no room for doubt as to the source of infection and the casual agent responsible for the so-called obscure sheep disease to be nothing but immature amphistomes.

Treatment:—In view of the rapid spread of the epizootic in the flock, and the appalling deaths that were daily mounting up, it was regarded that treatment on symptomatic lines would produce little effect. And, therefore, no regular course of symptomatic treatment was pursued. This view was later found to be justified when the etiological factor was identified. Nevertheless, antiseptics and astringents were administered in a few of the early cases in the outbreak, but they did not give any encouraging response. Subsequently, with the discovery of the immature amphistomes, carbon tetra chloride was tried in 2 to 5 c.c. doses, as tetra-chlorethylene was not available. Towards the latter part of the outbreak, tetra-chlorethylene in capsules were obtained from Park Davis & Co and administered with good results, especially in sheep in the early stage of the disease (2 capsules of 2 c.c. each). Treatment with this drug before the appearance of symptoms, or administering the drug as a prophylaxis to keep down the amphistome content in sheep is likely to yield better results. Arrangements were made by the writer to include this drug in the periodic dosing of sheep and it is presumed it will be administered and the results watched.

When one regards the pathological lesions produced and the causative agent responsible for the condition, it is but reasonable to expect little from attempts to treat the affected animals as the damage already caused when the symptoms are shown are too severe to be repaired. Phenothiazine in doses of 10 m. gms. had no action on the parasite as was evident from the fact that all the affected sheep were administered with this drug, just two weeks before the outbreak of the disease. Tetrachlorethylene may yield more encouraging results if used in the early stages of the disease. Any rate it is likely to eliminate or keep a low amphistome content in sheep if administered periodically. Measures preventive and curative, intelligently combined and regulated will undoubtedly go a long way to avoid further outbreaks of this epizootic in sheep in the farm. Quoting Ross, sheep owners should necessarily realise that the greater the restriction of a small grazing area and the less selective feeding compulsory for the sheep together with an increased rate of stocking, the greater is the care and intelligence required in management both of pastures and sheep.

Preventive measures indicated by the authorities, their limitations and measures adopted by the writer :

1. Mechanical removal and destruction of snails.—This measure, suggested by Research workers, is efficient from a theoretical point of view, but it is doubtful whether it can be accomplished in practice without a large financial commitment. The huge tanks, the enormous number of snails and the possibility of continued and persistent recurrence of snails into the tanks through the various inter-connecting and feeding channels following rains almost every year and the capacity of the snails to breed throughout the year, present difficulties of enormous magnitude. Economically, it is doubtful whether this method of combating amphistomes is profitable, unless state efforts are pooled and directed to mass treatment of infected tanks. No doubt a fair quantity of snails can be removed and destroyed once, but it cannot be continued indefinitely. Further, it is difficult to get at the snails in their entirety.

2. Introduction of ducks in large numbers.—Authorities state that introduction of ducks in tanks will keep down snails or eliminate them altogether. This farm has a flock of ducks numbering about 300 and all of them are allowed free access both to the Jegoor and Karnoor tanks, but they have made little appreciable reduction in the snail population of these tanks. During the rainy season, both the tanks in the farm attract teams of wild ducks, and yet their influence on the snail population is little if not nothing. The ducks did not evince any great desire for the species of snails about the tanks. The writer therefore believes that though the ducks may keep down snails to a small extent, they will not eradicate them.

3. Copper sulphate treatment of tanks.—(Ross and Gordon, 1936).—This is an other measure presenting problems. The vast expanses of water often make it difficult to correctly assess the quantity of salt to be used for the required lethal effects on snails without detriment to other aquatic life. It is also necessary to be assured that the treatment does not render the water harmful to animals and men and also for the crops. Assuming that all these difficulties can be overcome, then the administration of copper sulphate may be done once, but can it be repeated indefinitely in view of the periodic invasions of snails after each rainy season? Will this measure be feasible economically? In view of the above embarrassments to be contented with, the writer had adopted the following less expensive methods calculated to give least access to cercaria and cause infection. The measures have been effective and there has been no outbreak of the disease this year as anticipated.

(i) All the paddocks suspected to be infected, *i.e.*, all those portions of paddock adjoining the two tanks in the farm, were completely closed throughout the year to cattle and sheep grazing.

(ii) Cut-grass from these areas were processed into silage or hay before being fed to cattle.

(iii) Periodic destruction, preferably in summer, by burning down all grass and other vegetation on the bank and tank shores in order to destroy all encysted cercariae.

(iv) Cattle and sheep were not allowed access to these tanks and their banks and shores, particularly in wet cool seasons of the year, when the grass was flush. Alternative arrangement to water livestock while grazing was made in troughs.

(v) All marshy and low lying areas were closed to grazing.

Summary:—Observations on an outbreak of the so-called Obscure Sheep Disease in Livestock Research Station, Hosur, in 1946-47, characterised by acute gastro-enteritis, are recorded.

2. Sheep, cattle and buffaloes were susceptible to the disease. Both adults and young were affected.

3. The source of infection was from grazing on grass infected with encysted cercaria of amphistomes.

4. The disease was not confined to the farm but appeared to be prevalent throughout the taluk.

5. The etiological factor for the disease was immature amphistomes.

6. The period of incubation appeared to be approximately 50 to 60 days as calculated from the dates of grazing on infected pasture and the first manifestation of the disease.
7. Course of the diseases lasted from 24th December 1946 to 10th March 1947.
8. Affected sheep particularly, and cattle and buffaloes as well, showed symptoms of intermaxillary oedema and diarrhoea.
9. In sheep, death generally appeared from shock due to severe colicky pains resulting from acute enteritis or exhaustion from diarrhoea.
10. There was no elevation of temperature in the affected sheep.
11. An acute gastro enteritis affecting the pyloric portion of the abomasum and duodenum to a distance of $1\frac{1}{2}$ to 2 feet with evidence of acute catarrh or diptheretic enteritis and the presence of immature amphistoms partially embedded in the mucosa was a constant feature of pathological importance in all carcasses examined.

Acknowledgments

I am indebted to Sri P. R. Krishna Iyer of the Indian Veterinary Research Institute, Mukteswar and Sri S. V. Mudaliar, Principal, Madras Veterinary College, for their valuable suggestions.

REFERENCES :

1. Monning, H. O.—*Veterinary Helminthology & Entomology*—3rd edn, 1947.
2. Bawa, H. S. *Indian Journal of Veterinary Science and Animal Husbandry*. Vol IX—Part IV—1939—425—429.
3. Mudaliar, S. V. *Indian Journal of Veterinary Science*, Vol. XV Part I 1944—51—56.
4. Pande, P. S. 1935—*Indian Journal of Veterinary Science*—364—375.
5. Ross & Gordon—*Internal parasites & parasitic diseases of sheep*—1936.
6. Ross—*Journal of Council of Scientific & Industrial Research, Australia* 4—1931—131—133. Reprint S. J. D. G., seen 1935.

SERUM PHOSPHATASE ACTIVITY IN SHEEP, PART I

BY

K. N. GOVINDAN NAYAR ; G. A. SASTRY and

K. T. K. NAMBIAR

Department of Physiology, Madras Veterinary College.

In practical feeding of farm animals Calcium and Phosphorus may be said to be the most important mineral constituents for obvious reasons. In metabolism, these two are inextricably associated. They are found together in bones and teeth, which form the bulk of the mineral content of the body.

Inorganic salts entering into the structure of the bones are not laid there once for all much the same way as mortar on a masonry structure. Bone is a living structure and the salts there are in a continuous state of flux. Exchange of these salts between the bone, the circulation and other tissues and organs of the body goes on continuously. The bony skeleton of the body may aptly be compared to a mineral reserve store of the body, which is continuously being drawn upon to meet the metabolic needs of the body for Calcium and Phosphorus and under normal conditions just as continuously replenished from the minerals absorbed from food, so that its composition remains more or less constant. This dynamic equilibrium is influenced and regulated by many factors such as the concentration and the ratio between Calcium and Phosphorus in the plasma, acid/base ratio of the blood, nature of food, and some other factors such as pregnancy, lactation and hormones and enzymes. A significant enzyme controlling this swirl Ca, and P, in metabolism is the alkaline phosphatase, which occurs in many organs and tissues but especially in bone and teeth. A small amount of this enzyme is normally found in plasma or serum and this is altered in certain cases of abnormal Ca, and P, metabolism such as generalised bone disorders. The exact significance of the changes is not very well understood, but they obviously reflect even more than the changes in concentration of serum Ca, P, or other factors, a disturbance in the Ca, and P, metabolism. Hence intelligently interpreted, estimation of serum phosphatase activity is a sensitive index of Ca, P, metabolism and as such of practical use to the clinician and the research worker.

Activity of serum phosphatase in sheep

Much work has been done on the serum phosphatase activity in man by Robinson et al (26 to 31), Kay (17 to 22), Bodansky (5 to 9). King and Armstrong (23), Bessie et al (4), and Giri (13, 14, 15), both in health and disease and as such valuable and helpful information is available for man. But one cannot say the same with reference to animals in general and sheep in particular, though Allcroft and Folly (1), did some work on cattle and sheep, Auchinachie and Enslie (2) on sheep, Phyllips (25) on cattle,

Common (10, 11, 12), Hall and King (16), Auchinachie and Enslie (3) on poultry. But the findings of Allcroft and Folly are contradictory to those of Auchinachie and Enslie (2). While the former found the normal phosphatase activity of sheep to be varying widely (viz., 3 to 166.1 Kay's units) and hence of no clinical and diagnostic help, the latter not only found the normal phosphatase activity between .226 and .335 Kay's units but "found that the increase in the plasma phosphatase, which occurred in sheep on an inadequate diet took place appreciably earlier, than the fall in serum Ca and before any other sign of disordered metabolism had appeared" and hence of useful diagnostic aid. The present work was undertaken with a view to estimate the normal phosphatase activity of the sera of sheep of this country and to ascertain if possible, the reasons for the wide variation noted by Allcroft and Folly (1). We may mention here that our findings so far corroborate those of Auchinachie and Enslie.

It is usual to study an enzyme by noting how the rate at which the substrate-changes, in the presence of the enzyme, varies with some factors such as concentration of the substrate, concentration of the enzyme, temperature, reaction of the medium and other factors. With an excess of substrate and a given amount of the enzyme, the degree of hydrolysis is in most cases proportional directly to the time of digestion, but due to many uncontrolled and in some cases uncontrollable factors this rule may hold good only within a limited range. Determination of those conditions which produce a uniform monomolecular reaction is the first step in the study of an enzyme and that is what we have attempted in this work.

Experimental

Various methods have been proposed for the determination of serum phosphatase activity, the method of Bodansky (1, 9) having perhaps found the widest application. This method with certain modifications introduced by us (24) was adopted. A bodansky unit of activity corresponds to the liberation of 1 mg. of inorganic Phosphorus by 100 cc. of serum during an incubation period of 1 hour. 30 such units equal approximately 1 Kay's unit (3)

Fresh buffered substrate was made each day in the following way:

Sod. diethyl Barbiturate	...	0.42 gms.
Mg. SO ₄ 7H ₂ O; M/10 solution	...	10 cc.
Sod. Glycerophosphate	...	0.4 gms.
Distilled water	...	up to 100 cc.

To 10 cc. of this substrate when 1 cc. of serum is added it has a pH of 8.6.

10 cc. of the buffered substrate solution are taken in each of a series of test tubes, stoppered and placed in thermostat at a temp. of 37° ± 0.1°. After allowing 15 minutes for the solution to attain the temp. of the thermostat, one cc. of the serum is added to each of the tubes, stoppered,

well mixed by rotation and replaced in the thermostat. When digestion has proceeded for the required time, the tubes are removed, cooled rapidly in ice and 4 cc. of 10 per cent Trichloroacetic acid added, mixed and set aside for 10 minutes and then filtered through Whatman filter paper No. 42. About 10 cc. of the protein free filtrate are obtained from each.

The total inorganic phosphorus in the filtrate is estimated, by Bodansky's method (5), the serum inorganic Phosphorous deducted and the phosphatase activity calculated in Bodansky's units. For details of the estimation the original papers may be consulted.

Duration of Digestion

In arriving at a suitable duration of incubation we had to keep in view two objectives:

- A 5 cc. aliquot of the phosphatase filtrate should have an inorganic P content as far as possible within the range of the technique.
- At about this duration, the reaction should be monomolecular.

Samples of serum-substrate mixtures were incubated for 10, 20, 30, 40, 50, 60 minutes in each case, and the phosphatase activity calculated at these varying durations of digestion. It was found that when the duration of incubation was less than 40 minutes there were many irregularities in the activity noticed, but from 40 minutes to 1 hour, the reaction was practically monomolecular, though a slight gradual fall was noticed. The results for durations of digestions of 40, 50, and 60 minutes are given in table I.

TABLE I

1 cc. of serum + 10 cc. of substrate — Phosphatase activity in Bodansky's units.			
Serial No.	Duration of incubation.		
	40 min.	50 min.	60 min.
1.	10.6	9.3	9.2
2.	6.4	5.5	5.4
3.	8.1	7.0	6.4
4.	3.2	2.2	2.0
5.	10.1	8.9	8.8
6.	8.8	2.4	2.7
7.	1.6	1.4	1.5
8.	5.1	4.5	4.0
9.	5.1	5.2	5.1
10.	5.8	6.0	6.0
11.	9.2	8.8	8.9
12.	5.0	4.4	4.2
13.	8.5	8.3	8.4
14.	9.1	8.2	7.9
15.	3.7	3.9	3.9
16.	6.5	6.5	4.6
17.	5.3	4.3	4.1
18.	5.4	4.6	5.3
19.	8.1	6.8	7.5
20.	5.8	5.8	5.5

It was decided to consider 45 minutes as a suitable duration of digestion and this was adopted in the subsequent work.

Optimum pH

The phosphatase activity of the same sera at different reactions of the serum-substrate mixture was estimated by adjusting the pH of the mixture to different values from 8.4 to 9.0 by adding 2 drops of 0° IN HCl to get at a pH of 8.4; 2 drops of 0.1N NaOH to get a pH of 8.8 and 4 drops of the alkali to get a pH of 9.0, as has been estimated by using the Hellige's comparator, and incubating for 45 minutes at 37°c. The volume of HCl and NaOH added was taken into consideration while calculating the phosphorus liberated by the phosphatase activity. The results are given in the following table from which it can be seen that the optimum pH of the alkaline phosphatase of the sheep is 8.8.

TABLE II

Mg. of P liberated calculated for 1 hour by 100 cc. of serum.				
Serial No.	pH.			
	8.4	8.6	8.8	9.0
1	4.7	6.3	8.9	8.4
2	8.0	9.1	13.2	12.6
3	3.6	5.9	8.1	7.2
4	4.7	8.3	10.3	9.3
5	3.3	7.7	9.8	9.4
6	4.7	5.8	7.6	6.6
7	5.0	5.6	8.5	6.0
8	3.0	3.1	4.1	4.1
9	1.9	3.3	5.0	3.7
10	6.3	6.5	9.8	9.1
Average 4.5 6.2 8.5 7.4				

Optimum Temperature

The effect of varying the temperature at which digestion proceeded was next studied and the results are given in the accompanying table.

TABLE III
Serial number of sera.

Temp.	Activity in Bodansky units										Average.
	1	2	3	4	5	6	7	8	9	10	
36°	6.4	10.6	10.3	12.1	11.5	8.1	12.3	11.7	20.2	7.2	11.0
37°	10.9	6.1	9.8	11.6	11.5	8.9	15.6	12.7	20.2	6.8	12.4
38°	10.9	9.0	9.8	12.8	11.2	8.6	14.4	11.8	19.2	6.8	11.4

Between 36° and 38° in any case, temperature does not seem to have any appreciable influence on the activity just as has been found to be the case of esterases in general.

Normal phosphatase activity in sheep serum

Samples of blood were collected from the slaughter house in the morning. About 30 to 40cc of blood was collected in each case into a 100 cc. conical flask, the blood being caught directly into the sterile flask as it spurted out of the carotid artery when the throat of the animal was cut. These were left in a cool place undisturbed for about 2 hours in which time serum separated from the clot. The serum was decanted into a centrifuge tube and centrifuged for 10 minutes at about 2000 R. P. M. to pack the few cells to the bottom of the tube, the clear serum was decanted into another tube and this procedure repeated once.

Each sample of serum-substrate mixture was adjusted to pH 8.8 and incubated at 37°c for 45 minutes and the serum phosphatase activity calculated in Bodansky units, the results are tabulated below :

TABLE IV

Serial No.	Phosphatase Activity in Bodansky units.	Serial No.	Phosphatase activity
1	7.8	31	6.0
2	6.2	32	9.0
3	5.0	33	5.9
4	5.2	34	7.2
5	5.8	35	9.5
6	5.0	36	5.7
7	3.6	37	4.8
8	3.7	38	10.9
9	10.0	39	6.1
10	5.0	40	9.8
11	7.7	41	11.6
12	5.8	42	11.5
13	7.4	43	8.9
14	9.8	44	6.8
15	8.9	45	3.8
16	9.6	46	9.0
17	11.4	47	6.5
18	6.6	48	6.1
19	6.6	49	5.5
20	10.2	50	13.9
21	6.0	51	14.5
22	5.5	52	8.8
23	8.6	53	13.2
24	6.2	54	8.1
25	9.1	55	10.3
26	7.2	56	9.8
27	9.8	57	7.6
28	9.1	58	8.5
29	5.0	59	4.1
30	6.1	60	5.0

The activity in normal sheep vary between 3.6 and 14.5 Bodansky units and as such our findings are in agreement with those of Auchinachie and Enslie (2).

Summary

(1) A method of estimating the serum phosphatase activity in sheep is presented. The standard conditions suggested are:—pH 8.8 duration of incubation 45 minutes, and temperature 37°C.

(2) The authors are of the opinion, that the phosphatase activity of normal sheep serum varies only within reasonable limits, if the above standard conditions are satisfied. It may be stated in this connection that they have found that the activity under other conditions is very irregular with sheep serum (and more so with cattle serum).

Acknowledgment

We wish to express our gratitude to Sri. S. V. Mudaliar, G.M.V.C., Principal, Madras Veterinary College, for the interest he has taken in this work and for his advice and encouragement.

REFERENCES

1. Allcroft W. M. and Folly S. F. (1941) *Biochem J.* 35, 254.
2. Auchinachie D. W. and Enslie A. R. G. (1933) „ 27, 351.
3. „ „ (1934) „ 28, 1993.
4. Besse et al (1946) *Biol. Chem. J.* 164, 321.
5. Bodansky, A. (1932) „ 99, 197.
6. „ (1933) „ 89, 235.
7. „ (1934) „ 104.
8. „ (1937) „ NCIX.
9. „ *Proc. Soc. Expt. Biol. Med.* 28, 760.
10. Common (1932) *Agri. Sci. J.* 22, 576.
11. „ (1933) „ 23, 555.
12. „ (1934) *Nature* 133, 572.
13. Giri et al (1939) *Ind. J. Med. Reser.* 27.
14. „ (1939) *Biochem J.* 33, 316.
15. „ (1944) *Biochem & Allied Res. in India*, XV 2.
16. Hall and King (1930-31) *Poultry Science*, 10, 132.
17. Kay H. D. (1926) *Biochem. J.* 20, 791.
18. „ (1926) *Brit. J. Expt. Path.* 7, 180.
19. „ (1928) *Biochem. J.* 22, 855.
20. „ (1929) *Brit. J. Expt. Path.* 10, 250.
21. „ (1930) *Biol. Chem. J.* 89, 235 & 249.
22. „ (1931) „ 89, 239.
23. King and Armstrong (1934) *Can. Med. Assn. J.* 31, 326.
24. Nair K. N. G. : Sastry, G. A. Nambiar, K. T. K. (1946) *Madras Veterinary College Med. Assn. Annual Number VI*, 18.
25. Phyllips (1932) *Science*, 76, 239.
26. Robinson (1923) *Biochem J.* 17, 286.
27. „ (1924) „ 18, 740.
28. „ (1925) „ 19, 153.
29. „ (1926) „ 20, 847.
30. „ (1929) „ 23, 767.
31. „ (1930) „ 24, 1922 & 1927.

EVALUATION OF NUTRITIONAL STATUS

By

C. VENKATESA RAO, B.V.Sc., M.Sc.

Madras Veterinary College.

With the discovery of vitamins and their specific effects on the health, the concept of dietary deficiency disease was formulated. The concept was soon extended to include disorders arising from deficiency of dietary essentials other than vitamins viz., proteins and other minerals. The new diagnostic methods discovered and followed in recent times have clearly shown how marginal forms of malnutrition affects the individual. The evidence so far obtained on this, points increasingly to the fact that malnutrition is a problem to be considered seriously and that detrimental effects both immediate and long range do result. Most apparant of the immediate effects are suboptimal health resulting in lowered production of milk, eggs, wool and work in animals. Thus Kruse (1943) points out that if diagnosis and treatment of malnutrition results in relief from this suboptimal health and consequent reduction in yields this can well be regarded as at least one important justification for the trouble and expense involved in detecting these conditions. Further the importance of adequate tissue stores of the various nutritional essentials has also been pointed out in well known animal experiments of Sherman (1943) in which it has been shown that increasing the nutritional level above ordinary requirements especially with respect to riboflavin results in increased health and vigour, a longer prime of life and sturdier offsprings. Nutrition studies with animals and human beings show further that in females particularly adequate tissue stores of the nutritional essentials are of utmost importance with respect to health and normalcy of the young. The further possibility that malnutrition may be implicated in the etiology of other infectitious diseases is another important consideration. This fact has been analysed and summarised by Kruse (1943).

These deficiency diseases are prevalent in this country too, but for want of proper diagnostic methods and scientific surveys they have not been brought to light. This existence of deficiency diseases is further supported by the fact that our soils, and fodders were found to be deficient in calcium and phosphorus. But the number of cases of osteodystrophic diseases reported in animals have been very few. Only Hay (1879) from Assam : Smith (1887) from Calcutta : Ayyar (1937) from Ootacamund : Oliver (1933) from Simla : Rathnam (1940) from Madras Body Guard horses : Pande (1934-35) in Assam have reported few but unauthentic cases of calcium and phosphorous deficiency in animals. Same statement holds good in the case of vitamins too. Night blindness in animals has been found to occur in all parts of India and a few cases have been diagnosed and reported by Balwant Singh (1937-38) in Calcutta cows : Naik (1935-36) in workdig bullocks in Bombay : Gurubachan Singh (1936-37) from

Akola district of C. P.; Sahay (1937-38) from Bihar in calves; Dutta (1933) from Sind, Baluchistan and Quetta and Fernandes (1940) in Marwara during famine. Most of these reports are based on indirect evidence of response from treatment with that particular dietary essential and not based on correct and scientific diagnostic methods. Even in the matter of goiter although Maccarson (1924) has reported several cases of goiter and also outlined goiter areas, it is surprising that no authentic case of goiter was reported from that area in animals in this country. Few unauthentic cases of goiter and other effects of Iodine deficiency was reported by Murari (1931) and Sen (1945). No authentic or even unauthentic case of protein deficiency was reported despite the fact that our animals are always on low protein level. However, it is an indisputable fact that there are many cases of deficiency in this country but for certain reasons of difficulty in diagnosis they have not been explored fully. Most important reason for difficulty in diagnosis is the fact that the nutritional state may vary by imperceptible degrees ranging from extreme obvious malnutrition to progressively milder, outwardly undetectable stages to comparative perfection. The great majority of nutritional deficiency fall in subclinical condition of malnutrition characterised by tissue changes rather than by gross externally visible alteration. Lacking the typical symptoms of severe malnutrition as a guide, it is no wonder that diagnosticians often find it difficult to detect evidence of malnutrition. Even if a practitioner were to come across some deficiency disease it takes some time before pathological conditions are ruled out and true nature of the disorder recognised. Another important consideration is that no systematic survey of soil, food and diets of cattle was undertaken.

Scientific advances in nutrition as well as the growing public interest in the nutritional diseases have stimulated the developments of special diagnostic methods in foreign countries. Already the findings of these newer diagnostic methods have revealed a greater incidence of malnutrition than has been apparent to clinicians in the past. A study and thorough understanding of these different methods of diagnosis is an essential adjunct in the proper diagnosis of these deficiency diseases in this country too.

Review of methods

At the beginning of the twentieth century nutrition status was diagnosed by physicians on the bases of physical or constitutional structures. Factors considered indicative of deficiency included height and weight, deposits of subcutaneous fats, muscular developments posture, appearance of skin and mucous membrane and the general vitality. This criterion were at best indirect and largely subject to means of evaluating nutritional status. In addition the results were subject to considerable error in interpretation because of wide variations in individual body build. More than a decade was spent in trying to improve the value of these measurements for establishing various height-weight formulas and indices, but these met with little success.

Extensive surveys of the diets of animals and typical population groups of human beings, were undertaken in western countries. This procedure had revealed that a large proportion of animals and human beings are subsisting on diets which fall short of desirable or minimum nutritional standard. On the basis of these methods certain criteria indicative of existence of certain diseases have been fixed.

Later diagnostic methods were based on the principle that the very early stages of malnutrition are reflected in the condition of the tissues and they were designed for the detection of such characteristic tissue changes at lowered concentration of the essential factors in blood, depleted tissue stores, gross structural and functional changes in tissues and organs. The tests commonly used to measure these changes fell into several bases of groups: Biochemical, microbiological, biophysical, special clinical and morphological including biomicroscopic.

Most of the biochemical methods are designed for analysis of blood and urine. These methods can be used for most of the minerals, proteins and vitamins. In general the biochemical methods are based on reaction of the dietary essential to yield coloured, or fluorescent, substances which may be measured quantitatively by calorimetric, fluorimetric or titration methods. Other tests involve the reaction of vitamins with specific dyes, determination of vitamin-containing enzymes in blood, reaction of vitamins with standard chemical reagents. Several procedures are adopted to collect blood and urine samples. The blood level of these substances are determined before feed in the morning. In urine usually estimations of these things are done on a 24-hour collection samples. Still other procedures involve the response of the patient after 1, 4, or 24 hours to a single test dose of the vitamin as determined by its absorption into blood or its excretion. Low values in this type of test usually indicate not only recent efficiency but chronic tissue depletions.

Microbiological methods depend on the failure of a particular micro-organisms to grow in the absence of a specific vitamin. The concentration of a nutrient such as vitamin in the test sample is measured by the extent to which it stimulates growth. The growth-responsible microorganisms in turn are measured quantitatively by estimation of the degree of turbidity produced in the culture.

Biophysical methods have been planned to measure, by special instruments, functional or structural requirements caused by vitamin deficiency or other nutrients. The measurement of dark adaptation as a criterion for vitamin A deficiency is a typical example. Another example of biophysical methods is the measurement of capillary fragility under controlled pressure as an index of vitamin C status of the body, Dollordorf (1933). Disturbance in vitamin D or calcium metabolism was formerly tested biophysically by neuromuscular response to galvanic stimulus a test for tetany as described by

Homes (1916) but this has been replaced by more modern and recent biochemical methods for determining calcium levels in blood.

Morphologic methods include use of X-ray and biomicroscope. The X-ray has been used to detect rickets as well as early stages of infantile scurvy.

More recently the introduction of biomicroscope for the examination of living tissues in the body has greatly furthered the detection of early deficiency stages. Using this means of diagnostic examination, Kruse has reported the occurrence of specific biomicroscopically diagnosable changes in at least four deficiency diseases. These changes have been observed in the tissues of conjunctiva in vitamin A deficiency, Kruse (1941); in the cornea in ariboflavinosis, Kruse (1941) and Sydenstricker, (1940); in the tongue in niacin deficiency Kruse (1942) and in the gums in the deficiency of vitamin C Kruse (1942). By this means of examination it has been possible to detect the very early stages of these deficiencies, an achievement which was impossible by ordinary clinical methods.

Discussion of the methods:—The value of the existing methods for detection of early nutritional deficiencies depends on a number of important criteria. These include simplicity, speed, reliability of the test, interpretation of the findings, minimum of equipment and applicability to all age groups. The methods should also be capable of detecting the various points, stages and degrees of the existing diseases. Keeping these points in view it would be worthwhile to examine the various methods mentioned in this review. Biochemical and microbiological methods on blood and urine have several advantages. These permit quicker reflection of dietary habits and also serve as effective secondary screening processes in persons without avitaminotic or other deficiency symptoms or tissue changes. Such influences are first mirrored in blood, and only when they have existed for some time is there a change in the tissues. The drawbacks of the biochemical method are that an isolated instance of a recent deficient diet would erroneously appear as deficiency disease when judged by blood studies, while the existence of a chronic form of the deficiency might go undetected if the diets immediately preceeding the blood test were a good one.

The biophysical methods, such as measurement of dark-adaption of the eye for vitamin A deficiency and capillary strength for vitamin C, have been very helpful and are usually fairly simple. It has been reported, however, that these methods often fail to detect stages of vitamin deficiency.

The biophysical and biochemical methods despite their limitation, however, do have their individual specific uses and are useful as sources of information on different aspects of nutritional disturbance. As they are perfected it is to be expected that their usefulness will be further enhanced,

Of all the methods reviewed so far, it is believed that those comprising gross and biomicroscopic examination of specific tissues for characteristic morphological changes most nearly meet all the previously listed requirements for evaluation of nutritional status satisfactorily. The biomicroscopic method can also be used for all age groups, it is fairly simple to operate, and can be used to detect all phases of deficiency.

Summary and conclusions:—The importance of detecting marginal cases of malnutrition and the work done on these aspects have been described. The history of the development of new tests for the detection of deficiency diseases and their comparative usefulness in correct evaluation of diagnosing deficiency diseases have been surveyed and discussed. It has also been shown how these tests are not only useful for detection of marginal cases of malnutrition but also how they have contributed to the increased understanding of the nature and significance of nutritional diseases. These new diagnostic methods may well be regarded as an effective weapon in the eventual control and elimination of cases of malnutrition.

BIBLIOGRAPHY

1. Ayyar R. S. (1931) *Ind. Vet. J.* 7, 263.
2. Bulvant Singh (1937-38) *Ann. Report.*
3. Dalldorff, G. (1933) *Amm. J. Dis. child.* 46, 794.
4. Dutta, S. C. A. (1933) *I. N. D. J. Vet. Sc. and A. H.* 3, 254.
5. Fernandes (1940.)
6. Gurbachan Singh (1936-37) *Ann. Report V. I. O. Bengal.*
7. Hayes, M. H. (1879) *Vet. Jour.* 8, 408.
8. Holmes, J. B. (1916) *Amm. J. Dis. child.* 12.
9. Kruse, H. D. (1941) *Milbank Mem. Fund. Quart.* 19-207.
10. Kruse, H. D. (1942) *do.* *do.* 20-29.
11. Kruse, H. D. (1943) *Handbook of Nutrition. Am. Med. Ass. Chicago.*
12. Maccarrison (1914) *Ind. J. of Med. Res.* 1.
13. Naik, K. C. (1935-36) *Annual Report, V. I. O. Bombay.*
14. Olver, A. (1933) *Ind. Jour. of Vet. Sc. & An. Hus.* 3-350.
15. Ratnam V. D. (1942) *do.* *do.* 10-175.
16. Pande, P. G. (1934-35) *Ann. Rep. V. I. O. Assam.*
17. Murari, T. (1931) *Ag. & Liv. in Ind.*
18. Sherman (1943) *Jour. Biol. Chem.* 104-91.
19. Sabay (1937-38) *Anu. Rep. V. I. O. Bihar.*
20. Sen, K. C. (1935) *Ag. and Liv.* 5-145.
21. Lydenstricker V. P. et al (1940) *Jour. of Am. Med. Ass.* 114-2437.

ESTROGEN THERAPY

The availability of dependable yet inexpensive analogues of the oestrogenic hormones brings specific therapy of many reproductive disorders within the scope of routine veterinary practice. The products listed below enable the needs of both large and small animal practice to be met by convenient and accurate dosage.

'HYPOLOID'SM STILBŒSTROL DIPROPIONATE (Veterinary)

For intramuscular injection: 10 mgm. per c.c., in bottles of 10 c.c. and 25 c.c.
1 mgm. per c.c., in bottles of 5 c.c.

'WELLCOME'SM SOLUTION OF STILBŒSTROL IN OIL (Veterinary)

For intra-uterine injections: 1 mgm. per c.c., in bottles of 100 c.c.



BURROUGHS WELLCOME & CO., LONDON
(The Wellcome Foundation Ltd. Incorporated in England)

Associated Offices:
NEW YORK MONTREAL SYDNEY CAPE TOWN SHANGHAI BUENOS AIRES CAIRO
AND COOK'S BUILDING, HORNBY ROAD, BOMBAY

B.W. & Co.

A MARK TO REMEMBER

When writing to advertisers, please mention this Journal.

INDIAN VETERINARY RESEARCH INSTITUTE, MUKTESWAR,

POST-GRADUATE SCHOLARS WITH THE OFFICERS OF THE CENTRAL
RESEARCH INSTITUTE, KASauli, DECEMBER 1948.



Left to Right:

Standing:—V. S. Deo (Bombay), B. N. Sahoo (Orissa), A. Thomas, K. G. Sastry, (Madras), H. B. Lobarni (Rajasthan),
Sewa Singh (Patiala), R. L. Kaushal (Madhya Bharat), S. K. Das (Bengal).

Sitting:—Sardar G. K. Singh, M. N. Lahiri, C. B. D'Silva, Lt. Col. M. L. Ahuja (Director), Sardar B. Singh, (O.C., B.P.S.),
Sardar N. Singh, B. N. Lahiri.



Late Rao Sahib K. KAILASAMIER, G.B.V.C.,

Retired Superintendent,
SERUM INSTITUTE, MADRAS.

Born : 19-6-1883

Died : 6-3-1949

THE Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

Vol. XXV

MARCH, 1949

No. 5

Editorial

KYLASAMIER

It is with a profound sense of grief and sorrow that we have to record the death of the doyen of the profession in Madras, Rao Sahib K. Kylasamier, on Sunday, the 6th March 1949, at his home in Nungambakkam, Madras. Little did we realise when he took to bed about the 15th February '49 that his end was so near and that he would so soon shake off his mortal coils. As one who was part and parcel of us for nearly four decades, it is extremely hard for us to give full expression to our feelings of distress at the great void created by his death.

Kylasamier was one of the earliest pioneers of the profession in Madras who contributed quite a good deal towards its organisation and development. The existence of the profession was practically unknown in the days when he entered service in the Madras Veterinary Department nearly half a century ago. People were looking askance at the remedial measures enunciated for the control and prevention of cattle epidemics and, in fact, were resisting all our approaches in that direction. It was at that time that Kylasamier made his mark. His persuasive manners and skill in organisation, combined with his charming and assuring countenance, very soon disarmed all opposition. He got himself endeared to one and all and, wherever he went, he became quite popular with the ryots. It is very well known that he was a *persona grata* with the Pattagar of Palayakottai, the greatest cattle-breeder in South India.

Kylasamier's outstanding work was in the combating of Rinderpest which was then laying a heavy toll in the various parts of the Presidency. The Mobile Corps which toured all over the Presidency under his able guidance and control, scorching out the disease wherever it existed, will long be remembered by the profession and the people alike as an exceedingly efficient piece of organised pioneer work. The successful way in which he started the Serum Institute, Madras, and put it on a firm solid basis is a standing monument to his achievements.

His administration was marked by a high degree of skill and efficiency, and he was popular, not only with his assistants and colleagues, but also with the public to an amazing extent. His optimistic and generous outlook was quite invigorating and, while he suffered no fools, nor knaves either, he infused hope and courage into the weak and timid. A perfect gentleman with varied activities and fine taste, loved and feared alike, he was a welcome figure at all times, anywhere and everywhere.

In service, and more when out of it, he laboured to organise the profession on sound lines and his invisible hand was discernible at every stage of its progress. The starting of this Journal twenty five years ago and its successful running till today was in great measure due to his genial, willing and hearty co-operation, and he has all along been our friend, philosopher and guide. He was looking forward with great interest to the celebration of our Silver Jubilee in July next, but alas, He had willed otherwise! Right to the last, he was taking an interest in all our activities and he was the life and soul of everything pertaining to the profession in Madras and, to a good extent, even beyond. We, therefore, do not indulge in any exaggeration when we say that his death is an irreparable loss not only to us but to the profession at large.

We extend our sincere and heartfelt condolences to the members of the bereaved family whom we can readily assure that the loss is not theirs alone but is shared by the whole profession, and a vast number of friends and admirers.

A MEMOIR

The news of the death of Rao Sahib K. Kylasamier must have come as a great shock to the profession. To many like me, it has come more as a personal bereavement. It is indeed hard to believe that he is dead. With him has passed away a great pioneer of the profession and a popular outstanding personality.

Born in Travancore on ninth June, 1883 with a silver spoon in his mouth. Kylasamier started an adventurous career, after a short preliminary course of studies in his native land, and joined the Bombay Veterinary College in 1903—adventurous, because, in those days, Bombay was a far-off place and Veterinary study was a practically unknown course. He graduated in 1905 with great proficiency in the 'Practical' and, soon after, was appointed as House Surgeon in the hospital attached to his college. He greatly impressed his officers with his smartness and intelligence, but his stay there was only short, as his family could not bear his separation long. In 1906, he came over to Madras and joined the Civil Veterinary Department on the staff of the Madras Veterinary College, where he was acclaimed as a great acquisition. He soon endeared himself as a popular teacher and a great clinician. Three years later, he was transferred to the District work as a Veterinary Inspector. There he found work suited to his nature and found ample scope for the exhibition of his innate powers of organisation and skill. In the year 1912, when Rinderpest was levying a heavy toll, he was selected to organise a Mobile Corps to combat it. The efficient way in which he organised that Corps, and the successful way in which he conducted the campaign against the disease all over the Presidency brought a feather to his cap. The Veterinary Surgeons

who worked in that Corps still remember with affection and pride the spirit of *camaraderie* he brought into it and made it into a live organic unit. He moved with the people very freely and his intimacy with the ryots and popularity with them developed to an extraordinary extent. In 1917, he was selected to one of the newly created posts of Deputy Superintendents of the Civil Veterinary Department, Madras, with headquarters at Coimbatore and with jurisdiction over a fourth of the presidency. The question of introducing the S. S. method of inoculation as a prophylactic against Rinderpest was then being discussed at great length. It was mainly due to the initiative and resourcefulness of Sri Kylasamier that that method came to be adopted with such conspicuous success all over the Presidency. During this period he drew himself closer to his subordinates and the people at large. Very well up in his profession, endowed with great mind, fair-minded and unbiassed in judgment, and possessed of delightful charming manners, administration was quite an easy thing to him. His personal devotion to work and his keen sense of duty soon brought erring individuals to correction and it was astonishing how, with the minimum of punishment, he effected the maximum of efficiency. Thereafter, in 1928, he proceeded to the United Kingdom for higher studies and specialised in Bacteriology and Pathology. On return in 1929, he was appointed as a Lecturer at the Madras Veterinary College. And when, after great hesitation, the Government decided in 1932 on opening a Serum Institute in Madras, Sri Kylasamier was appointed, as its Superintendent. The thoroughness and efficiency with which he organised and conducted it reflected great credit to his ability and skill. It was acclaimed as a great success and the Institute met, in a very short time, the increasing demands for the common biological products needed in the Presidency: what was more, it became a successful commercial concern and brought profit to the

Government. In appreciation of his meritorious work all along, he was awarded in 1932, the title of Rao Sahib—an honour which was greatly appreciated by one and all as a well merited distinction. He acted on three occasions as Principal, Madras Veterinary College, with conspicuous ability and success, and retired in the year 1938 as a greatly respected, popular and distinguished member of the profession.

Though superannuated by Government, Kylasamier continued to be young in body and mind and maintained his lively interest in the progress and advancement of the profession which he loved intensely. He was from the beginning a staunch supporter of the All India Veterinary Association and its branch in Madras. In those days when Government frowned on the activities of the Association, he was a tower of strength to it and it is well known how he used to come to its aid in times of need. He was one of the founders of the Indian Veterinary Journal and contributed a good deal for its successful running all along and right up to the time of his illness. For over a decade he was the President of the Madras Association and took a keen and active part in all its deliberations. His mature wisdom and mellowed advice were always sought after by many—not necessarily in his profession—and he helped them all in his own endearing and loving manner to the best of his ability. He was a great connoisseur of art and music, and this brought him a number of friends in various walks of life.

A gentlemen to the core and a humanitarian of a high order, he has died at the age of sixty-six full of honours and achievements. He never looked his age and was full of vigour and vitality. He could have been spared to us

for some more years, but His will has been otherwise. It is difficult to fill up the gap caused by his death but his life will always remain an example for others to follow. Of him, it can be truly said,

Life's race well run
 Life's work well done
 Life's victory won
 Now cometh rest.

May his soul rest in peace!

R. S.

RETIREMENT

Sri M. R. SUBRAMANIA SASTRY, G.M.V.C.

The 'old guards' of the Civil Veterinary Department, Madras, are fast retiring on superannuation: the latest of them is Sri M. R. Subramania Sastry of the Madras Veterinary College.

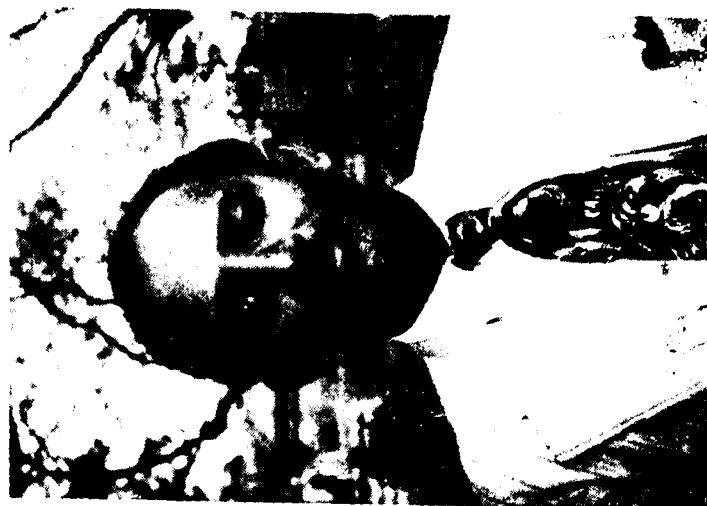
Hailing from the village of Maharajapuram in Tanjore District, Sri Sastry had his early education in Mayuram and joined the Madras Veterinary College in 1912. Graduating in the year 1914, he, like all the Veterinary Graduates of those days, entered Government service and worked in a number of stations in the Presidency, either on touring duties or in charge of important hospitals. Wherever he was, he became very popular with the people and was held in high esteem by every one. For some time he worked on the subject of Parasitology under the direct guidance of Sir Frank Ware but did not continue the specialisation. It was a good thing he did not, because the profession would then have lost a good and able clinician. In 1934, he attended the



SRI M. R. SUBRAMANYA SASTRY, G.M.V.C.

Retired Lecturer in Pharmacology and Therapeutics.

MADRAS VETERINARY COLLEGE.



LIEUT. C. KRISHNA RAO, B.V.Sc., M.S., C.V.E.
Superintendent, Livestock Research Station,
Tumkur, Bellary.



K. S. SHETTY, G.M.V.C., Ph.D. (Edir)
Civil Veterinary Department,
Hyderabad Dn.

refresher course at the Madras Veterinary college, and passed the examination at the end of it with a first class distinction. For nearly six years he was in charge of the important hospital at Botcamund, the queen of hill stations and the then headquarters of the Government for nearly 6 months in the year, and earned a great name there as an able practitioner. Thereafter, he was selected, in the year 1940, as a Veterinary Research Officer for Research in the Indigenous Drugs of India with special reference to their toxicology and worked in that scheme at the Madras Medical College for three years till July 1943. His preliminary studies on the pharmacological properties of a few toxic plants were of great value but, then, he was transferred to the Madras Veterinary College as a Lecturer in Pharmacology and Therapeutics. This also turned out to be a fortunate thing. His ripe experience as a long-standing able practitioner, and his subsequent work in experimental pharmacology, eminently fitted him for this new post and he acquitted himself exceedingly well. His clinics were very instructive and educative and was keenly sought after by the students with whom he was very popular. This popularity became greater still when he became the Warden of the hostel combining in himself the other duties of the Resident Veterinary Officer and Personal Assistant to the Principal. With the age of approaching superannuation, he went on leave preparatory to retirement and finally retired on 15th February 1949 with a record of good, efficient and approved service, much to the regret of his students and his clientele.

Sri Sastry is one of those pioneer workers in Madras presidency who earned a name for the profession by their hard work, ability and integrity and, while we wish him all health and happiness in his retirement, we hope he will not allow his vast experience and knowledge to rust away but will place it freely at the disposal of the profession.

RETURNED FROM ABROAD

It is gratifying to record that the officers of the Veterinary Departments who were deputed for training overseas are returning one by one, greatly benefitted by their stay abroad. The reports that are to hand about those who have returned are highly flattering and we are very glad that these deputationists have left an exceedingly favourable impression behind. It is now for the respective Governments to utilise the knowledge and equipment of these officers to the best interests of the country and the profession.

The two officers mentioned below returned from abroad recently and we have great pleasure in giving a short sketch of their career.

K. S. Shetty, G.M.V.C. Ph.D. (Edin.)

K. S. Shetty hails from South Kanara District of the Madras Presidency and had his early education in his countryside. After completing his collegiate studies with his Intermediate in Arts and Science, he joined the Madras Veterinary College and took the diploma in 1932. He then entered the Hyderabad State service and served there for nearly 13 years in various stations, on itinerating duty and in charge of Hospitals, with distinction. He was awarded a first class certificate by the State in recognition of the good work done during that period—the only one to be so honoured by the Government of the State so far. Thereafter he was deputed for higher training in 1945 and he had the good fortune to come in close contact with the late Prof. D. C. Matheson of the Royal (Dick) Veterinary College. He joined that College as a P. G. student in Bacteriology and studied there for one year. He was then recommended to the University of Edinburgh for admission to the Ph. D. course. After working for two years there, he submitted a thesis on "A study of the Bacterial flora of the upper respiratory tract of the dog and cat", a subject of great interest from the public health aspect, and took his Ph. D. During his stay in Great Britain, he visited a number of reputed British and Continental institutions to study research and organisational methods.

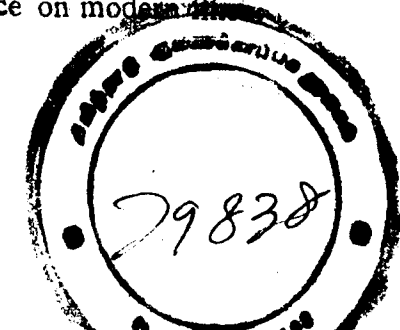
We understand that his posting in the State is not yet settled although it is some weeks since he returned. We do hope that he will soon be so fixed up as to give full play to his talents and equipment.

Lieut C. Krishna Rao B.V.Sc. M.S. (Calif)

KRISHNA RAO has had a brilliant academic career. With treble distinctions in the Intermediate in Arts and Science examination, he joined the Madras Veterinary College in 1938 and passed out in 1943 with a first class B. V. Sc. degree. Entering Government service, he worked in the Department of Pathology and Bacteriology of his *Alma Mater* for a short period and then joined the Indian Army Veterinary Corps in 1944. While there, he was selected by the Madras Government for training in Animal Husbandry in the United States of America and, obtaining his release for studies abroad, left for America in July 1946. He attended the University of California, Texas Agricultural and Mechanical College and the University of Missouri. In September 1947, he obtained his M. S., degree in California for his work on Physiology of bovine spermatozoa. His training in America was very elaborate and covered the various phases of Animal breeding, Poultry breeding and Reproductive physiology. He was also working for his Ph. D., and, although he was very highly commended as among the top group of Graduate students there, it was a pity his application for extension of stay abroad was not favourably viewed by the Madras Government. He had therefore to return home in November 1948 and, having been fortunately stranded for two months in England, owing to shipping difficulties, spent his time there usefully in visiting the local institutions.

He is now in charge of a Livestock Research Station in Bellary District and we hope he is being given all the facilities and help required in the running of the place on modern lines.

J L
KZ m2, N24
N49.25.5



PERSONAL

SIR FRANK WARE

We are very glad to announce that Sir Frank Ware, whose recent illness had caused anxiety to many of our readers, has replied to our enquiries about his health that he has returned home from the hospital, though still feeling the effects of the infection which he contracted while on deputation to S. Africa. We wish him an early recovery so that he may resume his usual activities soon.

K. ANTHONY, G.M.V.C.

It is with greatest pleasure we announce that Mr. K. Anthony, consulting Veterinary Surgeon, Anthony's Animal Clinic, Kuala-lumpur, has enrolled himself as a Life Member of the *Indian Veterinary Journal* by paying an advance subscription of Rs. 100/-. It is very encouraging that Veterinary Surgeons from overseas are taking so much interest in this *Journal* and are helping it both financially and professionally by sending periodic contributions to it. Actions like these go a long way in cementing the bonds of friendship between different countries and we convey our thanks to Mr. Anthony for his contribution.

Sri. A. M. MUTHAPPA, G.M.V.C.

We are happy to learn that Sri. A. M. Muthappa has been appointed as the Chief Veterinary Officer, Coorg. After a distinguished academic career at the Madras Veterinary College, he joined the Coorg Veterinary Department and soon made his mark there. He was among the foremost in popularising prophylactic inoculations, especially the Serum-simultaneous inoculation against Rinderpest. He was also among those responsible for the organisation of the Coorg Veterinary Association of which he still continues to be the Honorary Secretary. Keen and energetic, he will, we are sure, soon make the Government and the people feel the importance of the Veterinary Science to the welfare of the land. We wish him all success in his new appointment.

Clinical Articles

A CASE OF ANTHRAX IN A DOG

By

M. S. DAS, B.Sc., M.R.C.V.S.,
Dept. of Pathology & Bacteriology,
Bengal Veterinary College, Calcutta.

INTRODUCTION

It is generally known that, although dogs and other carnivores are susceptible to infections with anthrax bacilli, such animals are, however, fairly resistant to this organism.

Toussaint (1878) reports to have produced rather refractory results on experimental infection in dogs, the only reaction in many cases being local abscess formation at the site of infection.

Davies (1886) describes 4 cases of naturally occurring anthrax in dogs in Madras, two of which contracted the disease accidentally licking the blood of a horse died of anthrax, during the post mortem examination. The other two got the infection from contact with the previous ones. In each case the author bases his diagnosis on high fever (103°F—104°F); sudden onset of the disease; death within 2 or 3 days; swelling with gelatinous exudate in the throat region. He also mentions detection of rod-shaped organisms on microscopic examination.

The Annual Report of the Prussian Official Veterinary Surgeons (1908) contains records of several cases of anthrax transmitted to dogs. One dog, the report states, developed anthrax after licking the blood of a cow which died of the same disease. It showed severe inflammation of the throat and larynx but ultimately recovered. Two other dogs which were fed on flesh of sheep died of anthrax succumbed to the infection. Another dog showed bloody diarrhoea after eating anthrax flesh; this case also recovered.

Jonesen (1922) records a case of anthrax in a dog and states that it picked up the infection from an ox died of anthrax. The dog showed symptoms, only a few hours before death, when the animal was dull and exhibited difficulty in respiration. There was some swelling of the submaxillary region together with vomiting. Post-mortem examination revealed marked congestion of all the organs, the blood being black and watery. Ecchymosis on the epicardium and enlargement of the spleen without the pulp being diffuent were also noted. The kidneys showed necrotic centres and evidence of acute nephritis.

Verge and Placidi (1935) have tried injecting dogs experimentally with anthrax bacilli. Dogs and cats, they observe, are susceptible to the infection with anthrax when sufficient culture was injected through intradermal, intravenous or intratesticular routes. The susceptibility of the dogs was greatly increased when the animals had been subjected to a period of fasting.

Wright (1936) describes cases of anthrax in a pack of hounds which were given a meal of knacker's meat. On the day following all the dogs had diarrhoea and a few of them died during the night. Symptoms shown were rise of temperature to 105°F, listlessness and black diarrhoea; some dogs had swellings in the throat and some had swellings in various other places in the head.

The Case under report

The subject of this report was a small-sized mongrel. The history supplied by the Veterinary Surgeon and the owner was that the dog suddenly strayed away from the house, and that, after three days, it was found lying on the road-side, obviously suffering from a serious ailment, unable to move or take any notice of any food. When brought to the surgery, the dog was unable to put any weight on its hind legs, as if it were suffering from paraplegia. There was vomition and black diarrhoea, and the temperature recorded was above 105°F.

Soon after, the dog died and the autopsy was performed within about an hour of its death.

Post-mortem Findings

EXTERNAL APPEARANCES:—The body condition was good; there were no signs of injury except a small abraded area on the inner aspect of the thigh.

INTERNAL APPEARANCES:—

Pharynx, Larynx and Oesophagus:—Normal.

Trachea:—Presence of excessive amount of mucous.

Pleural cavity:—Some fibrinous fluid present.

Lungs:—Both lobes highly congested.

Heart:—Normal.

Peritoneal cavity:—Large amount of haemorrhagic fluid present.

Liver:—Congested in many parts.

Spleen:—Not enlarged; slightly softer.

Kidneys:—Both congested.

Stomach:—Empty with areas of petechial haemorrhage.

Small Intestine:—Mucous membrane severely congested; linear streaks of ulcers present.

Large Intestine:—The changes here were striking. The whole length was intensely inflamed and the entire thickness of the wall was of a dark greenish color.

Bladder:—Full and congested.

Generative organs:—Normal.

Brain and Spinal Cord:—Slightly congested.

Blood:—Not clotted.

LABORATORY EXAMINATION:—Microscopical examination of the blood films from the heart and liver revealed the presence of rod-shaped organisms with capsules and truncated ends in short chains (2-7), three or four-unit chains predominating. They stained deep with polychrome methylene blue. No spores were present.

Cultures of materials from blood on plain agar showed typical colonies of Anthrax.

Biological experiments were carried out by using the saline suspension of heart blood. To obviate contamination, the saline suspension was kept in one per cent phenol solution for one hour and was then inoculated subcutaneously into a guinea-pig. The guinea-pig died within 48 hours after showing high temperature and s/c oedema at the site of inoculation.

On *post-mortem* examination, its spleen was found to be enlarged and anthrax bacilli were recovered from the blood.

DISCUSSION:—The importance of anthrax in dogs lies mostly in the fact that these carrion eaters are dangerous agents for the spread of the disease. Further more, unsuspecting veterinary surgeons are exposed to a certain amount of risk while carrying out *post mortem* examination on dogs.

In this particular case, the carcass was opened without suspecting anthrax. The mistake was committed mainly because of the rarity of such cases and also because of the absence of swelling of any kind in the throat region. It was not until the microscopical examination of the blood smears was made that the case was seriously thought to be one of Anthrax.

It is very interesting to note that the spleen was not enlarged at all and that the most outstanding P. M. feature was the condition of the large intestine.

Acknowledgment

My sincere thanks are to Major J. M. Lahiri, M.R.C.V.S., F.Z.S., Principal, Bengal Veterinary College, for his helpful suggestions.

REFERENCES

1. Toussaint, H. (1878)—*Vet. Jour.*, Vol. 7, p. 69.
2. Davies, G. F. (1886)—*Vet. Jour.*, Vol. 22, p. 401.
3. Annual Report of the Prussian Official Vety. Surgeons (1908);—*Quoted in Vet. Rec.*, (1911) No. 1192, p. 720.
4. Joneson, A. P. (1922)—*Arch. Veterina*, No. 4, p. 168.
5. Verge, J. and Placidi, L. (1935)—*Abstract in Vet. Bull.*, p. 720.

BOVINE MASTITIS IN BIHAR*

By

R. B. PRASAD, G.B.V.C., P.G.

Laboratory Assistant, In charge Mastitis Scheme, Bihar.

Introduction:—The problem of Bovine Mastitis as a major factor in economic milk production led the Government of Bihar to start in 1945 a "Mastitis Scheme" under the auspices of Civil Veterinary Department, Bihar, to investigate into the epidemiology, control, and treatment of that disease. Under that scheme, a series of field and laboratory investigations have been carried out in the course of the last two and a half years and the observations described in the present report deals with the incidence, bacteriology, treatment and control of mastitis. The work required to be done under this scheme has not yet been completed but it seems desirable that the information already obtained should be recorded so that it might be of help to those engaged in similar studies.

Incidence and Losses:—It has been stated by nearly all workers that milk yield is usually reduced when a cow becomes infected although the milk itself did not always appear macroscopically altered, and also that a clinical examination of the udder sometimes gives negative results. Shaw and Bean (1935) found that mastitis infections reduced milk productions approximately 22 per cent, and butter-fat production 24 per cent, after allowing the maximum variation found in the milk and butter-fat production in non-infected quarters. Ernst (1909-10) estimated that 20 per cent of all cattle in Germany suffered from mastitis and, according to Sealemen, (1932) 10-20 per cent of all cows in Central Europe. There is no record to show that any systematic work has been done in this direction in this country, but from the data collected by the author in regard to the incidence of latent or non-clinical mastitis in Bihar, it is estimated that about 4.4 per cent of the milch cattle suffer from this form alone.

Latent Mastitis.—Minett (1930) stated that streptococcal mastitis was insidious in its course and that cases of latent mastitis were common. The term "Mastitis" has been applied even to those forms of mastitis which do not show any clinical manifestation and which, indeed, in some cases, are rather difficult to diagnose without the aid of laboratory methods.

Material and methods:—In order to determine the incidence of latent mastitis, samples of milk were collected from apparently normal udders of healthy milch animals and were subjected to the indirect tests for mastitis such as strip-cup, brom-cresol-purple paper and sediment and direct microscopic tests in the field where facilities for cultural tests were not available. Direct tests were also done when the samples were collected in the laboratory.

* Paper read on the occasion of the 10th Annual General Meeting of the Bihar Veterinary Association held at Patna in December, 1947.

As many as 5924 samples of milk were collected from 1481 milch cattle in the field and were subjected to the indirect tests. 66 animals proved positive, thus showing a latent infection of 4 per cent. To compare this result, 532 samples of milk collected from 133 milch cattle were subjected to cultural test; the result was that 11 of them proved positive, revealing 8.2 per cent of 'latent' mastitis. It will thus appear that there is much disparity in the results of direct and indirect tests applied to detect 'latent' mastitis. To co-relate the results of indirect and direct tests for 'latent' mastitis, 24 samples of milk from 6 cows were collected and subjected to both the tests. The indirect tests revealed infection in only one cow whereas the direct tests proved positive in 2 cows. Thus it would appear that the indirect tests failed to detect all cases of 'latent' mastitis. More samples will have to be examined to confirm this finding but even, at this stage, it can be stated that the direct tests are more reliable in the diagnosis of 'latent' mastitis.

Bacteriology and Technique:—Bacterial types associated with 103 acute and chronic cases of mastitis:—The predominating types met with were as follows:—

(1) Streptococci	...	89
(a) Streptococcus agalactiae	...	87
Hæmolytic (β)	...	56
Non-hæmolytic	...	31
(b) Streptococcus dysgalactiae	...	2
(2) Staphylococci	...	12
(3) Bacillus pyogenes	...	1
(4) Coliform bacteria	...	1

1. **Streptococci:**—In practically every case the material was examined on the day it was taken; only in a few cases on the following day. When milk showed no abnormal appearance, 10 c.c. of the sample was centrifuged; the deposit was mixed with about 2 c.c. of sterilised normal saline solution, of which one-half was plated in 10 c.c. agar-plate containing 5% defibrinated ox-blood. The remaining half was further diluted in 9 c.c. saline of which 1 c.c. was similarly plated. When milk-samples were altered in appearance, the two saline solutions were made direct from a small quantity, usually about 0.1 c.c. of the material. The blood-agar plates were incubated at 37°C. and, after 24-48 hours, the type of hæmolysis, if present, was observed by the naked eye and under a magnifying lens. Two or three colonies from these plates were picked off and were transferred to serum-broth. Those cultures were used for subsequent inoculation of plain broth tubes, litmus milk, fermentation media, 1% glucose-broth and infusion-broth containing 1% sodium

hippurate. The plain broth medium was observed at the 24th hour to determine the nature and character of the growth. Litmus milk at 37°C. was observed on the first, second and fifth day. The fermentation media consisted of 1% peptone water enriched with one-tenth of its volume by plain broth to which test substances were added to make the concentration to 10% and the final pH adjusted to 7.2 to 7.4. The final H-ion-concentration in 1% glucose broth was observed after incubation for 5 days at 37°C. and was done by colorimetric method. For hydrolysis of sodium hippurate to glycocholic and benzoic acid, the cultures were grown for 5 days in infusion-broth containing 1% sodium hippurate at 37°C.; then to 1 c.c. of the clear supernatant fluid were added 0.3, 0.4, 0.5 c.c. respectively of 12% acidified ferric chloride solution. Results were not considered positive unless a heavy precipitate appeared on the addition of ferric chloride; when the first result was negative, the test was repeated at least once again. For microscopical examination of incubated milk, the whole milk was incubated for 18 hours. The incubated milk was thoroughly shaken and a loopful (0.01 c.c.) was taken for preparation of the smear. The smears were air-dried and then immersed in Newman's stain. After about 5 minutes, the smears were taken out and allowed to be air-dried before being washed. After washing, it was again air-dried and then examined under the microscope. The classification of streptococci was made just on the same lines as laid down by Dr. F. C. Minett in his report "Bacteriological Differentiation of Mastitis Streptococci" read at the Twelfth International Veterinary Congress.

2. *Staphylococci*:—The material was centrifuged, and the diluted centrifugal deposit was sown on blood-agar successively. The first plate was crowded with colonies and the medium partially or completely haemolysed. Subsequent plates showed deep colonies which were surrounded by zones of incomplete haemolysis upto about 8 m.m. in diameter. In broth, they produced dense uniform turbidity. On the surface of agar, the colonies were dirty-white. The litmus milk was rendered acid; it firmly coagulated with clear whey. Acid was produced in glucose, lactose and mannite, but not in salicin. All of them were coagulate positive using citrated ox-blood.

3. *Bacillus pyogenes*:—The character of the material obtained from the case was a thick purulent fluid with putrid odour. Microscopically, the secretion showed enormous number of short, slender, gram-positive bacilli. Blood-agar plates sown with serial dilutions of the secretion showed, after 48 hours incubation, large numbers of small colonies surrounded by narrow zones of haemolysis. Two or three of these colonies were picked off and put into tubes of serum-broth. Loopful of culture from serum broth was implanted on the surface of the solid serum which showed liquifaction at the point where growth had occurred.

TABLE I
Reaction of Streptococci

Particulars of Streptococci	Total no. of strains	Blood-agar plates (Deep colonies)	Growth in broth	Litmus milk 37°C	Final pH in 1% Glucose broth	BIOCHEMICALS					Sodi. hippu- rate splitting	Mi. ex. of culture samples	Clinical nature of the disease.
						Salicin	Mannite	Asculin	Glucose	Lactose			
Streptococcus agalactiae.	87	β-haemolytic (56) Non-haem-olytic (31).	Broth, clear or solu- tion tur- bid with flocculent deposit.	Acid, clot slightly reduced.	4.7 to 5.0	+	—	—	+	+	+	Long chain- ed cocci arranged in palisade fashion.	Acute and chronic.
Streptococcus dysgalactiae.	2	Non-haemolytic.	Fair deposit solution turbid.	Acid, soft clot; partial reduction.	5.0 to 5.2.	—	—	—	+	+	—	Shorter chains.	Acute.

4. *Escherichia Coli*:—The case was a seriously acute one. Blood agar plates sown with serial dilutions were β haemolytic with wide zones. Two or three colonies of blood-agar were transferred to neutral-red broth which turned yellow. The litmus-milk was rendered acidic and contained clot and gas. Acid and gas were produced in glucose, lactose and mannite but not in salicin. V. P. was negative and indol production was positive. The culture in plain broth gave rise to uniform turbidity with a somewhat foetid odour.

Treatment:—Treatment was carried out in 33 clinical cases of mastitis. There were 15 cows and 5 buffaloes in the acute stage and 8 cows and 5 buffaloes in the chronic stage of the disease. As udder infusion, the following drugs were tried:—

1. Sugar-acriflavine solution-containing 20% household sugar with acriflavine in the concentration of 1 : 1500.
2. Euflavine solution (M. & B).—one tablet dissolved in 2 pints of sterile distilled water (1 : 10,000).
3. Sodium salt of Penicillin.
4. Homogenised suspension of sulfanilamide in liquid paraffin.

The following technique was observed in giving udder infusion of the first two drugs:—

The udder was washed with E. C. lotion and dried; the affected quarters were stripped and the tips of the teat cleaned with a swab of cotton wool soaked in alcohol. The solution was injected either by the use of a gravity apparatus or by means of a syringe attached to the teat syphon inserted into the teat canal. 100 to 200 c. c. of the solution was first injected and immediately removed as a preliminary washing-out process. The teat syphon was then re-inserted and the quarter filled with the solution to a tension which would normally be present just before milking; the quarter was then lightly massaged. In the case of cows in milk, the solution was allowed to remain in the udder for five minutes only. Thorough stripping was then carried out and repeated 3 or 4 times daily for the next two or three days. In the case of dry cows the solution was stripped out after an interval of 18 to 24 hours.

Penicillin was given as udder infusion in the following way:—The udder was washed with clean water and then dried by a dry duster. The affected quarter was stripped to its last drop of milk. In the beginning 50,000 Oxford units, dissolved in 40 c.c. sterile N. S. S., was injected in each of the affected quarter (using the teat syphon and glass syringe attached to it). The subsequent doses consisted of 50,000 and in some cases 25,000 units dissolved in 80 c.c. of sterile N. S. S. and was repeated at an interval of 12 hours. The injected solution was left *in situ* and diffusion into deeper paranchymatous tissue was assisted by massage

of the quarter for a short period of time. The total unit of penicillin given in one affected quarter was 300,000, or sometimes 400,000 units.

Along with udder infusion, sulphanilamide and soluseptasine were also given in streptococcal mastitis. The initial dose of sulphanilamide given was 1 grain per pound body weight and was followed by one-third of the initial dose every eight hours and was continued for 5 days. Soluseptasine in 20% solution was injected in doses of 50 to 60 c.c. subcutaneously for two days consecutively.

In the case of staphylococcal mastitis, Thiazamide in doses calculated on the same basis as for sulphanilamide was given along with subcutaneous injection of staphylococcal toxoid (when available) in doses of 10, 15, 20 and 25 c.c. at two days' interval.

In addition to the above treatment for acute mastitis, fomentation, application of emollient, frequent stripping and massage were done.

From table II, it would appear that Penicillin was very efficacious in cases of streptococcal mastitis: encouraging results were obtained even with the administration of 2 lacs units. Sugar-acriflavine and Euflavine had some discouraging results amounting to cessation of milk secretion in some cases. In the opinion of the author they can be used only to sterilise affected fibrosed quarters shedding mastitis organisms so as to prevent the spread of further infection in the herd.

Control:—There appears to be no known reliable biological means of prevention but much may be done towards prophylaxis by adopting such preventive measures as are adopted against infectious and contagious diseases. In this connection, it may be worthwhile to refer to the observations made by Minett (1939) that streptococcal mastitis is contagious due to the following facts:—

- (a) The disease spreads to the healthy ones when infected cows are placed in their midst.
- (b) The spread of the disease can be prevented by measures designed to prevent milk-borne infections.
- (c) The fact confirmed by Stableforth (1938) that, in most of self built herds, the infecting type of *streptococcus agalactiae* is exactly the same serologically in all or most of the cows.

Steck (1932) showed that a stage of "Cultural Latency" may be found to exist in an infected herd when the examination of the milk by methods capable of revealing even as few as 2 to 10 streptococci per c.c. may be negative for periods as long as 6 months. Moreover, there is also a stage of "clinical latency" when the mammary tissue, though harbouring infections, may not manifest any clinical symptoms and the incidence of which is

TABLE II

Particulars of animals treated.	Predominating clinical symptoms.	Lab. Diag-nosis.	Treatment adopted.	Results of the treatment.
1 Cow and 1 Buffalo	Acute stage-quarters swollen and painful giving orange coloured fluid: secretion very scanty. T. 103 to 104. 8 F.	Staphylococcus aureus.	Orally Thiazamide with subcutaneous injection of staphylococcal toxoid.	Temperature became normal. In the cow, the affected quarter dried up and became function-less. In the buffalo, the affected quarter became normal with a considerable reduction in milk-yield. (From 2 lbs. to only 12 oz.)
6 Cows and 1 Buffalo.	Acute stage-quarters swollen, secretion cloudy, fluid containing clots or clear yellow serous fluid with a few large clots. On palpation, the affected quarter was painful and there was a feeling of hardness underneath the skin.	Streptococcus agalactiae.	3 Cows and 1 buffalo were given udder infusion of sugar-acriflavine and the rest were given udder infusion of Eufflavine.	The affected quarters of 1 cow of 'sugar-acriflavine group' and 2 cows of 'Eufflavine group' became dry; the affected quarters of 3 cows and 1 buffalo recovered with some reduction in milk yield.
6 Cows and 3 Buffaloes.	Ditto. 1 Cow had also thickening of the teat duct.	Streptococcus agalactiae.	Penicillin as udder infusion, and sulphanilamide orally.	All of them recovered with restoration of milk secretion but the thickening of teat duct in the cow persisted and its milk yield was reduced.
8 Cows and 5 Buffaloes.	Chronic stage—the affected quarters were fibrosed partially or completely. They were giving not more than a few c. cs. of whey-like fluid.	Streptococcus agalactiae.	Eufflavine solution given as udder infusion.	None of the affected quarters secreted normal milk. But the shedding of the mastitis organism ceased in all cases in the two samples taken at fortnightly intervals.

detected only by laboratory methods. Hence a thorough study is required for control during the course of application of preventive measures.

In the light of the above, the following practical measures were devised for trial:—

(1) Detection of cows most likely to spread infection and their treatment.

(2) Treatment of fresh cases.

(3) The removal and segregation of all infected stock either in a separate milking shed, or at one end of the shed; the milking of clean stock before the infected stock by a separate milker.

(4) The following general points of hygiene to be followed:—

(i) Milking intervals to be regular and the same order of milking maintained.

(ii) Over-stocking to be avoided.

(iii) Driving the cows over long distances to be avoided.

(iv) Inefficient and faulty methods of milking to be avoided.

(v) Sores on teats to be properly treated.

(vi) Ill-designed sheds with slippery floors to be avoided.

(vii) Litters soiled by milk, either from rejected foremilk or otherwise, to be properly disposed of.

(viii) Just before milking, the udders to be washed with Potassium permanganate solution and then dried with a duster. The milker's hands to be disinfected between the handling of each cow.

Acknowledgment

The instructions and valuable suggestions given by M. I. Malik Esq., B.Sc., M.R.C.V.S., Director, Veterinary Services, Bihar and the facilities and help extended by P. B. Kuppuswamy Esq., B.A., G.M.V.C. B.V.Sc., (Veterinary) Disease Investigation Officer, Bihar, throughout my work are gratefully acknowledged. The author is also grateful to the Director, Indian Veterinary Research Institute, Mukteswar-Kumaun for help in carrying out the cultural work.

REFERENCES

1. Minett, F.G., *Jl. of Hygiene*, Dec., 1935.
2. Shaw, A.D.; & Bean, A.C. *Jl. of Dairy Science*, Vol 8, 1935.
3. Minett, F.C.; Stableforth, A.W., & Edwards, S. J., *Jl. of Comparative Path. & Therapeutics*, Vol. 42, 1929.
4. White, G. C., Contures, G. W.; Anderson, E. D.; *Jl. of Dairy Science*, Vol. 9, 1937.
5. Minett, F. C.; XII International Veterinary Science Congress.
6. Minett, F. C.; *Jl. of Comparative Path & Therapeutics*, Dec., 1939.
7. Van Rosenberg, S. W. J.; *Ondersteport Jl. of Vety. Science and Animal Industry*, Vol. 16, 1941.
8. Campbell, D.; *Vety. Record*, 53, 1941.
9. Roach, R. W.; *Vety. Record*, 57, 1945.
10. Slanetz, L. W.; Allen, F. E.; *Jl. of Amer. Vety. Med. Assoc.* 107, 1945; 18.
11. Peterson, E. M.; Bovine mastitis (Survey of the literature to the end of 1935)

RABIES IN MONGOOSE

BY

H. M. BHATIA, L.V.P.

Veterinary Assistant Surgeon, Dagshai, Simla.

Occurrence of Rabies in mongoose is very rare and has been unknown in this country until recently. M. M. A. Abbasi (1943), Assistant Surgeon, Samrala, reported a case of Hydrophobia in man developed after about two months of a bite on the right ear by a wild mongoose. The same mongoose had also bitten a cow and it too died of rabies 12 days before the man fell ill. The rarity of such cases make the following instances worth recording.

On 25th June, 1946, one Islam Din of Kanjrikot, a village near Lahore, reported that one of his buffalo-cows was bitten by a mongoose and desired Anti-rabic treatment for the same. On being questioned as to why he suspected the mongoose to be rabid, he disclosed that the mongoose was unusually furious. He further added that there were many mongoose in the vicinity, but they were never seen going wild or attacking men or animals, and that this particular mongoose was very furious and had bitten one of the buffalo-cows. It also attempted to bite other men and animals present there, but before it could do more harm it was destroyed. As the dead body of the mongoose had been thrown away, no confirmatory tests for rabies could be carried out.

A similar case was subsequently reported from the **Model Town, Lahore**. In this instance, a mongoose was reported to have emerged from a hedge on 8-12-46 and attacked a *mali*. The *mali* saved himself having noticed it in time. After a while, the mongoose attacked another *mali* who also managed to escape the attack. On this, the mongoose rushed towards a pup, 6 months old, and bit it in the submaxillary region causing a deep wound. The *mali* chased the mongoose but it disappeared. After about ten minutes, it re-appeared and teased two buffalo-cows tied near by. One of the animals broke the collar rope, and so saved itself, but the other was bitten by the mongoose on the left lip of the vulva causing a wound. The *mali* attacked the mongoose but it again made good its escape. After a short while, the mongoose was seen drinking water from a shallow pit, when it was over-powered and killed. All this happened in and near about the bungalow of Mr. Sohan Singh, a student of Punjab Veterinary College, Lahore. He brought the carcass of the mongoose to the College on the following day.

At the college, the brain of the mongoose was removed and put to biological and microscopical tests. The latter test was positive and a fairly large number of Negri bodies was found.

Biological Test:—A rabbit was inoculated subdurally on 12-12-46 with the brain emulsion of the mongoose. It showed definite symptoms of rabies on 3-1-1947 and died on 4-1-1947. Its brain was removed and on examination was found positive for Negri bodies.

The buffalo which was bitten by the mongoose was given a full course of Anti-rabic treatment from 12-12-46 to 25-12-46 but it developed Rabies on 22-1-47. It was brought to the Punjab Veterinary College Hospital on the following day where it died on 24-1-47. Its brain was positive for rabies on microscopical examination and also on biological test.

Discussion

Mongoose belongs to the order Carnivora and to the family Viverridae, its zoological name being *Herpestes mongoose*. Although many classes of vertebrates may be affected by Rabies, the disease, for all practical purposes, is considered as a canine enzootic. At Kasauli, in India, out of 22,519 human patients who required anti-rabic vaccination, 80% did so owing to contact with dog, 18% with jackal and 0.3% with cat and wolves. It is not mentioned anywhere if it ever followed the bite by mongoose or any other member of the family Viverridae. [See foot note. *Ed. I. V. J.*] In India, under village conditions, mongoose is quite frequently met with and perhaps comes in much greater contact with domestic animals than jackal, wolf, fox, panther, etc. It is found in nearly all *kacha* stables and round about the wells where animals are commonly kept in the villages. Its bite on the large animals may, however, not be noticed. Thus, the danger of Rabies is far greater from this animal than other wild animals. In regard to the mode of infection of the disease in this animal, it may be said that it feeds mostly upon small mammals, birds and their eggs, reptiles, insects and carcasses of animals. As is well known, carcasses of animals dead of contagious and infectious diseases are indiscriminately thrown away in villages to which the mongoose have an easy access. Feeding on the brain, or getting into contact with the saliva of animals dead of Rabies may be the ordinary routine of infection for this animal. It may also come through the bite of other rabid animals like a rabid dog.

Uptil now all measures adopted for the eradication and control of rabies in this country have been directed towards the control of the disease amongst dogs. They should in my opinion include mongoose also.

[Rabies in mongoose and cases of mongoose bites have been recorded in India already—Vide extract in *I. V. J.* Vol. IX No. 2, Oct. 1932, P. 159 *Ed. I. V. J.*]

REFERENCES

1. Hutya & Marek, Special Pathology and Therapeutics of the disease of Domestic animals.
2. Council of Medical Research, *System of Bacteriology*, Volume 7.
3. Webster, Rabies & Anti-Rabic Treatment in India.
4. Abbasi M. M. A., *Indian Medical Gazette*, 1943.
5. Adam Sedgwick, *A Students' Text Book of Zoology*.

SULPHANILAMIDE -ITS USE IN FOOT & MOUTH DISEASE AMONG CATTLE

BY

F. C. BHUYAN, G.B.V.C.

Veterinary Assistant Surgeon, Nowgong, Assam.

A severe epidemic of Foot & Mouth Disease broke out amongst cattle in Nowgong town and surrounding villages in May and June last. That being a ploughing season, a great economic loss was caused by this outbreak; ploughing operations came to a stand-still and milk in the town became a scarcity. Cattle-owners flocked to the Veterinary Dispensary daily in great numbers for treatment and advice. They were even prepared to spend for any specific medicine for a speedy cure of their cattle.

As Sulphanilamide group of drugs gave me excellent result in cases of Rinderpest (which is also a virus disease) I decided to try this drug in this disease as well. Accordingly, 75 cattle suffering from Foot and Mouth Disease in the initial stages (showing a temperature of 103° F and above, dribbling of saliva from the mouth and kicking of feet, etc.) were put under this drug. The results were very encouraging.

The drug (Sulphanilamide—Veterinary M & B) was used in the following dosage according to the size of the animals. Bullocks, weighing about 500 to 600 lbs, received 15 to 18 tablets, and calves, 3 to 4 tablets of 0.75 grms each 3 times daily, mixed with molasses or treacle. Sufficient quantity of drinking water was allowed during the course of treatment. In most cases, 2 to 3 days' treatment was found quite sufficient to cure ailing animals in the initial stage. The bullocks could be put to work in 4 to 5 days, while the milk-yield in cows returned to normal in 3 to 4 days. Three of my own milch cows also got this disease, and they were cured by this drug in 3 days. In the initial stages, they were given 30 to 36 tablets a day, in 3 doses, with treacle.

The drug was also useful in the secondary stages and it cut short the duration of the disease to a great extent.

Incidentally, I may mention here that three months later, all my 3 cows passed yellow urine which stained their hind quarters, thighs and tails yellow; there was also slight icteric condition of m.m. of eyes and inappetance, but no rise of temperature. I got the blood of these cows, examined by Prof. U. Nobindro of the Assam Veterinary College, who remarked "blood smears showed no evidence of any protozoa and most of the red blood cells were crenated". The cows were put on Calcium treatment and

all the symptoms disappeared in a fortnight. The calcium treatment was continued for a month. The blood was again examined by the same Professor who reported the red cells to be quite normal.

I am not quite sure whether this sequelæ had anything to do with the administration of the drug and whether it had any delayed effect. I shall be very glad if some of my professional brethren would enlighten me on this point.

Remarks:—It is said that Sulphanilamide group of drugs have no action on virus diseases, but in my experience I have not found it true. I have successfully treated cases of Rinderpest with M & B 693, as recorded by me in the *Indian Veterinary Journal*, Vol. XXII No. 3. I have also, as mentioned above, treated 75 cases of Foot and Mouth disease with 95 per cent cure in the initial stages.

My thanks are due to Prof. U. Nobindro for kindly examining the blood and giving me the results.

CYSTICERCUS CELLULOSAE THEIR INCIDENCE IN CANINES*

BY

D. KRISHNAMURTY, B.V.Sc.,
Madras Veterinary College.

Among the different animals that have been mentioned as the intermediate hosts of *Tænia Solium* Linnaeus (1758), only the pig and the dog can be definitely regarded as the intermediate hosts of this parasite (Monnig 1947). While *Cysticercus cellulosæ* are encountered commonly in pigs, their incidence in canines has not been frequently recorded. In India, only a few records of the occurrence of these cysts in canines are available, in spite of the fact that these animals have an easy access to human excreta, particularly in the rural areas. The cystic stage of this tape worm in dogs was recorded in Madras Province by Ayyar (1929) in four autopsies, and later a reference was made to them by Rao (1934.) The cysticerci in these cases were found in various organs including, in one case, even the brain.

In an attempt to study the incidence of these cysts, an analysis was made of 500 canine autopsies conducted at the Madras Veterinary College Hospital during the past five years. It was found that only 7 animals had *Cysticercus cellulosæ* in them. The following detailed description of those cases would be found interesting.

*Read at the Annual Veterinary Conference of the Madras Veterinary Assistant Surgeons' Service Association held on 25-12-48. The specimens collected from the cases referred to in this paper were exhibited to the members at the conference.)

1. A brown Terrier dog was admitted on 24-2-1945, in the evening, with the history that it had bitten two persons that day. According to the owner, the dog had not shown any signs of cerebral disturbances previously and was in apparent good health. The case was admitted and kept under observation for Rabies. The animal developed typical clinical symptoms of Rabies and died on 26-2-1945. On autopsy, the outer surface of the brain was found beset with a number of cysts; on section of the brain, several more noted in the substance of the cerebrum, pons and medulla. No cysts were present in any other part of the body. The cysts were identified as *Cysticercus cellulosæ*. The smears and sections from the brain were then examined for Rabies with positive results and this was confirmed by the Pasteur Institute, Coonoor.

2. A black Cocker-spaniel bitch was admitted in the hospital on 12-7-1945 with the history that it was not taking its feed for the previous two days, but was drinking water in plenty and licking mud. It did not respond to the owner and was having a staring and anxious look, with paralysis of the lower jaw. The tongue was hanging out and black in colour. The case was kept under observation for Rabies. It died on 14-7-1945 after showing clinical symptoms of the disease. On autopsy, several cysticerci were found on, and in the substance of the cerebrum and cerebellum. Except for two such cysts in the peri-renal fat on the left side, none were noticed in any other part of the carcass. The smears taken from the hippocampus of the brain revealed negri bodies and this was confirmed by the Pasteur Institute, Coonoor.

3. A black Terrier dog, in good condition, was admitted on 5th July 1944 with a high temperature. Later, the animal developed albuminuria and non-parasitic eczematous patches on the back and was treated for chronic nephritis. The temperature was intermittent, the eczema and albuminuria were persistent and the animal was going down in condition in spite of good nourishment. At the request of the owner, the animal was destroyed on 5-9-1944 and an autopsy was conducted. Several *Cysticercus cellulosæ* were noted in the musculature of the limbs, back, loins, sub-lumbar, abdominal and thoracic regions. The myocardium showed several of these cysts and two such cysts were noticed in the cerebrum. No negri bodies could be detected in the brain smears.

4. A brown Terrier dog about eighteen months old was admitted into the hospital on the morning of 11-6-1948, with the history that it was not able to see or hear well, and was also not able to walk straight. The animal was otherwise in apparent good health. It died the same afternoon. On autopsy, five cysticerci were found in the myocardium of the left ventricle and a heavy infestation of these cysts were noted both on the surface, and in the different parts, of the brain and the commencement of the spinal cord. The brain smears were negative for negri bodies.

5. An Alsatian bitch was admitted in the hospital on 7-12-1948 with the history that the animal was having diarrhoea for the previous four days. It was in poor condition and died the same night. An autopsy was conducted and four small *Cysticercus cellulosæ* were detected in the myocardium of the left ventricle. A few cysticerci were present in the substance of the brain tissue and the musculature of the cervical region. The intercostal spaces showed several of these cysts. Impression smears from the brain were negative for Rabies.

* 6. Another Alsatian slut, aged about four years, was admitted on 25-12-1948 with the history that the animal littered about six months previously and was gradually getting thin since then. Intermittent fits commenced about a month back and these increased in frequency. On 26-12-1948, the animal was walking with a staggering gait, was circling on the left side and was falling down on a side. Although there was a temporary alleviation of symptoms during the next few days, the animal had a violent fit on 2-1-49, knocked against the kennel-wall and died at 10 A.M.

On autopsy, two cysts, each about the size of a small play-marble, were detected in the cerebrum — one, in the left lateral ventricle and the other in the substance of the brain at the posterior aspect of the right hemisphere. The ventricle was distended with about 100 c. c. of clear cerebro-spinal fluid. The cysts were identified as *Cysticercus cellulosæ*. Impression smears from the hippocampus of the brain were negative for negri bodies. No cysticerci were detected in any other part of the body.

* 7. A Dachsund bitch about two years old was admitted on 15-2-1949 with the history that the animal was not doing well since the previous day, showing weakness of the loins, and was having a staring look. The animal died on 17-2-1949. On autopsy, a single cyst identified as *C. cellulosæ* was noticed in the right lateral ventricle blocking the passage of the cerebro-spinal fluid. The ventricle itself was distended with cerebro-spinal fluid. Impression smears from the brain did not reveal any negri bodies.

Discussion

It would be seen from these seven cases that the cysticerci were detected only during necropsy and that no typical clinical symptoms, characteristic of their infestation, could be noted during life, in spite of the presence of even numerous cysticerci in the brain of four of them. In all the seven cases cysticerci were detected in the brain, but only five animals showed symptoms of cerebral aberration. In two of these five cases, there was the co-existence of Rabies to account for the nervous symptoms, while in the other three, there were no such compli-

*[These two cases were recorded since the presentation of the paper at the conference]

cation and therefore the cysts were, in all probability, responsible for the syndromes exhibited. Although Monnig (1947) states that 'dogs with cysts in the brain may show symptoms resembling those of Rabies' [and this was evident in the one case recorded by Ayyar (1929)], yet it would appear from the cases detailed above that these clinical manifestations were not a constant feature of their infestation, and that a careful differential diagnosis for Rabies should be attempted. All the seven cases cited above were well-bred dogs, carefully looked after and nourished, as they belonged to rich owners in the City of Madras, and as such, they may have had very little opportunity of ingesting human excreta. Judging from the dietary habits of canines in India, particularly those in rural areas, where the chances of contamination of their feed with human excreta are not remote, the incidence of *C. cellulose* ought to be greater than has been recorded so far and they should be carefully searched for while conducting autopsies on canines. A systematic autopsy of canine carcasses by the field staff is likely to throw considerable light on the different aspects of this disease as well as on other conditions which are so far described as of rare occurrence.

Summary

In this paper seven cases of cysticercosis in canines due to infestation of *cysticercus cellulosae* have been described. All of them showed the cysticerci in the brain while in four of them, the cysts were noted in the myocardium and skeletal musculature. Two of these cases showed clinical symptoms of Rabies and succumbed to it while there were numerous cysticerci in the brain. These findings suggest the necessity for evolving methods for conducting differential clinical diagnosis of this disease from Rabies.

Acknowledgments

I am deeply indebted to Sri. S. V. Mudaliar, Principal, Madras Veterinary College, for permitting me to record these cases. I also wish to acknowledge to Mr. V. S. Alwar, Assistant Lecturer in Parasitology, for helping me to identify the cysts and to the colleagues of my department for their co-operation.

REFERENCES

1. Monnig, H. O. (1947). *Veterinary Helminthology and Entomology*. Bailliere, Tindall & Cox, London, P. 115-116.
2. Ayyar, V. K. (1929). *Scientific papers of the Civil Veterinary Department, Madras (1929)*.
3. Rao, M. A. (1934). *Indian J. Vet. Sci, Anim, Husb*, Vol. V, P. 28, 1935.

IRGAFEN—A NEW SULPHONAMIDE FOR VETERINARY PRACTICE*

BY

CAPT. G. A. SASTRY, B.V.Sc.,
Veterinary College, Madras

IRGAFEN, N—3, 4-DIMETHYLBENZOYLSULPHANILAMIDE, is a white tasteless powder with a melting point of 222°C. It is slightly soluble in water. Its sodium salt dissolves in water to the extent of 6%. The solution of 5g sodium salt in 100 c.c. of water has a pH. of about 8.6.

Irgafen was tried by me in various affections of our animals wherever Sulphanilamide therapy was indicated and I have come to the conclusion that it is a very useful and reliable sulpha drug. Though I have had no sufficient opportunities to compare its advantages and efficiency over other sulpha drugs, as is claimed by the manufacturers, I can yet say that it is at least as efficacious as Sulphathiazole.

I tried this drug in bacterial gastro-enteritis of 6 dogs and a cat, in pyrexia of bacterial origin in 6 dogs, pneumonia in a couple of calves, in the febrile stage of distemper of 2 dogs and in a septic compound fracture of a dog. Due to nonavailability of a standard dosage for this drug in animals, the dosage adopted by me was that similar to Sulphathiazole—viz. 1 grain per 1 lb. body weight, though it is stated for men that "as a rule the total dose of Irgafen required for a course of treatment is about 50% smaller than of other sulpha drugs". In the pyrexial stage of an acute case of distemper, I gave an initial intravenous injection of 5cc of 5% Irgafen solution and maintained the concentration of the drug by oral administration. The high temperature of 104°F came down to 101°F the very next day.

As every one of you is quite conversant with the progress of the various diseases under sulpha drugs, I do not propose to dilate on that aspect. The aim of this article is only to introduce this new drug which has been found to be better than other varieties in medical practice.

The advantages claimed for this drug over other sulpha drugs are :—
(1) that "Irgafen is very readily absorbed by the intestinal tract but is excreted at a much slower rate. Therefore high concentrations in the blood are obtained rapidly and are maintained for considerable time. The blood level after the administration of Irgafen is twice as high as after Sulphathiazole and lasts much longer.

*Paper read at the Provincial Veterinary Conference held at Madras under the auspices of the Madras Veterinary Association in September 1948.

"Our clinical tests show as their most characteristic feature a high concentration in the blood which is maintained far longer than usual and permits in the majority of Coccal infections treatment with lower dosages and therefore a smaller quantity of this preparation than other sulphonamides is sufficient for the treatment"

(2) that the concentration in blood can be maintained at the desired height by small doses of Irgafen given at long intervals.

(3) that "the excretion of Irgafen is very slow but reaches a high percentage, upto 95% of the ingested dose being excreted by the kidneys. A very low percentage of Irgafen only is converted into the acetylated form. This is of great importance with the regard to the activity of the drug, as well as to the possibility of formation of crystals in the urinary tract". Due to the favourable solubility of Irgafen in its free and acetylated form in the urine, the fear of the formation of urinary crystals need not arise.

(4) that "Irgafen is less toxic than Sulphathiazole and Sulphadiazine" The toxicity of its sodium salt is about the same as that of other sulphanilamide compounds.

(5) that "the action of Irgafen against penumococci is specific and superior to that of Sulphathiazole and Sulphapyridine and against streptococci and B. coli, it is at least as potent as the best sulphanamides actually in use"

"Experimentally we found it highly efficacious against pneumococci; it had a good action on Streptococci and B. coli and lastly, prophylactic action against pneumococci after administration of single doses. This is due to the maintenance of the concentration in the blood for a sufficiently long period"

And lastly (6) that where other sulpha drugs failed Irgafen yielded good results.

Conclusion

I request the fellow practitioners in the field to give a fair trial to this useful drug and record their observations. I am grateful to Sri S. V. Mudaliar, Principal, Veterinary College, Madras, for facilities afforded to try this drug in the College hospital, to Mr. Berte D' Souza, Lecturer in Medicine, for his enthusiastic encouragement and guidance in these trials and to Sri M. S. Ganapathi of the Department of Medicine for his keen interest in this drug. I am thankful to Messrs. Raka Corporation Ltd. for their supply of this drug.

REFERENCES

1. J. R. Geigy. S. A.
2. Otto Gsell

Irgafen
Journal Suisse De Medicine (Translation)

Association News

THE BOMBAY VETERINARY MEDICAL ASSOCIATION

The 27th Annual General Conference of the Bombay Veterinary Medical Association will be held on the 14th and 15th April 1949 at the Bombay Veterinary College, Parel, Bombay. Hon'ble Dr. M. D. D. Gilder, B.A., M.D., F.R.C.S., Minister for Health and Public Works, Government of Bombay, has kindly consented to inaugurate the conference.

Dr. L. Sahai, M.Sc., M.R.C.V.S., Director of Animal Husbandry and Veterinary Science, Bombay Province, has kindly consented to preside over the deliberations.

Members are requested to contribute papers and forward them to the Honorary Secretaries, Bombay Veterinary Medical Association, Bombay Veterinary College, Parel, Bombay, before the 7th April 1949.

S. G. KSHIRSAGAR,
M. R. REEKAR,
Hon. Secretaries.

D. S. LAUD,
President.

College News

EXAMINATION RESULTS

MADRAS VETERINARY COLLEGE

The following candidates have passed the Final Diploma (G.M.V.C.) Examination of the Madras Veterinary College, held in March 1949:—

- | | |
|----------------------------|-----------------------------|
| 1. Gursaran Lal | 19. Sivasiddalingiah, T. G. |
| 2. Bhaskaran, R. | 20. Krishnan, K. S. |
| 3. Srinivasa Rao, N. | 21. Rajamani, S. |
| 4. Venkatasubba Rao, K. | 22. Subbarao, P. V. |
| 5. Krishnamurti, S. | 23. Mahmood Ahmed. |
| 6. Krishnamurti, U. S. | 24. Rajendran, E. I. |
| 7. Sivasubramanian, M. S. | 25. Prakasa Rao, T. V. S. |
| 8. Madhavakrishna Reddi, A | 26. Sibakumar Misra. |
| 9. Ramamurti, J. | 27. Siddappa, T. N. |
| 10. Vittal Malli, K. | 28. Kesavan, V. P. |
| 11. Kulanand Purohit | 29. Krishnamurti, P. S. |
| 12. Krishna, V. S. | 30. Subba Rao, V. V. |
| 13. Gopinath Nayar, P. | 31. Rama Rao, W. |
| 14. Subba Rao, T. | 32. Suryanarayana, V. |
| 15. Ramana Rao, N. V. | 33. Sankaran, K. |

- | | |
|-------------------------|-------------------------------|
| 16. Veeradimmiah, D. K. | 34. Natarajan, M. |
| 17. Anjaneyalu, V. | 35. Lakshmikantha Rao, K. |
| 18. Ramachandran, A. S. | 36. Venkatasubramanian, T. K. |

Vepery, Madras }
 Dated 26th March, 1949 } S. V. MUDALIAR, G.M.V.C.,
Principal.

BENGAL VETERINARY COLLEGE

List of students who have passed the Diploma Examination (G.V.Sc.) of the Bengal Veterinary College for the session 1948-49.

(Arrange in order of merits)

- | | |
|------------------------------------|----------------------------------|
| 1. Chhaganlal Morarbbhai Pancholi | 16. Shyama Pada Chakraborty |
| 2. Rabindra Narayan Deb | 17. Kali Kumar Mukherjee |
| 3. Ajit Kumar Chowdhury | 18. (a) Saroje Kumar Mukherji |
| 4. Sudhir Chandra Roy | (b) Monotosh Kumar Bhattacharjee |
| 5. Velupillai Suppiah Thambianayah | 19. Suryya Kanta Saha |
| 6. Bhuma Ranjan Mukherjee | 20. V. Rama Row |
| 7. Sandipan Chandra | Pradyot Kumar Karmakar } |
| 8. Digbijoy Lahiri | 21. Amal Krishna Banik |
| 9. Amita Kumar Putatunda | 22. Satya Ranjan Biswas |
| 10. Goura Hari Das | 23. Satya Nanda Banerjee |
| 11. Santi Moy Basu | 24. Upendra Nath Chakraborty |
| 12. Ahmad Nabi Kazmi | 25. Hirendra Nath Ghose |
| 13. Rajendra Mohan Ghose | 26. Bhupesh Chandra Das |
| 14. Bijoy Kumar Mukherjee, | 27. Amal Ranjan Gupta |
| 15. Mullick Mohammed Ahmad Khan | 28. Manindra Nath Roy |

Calcutta }
 Dated 4-4-1949. } K. C. MUKERJEE.
Vice-Principal-in-charge.

News

NEW TRYPANOCIDE DISCOVERED

Although it is as yet too early to be able to decide the full technical potentialities of 'Antrycide', the new trypanocide, whose discovery, by Imperial Chemical Industries was announced recently in England, nevertheless the preliminary data available shows beyond all doubt that the drug marks a new departure in the veterinarians' long struggle against the trypanosome.

Ever since Griffith Evans discovered the first trypanosome in India in 1880, biologists, chemists and veterinarians have joined hands in an attempt to find a complete answer to the cure of trypanosomiasis and the protection of susceptible animals against the heavy losses caused by the disease.

The fact that the preliminary research on 'Antrycide' was carried out in England and the initial field trials conducted in East Africa and the Sudan will not blind veterinarians to the important applications that 'Antrycide' will have throughout the Indian sub-continent. 'Over four years' intensive research by an I.C.I. team of workers was needed before this new heterocyclic chemical compound was isolated in sufficient purity to warrant extensive field trials throughout the endemic areas of Africa. This research team was headed by Doctors Davey and Curd, who were awarded the 1948 Gold Medal of the Society of Apothecaries for the discovery of 'Paludrine'. Dr. Curd's death, at the age of 39, as a result of a train accident last November, is a great loss to science in general and to veterinary protozoology in particular.

Trials in East Africa and the Sudan have proved that possibly a single treatment of 'Antrycide' will cure cattle of infection by *T. congolense* and *T. vivax*, the two worst forms of the disease found in Africa and which is spread by the *Tsetse fly* (*Glossina sp.*) It has also been shown to be successful against infection with *T. brucei* in cattle, horses and dogs), against *T. evansi* (in camels) and *T. simice* (in pigs).

Experiments, still proceeding, have already shown that 'Antrycide' may also be used to immunise cattle against various forms of the disease. It secures protection against *T. congolense* for six months, in the majority of cases. Certain cases in which the disease recurs after four months are now being studied but there are indications to show that they may be expected to respond to a second treatment.

Cattle protected against *T. vivax* have in most cases remained immune for four to five months. Preliminary reports indicate that protection against *T. evansi* does not offer any difficulty though fuller details are awaited.

It is realised to be of the utmost importance that the period of immunity shall be precisely determined so that protection throughout the whole Surra season shall be adequate.

The fact that 'Antrycide' has no toxic effects is a very big advance on all trypanocides so far available in which the toxic margin has always been very narrow. No undesirable effects, either local or general, are produced in the animal under treatment, and indeed, the administration of the drug is so simple and safe that the livestock owner is able to give the drug after simple instruction from a veterinarian.

Research and Development:—An interesting story lies behind the development of 'Antrycide'. The first stage in its evolution was the discovery of a great number of entirely new synthetic chemical compounds of a type likely to be effective against the trypanosomes. Tests on mice produced many failures until one was discovered which had a slight effect on the disease. This was named M. 7555. Chemical steps were then devised to isolate the active ingredient and to purify it into a more potent form.

Having achieved success in the laboratories, the I. C. I. team were then faced with the difficulties of field trials under tropical conditions. Trypanosomiasis does not exist in Britain and the risk of introducing it for experimental purposes even under the strictest precautions was one that could not be faced by I. C. I. or the Government.

Accordingly the entire laboratory equipment and personnel were transported to endemic areas of Africa and the Sudan where the Colonial Veterinary Service placed all their facilities and co-operation at the disposal of the visiting team. The Tsetse-fly and Trypanosomiasis Committee of the Colonial Office afforded willing help and laboratories were established in Khartoum, Nairobi and Entebbe in Uganda. The team had to face more than the normal scientific difficulties when working in the worst disease areas. The practical problem of rounding up of cattle was complicated by the constant need to protect them against wild beasts. On one occasion in Kenya some of the Masai people—famed lion hunters—were hired to keep cattle from being devoured before the completion of the experiment, which were interrupted, on another occasion, by a charging rhinoceros.

Further difficulties were encountered when test cattle succumbed to other diseases such as foot-and-mouth, rinderpest and East Coast fever. Large and voracious ants devoured the mice used in the laboratories, but despite all these difficulties and disappointments the work continued until the earlier promise of the new drug was fully confirmed. 'Antrycide' was shown to have curative action for all forms of trypanosomiasis encountered, not only in cattle but also in horses, camels and other animals.

Although 'Antrycide' has not yet been tested against human sleeping-sickness, this application is no doubt well borne in mind by those interested, but this disease is of less significance today when drugs are available to combat it and methods of diagnosis have greatly improved.

Samples of the new drug will at first be limited. Its use in the initial studies, will be confined to Government Veterinary departments, particularly in Kenya, Uganda and the Sudan where urgent need exists and where experts are already familiar with the new technique. We

hope that supplies may soon be made available to us to enable field trials against *T. evansi* infection in all its forms to be conducted in animals in India.

18, Strand Road,
Calcutta 1,
January 18, 1949.

IMPERIAL CHEMICAL
INDUSTRIES (INDIA) LTD.

Correspondence

ANNUAL ALL-COORG CATTLE SHOW

(From our Correspondent)

The All-Coorg Cattle show was held this year at Ammatti on the 23rd February 1949 in the school play ground. There were more than 450 head of cattle. All classes were represented. The response in sending animals from all divisions, except Fraserpet, was encouraging.

Sardar Bahadur Sir Datar Singh, Vice-Chairman, Indian Council of Agricultural Research, who kindly responded to the invitation presided and distributed the prizes. He arrived along with Dr. Zal R. Kothawalla, Dairy Development Advisor to the Government of India, and Mr. Sundaram Iyer, Agricultural Officer, Madras, when the show was in full swing, and went round the show and the exhibition stalls making detailed enquiries. At the assembly thereafter at 4 p.m. he was welcomed by the President Dewan Bahadur C.T. Mudaliar, B.A., the Chief Commissioner of Coorg. After distribution of prizes, the Vice-Chairman of the Indian Council of Agricultural Research in his concluding remarks spoke about the importance of an adequate milk supply and expressed his great appreciation for having got up the show successfully. He congratulated the Chief Commissioner and Veterinary Officers and said that on behalf of the Central Government, he would be extending all possible help. He wished all success and hoped that the show would grow from strength to strength.

As an adjunct to the show, the authorities of the Dairy, Veterinary, Agricultural and the Health Department had kindly put up very instructive exhibition stalls. It would have been better if the Veterinary Department had made arrangements to put up exhibits connected with artificial insemination. The Fodder Officer could have taken the opportunity to conduct propaganda on the preparation of silage.

The response from the local Government and the Public to an appeal for subscriptions and donations for the award of prizes was also encouraging. With similar response from the Centre, it is hoped that a better show could be put up next year.

SEWAGE FOR INCREASING MILK PRODUCTION

Strictly speaking there is nothing in the universe that can be ultimately classified as waste. Everthing under the sun can be made useful to man in some way or other, if only one knows how to utilise them scientifically and economically. On close observation, one can find that even the essential necessities of life can be produced from wastage and refuse.

The Premier of Madras, speaking at the recent Municipal Chairmen's Conference, rightly pointed out that an organised sewage and refusal disposal system will help the growth of more fodder, the raising of better cattle and crops, better milk-supply and eventually better citizens. This valuable suggestion of the Premier was very timely and will, it is earnestly hoped, open the eyes of the authorities concerned.

My intention in this small article is to show how the Madura Municipality is successfully utilising the sewage for the growing of fodder for cattle which, in turn, has helped in increasing Milk production.

The Madura Municipal Sewage Farm is located in the village of Avaniapuram four miles from Madura City. It is an extensive area comprising of about 153 acres, of which 113 acres have been provided with under-ground drainage, comprising a series of long earthen ware pipes, one foot long and three inches in diameter, laid at a depth of 2—4 feet below ground level. This is more or less a sort of filter bed. The lands are divided into longitudinal plots of 66 feet in width. The sewage of the town is collected through underground sewers and pumped to the farm from the main pumping station, to which a major part of the City sewage is directly connected, and from five sub-stations. About two million gallons of sewage are received at the Farm now through a 24 inch cast-iron pumping main. At the farm, the sewage is flooded on the surface in convenient sized beds (each bed measuring 12-1/2 cents to a depth of 2-4 inches. The sewage percolates through and the effluent is collected through the sub soil pipes and allowed to flow outside the farm limits for the use of paddy fields.

This farm has been in existence for over 20 years and is considered as one of the biggest in South India at present. Guines-grass is grown on 90 out of 113 acres under irrigation and, on an average, 9-10 thousand tons of green grass are produced yielding a revenue of nearly a lakh and ten thousand rupees per year. Twenty-five tons of grass are being cut every day and distributed to the whole city by bullock carts to feeding milch cattle, and they are sold at the rate of annas two per bundle of ten pounds. Nearly thousand animals can be fed every day even if each animal is given only a bundle. Thus by this method of disposal of sewage and grass cultivation, two things are achieved simultaneously—one wealth, and the other health for men and animals.

The main advantages of this method are :—

1. Effective disposal of sewage and consequent improvement of the sanitary condition of the town.
2. Addition of a substantial revenue to the Municipality by making wealth out of waste.
3. Supply of fresh green grass to cattle which are so badly in need of it throughout the year for increased production of milk.

Independence of our country has thrown additional responsibilities and difficulties on the shoulders of our revered leaders who have already taken up various schemes of far reaching importance with a view to solving the various wants of our people. As regards milk production, the latest one taken by the central Government is a five year plan for the development of dairy industry. The main aim of this is to increase the over-all output of milk production by 758000 maunds of milk so that we may be able to add atleast a pound of milk in our daily diet to meet the nutritional requirements. If this scheme is to be speedily and systematically worked out all over India—particularly in South India—cultivation of grasses like guinea grass should be undertaken in all Municipalities as is done in Madura. Then the day will not be far off when our country will be able to produce plenty of clean milk for the use of our poor citizens.

It is therefore one of my suggestions that all the Municipal authorities should follow the good example of Madura Municipality.

I cannot close this small article without expressing my sincere gratitude to the Superintendent of the Farm Mr. Kandasami, B.Sc. (Ag.), F.R.H.S., who has taken all the trouble to take me round the Farm and explaining everything in detail.

Madura, }
3-11-48, }

M. V. PILLAI, G.B.V.C.

Extract

USE OF CITY SEWAGE FOR CULTIVATION

EXPERIMENT TO BE MADE NEAR VANDALUR

A scheme for the maximum utilisation of the Madras City sewage as manure for large tracts of cultivable land now lying waste near the city was discussed at a Compost and Cattle Salvage Conference held here on March 29. Sardar Datar Singh, Vice-President of the Indian Council of Agriculture, presided over the Conference which was attended by Mr. K. Madhava Menon, Minister

for Agriculture, Madras Province, and a number of top-ranking officials the Agriculture, Development and other Departments of the Government of Madras and of the City Corporation.

Commending a plan suggested by the Central Government's Compost Development Officer, Dr. C. N. Acharya, to bring an area of 2,000 acres adjacent to the City under sewage cultivation, the President said; "Madras City is producing about 27 million gallons of sewage per day, which at present is let into the sea, which means the waste of not merely so much water which could be utilised for purposes of irrigation, but also nearly 2000 tons of nitrogen contained in the sewage, equivalent to 10,000 tons of ammonium sulphate, valued at Rs. 30,00,000 per year. There is plenty of suitable land available in Madras, out of which about 10,000 acres could be brought under sewage irrigation and made to yield an extra 5,000 tons of foodgrains."

It was agreed at the Conference that a fresh scheme on the subject might be prepared after examining the possibilities of sewage irrigation in an area near Vandalur to the west of Madras City. It was also proposed that the possibilities of growing fodder under sewage irrigation might be examined and that the problem of salvage of dry cattle and dairy colony be taken up as part of this more comprehensive scheme. The successful manner in which sewage irrigation has been established in Madura was referred to in this connection.

Legislation was proposed at the Conference to enable Government to oblige the Municipalities to convert their refuse into compost manure. The Conference also supported the action contemplated by the Government of Madras to appoint a Provincial Biochemist in general charge of the compost schemes. As against the present production of compost in the province, which is nearly 1,00,000 tons per year, it was decided to raise the target to 2,00,000 tons during 1949-50, as recommended by the Central Manure (Compost) Development Committee at its second meeting held at Jaipur in December last. It was revealed at the Conference that, in this province which had more than 1,000 towns with populations of 5,000 and above, it would be possible to prepare about 10 lakhs tons of compost manure per year which would increase food production by 10 to 15 lakh maunds per year.

On the subject of the village compost scheme a note submitted by the Compost Development Officer estimates that in the year 1948-49 the scheme has been tried in 4,000 village in the Province with a total production of 44,000 tons of manure.

"There are in all 34825 villages in the province," continues the Note, "and it is necessary that a proper scheme should be worked out which would ensure the collection and utilisation of the whole of the waste material available on the farms and villages. The 34825 villages contain about 370 lakhs of human beings, 225 lakhs of cattle (cows, bullocks and buffaloes) and by proper

utilisation of the waste material available in the above population, it should be possible to prepare nearly 500 lakhs tons of manure per year in the villages."

It was stated at the Conference that a Special Agricultural Officer had been deputed to visit all the Municipalities in this Province in connection with the Compost Development Scheme and submit a full report to the Governments.

"The Hindu", 1-4-49.

Review

PREGNANCY DIAGNOSIS TESTS: A REVIEW. By A. T. COWIE, B.SC., M.R.C.V.S., Ph.D. Joint Publication No. 13 of the Commonwealth Agricultural Bureaux, Great Britain. 1948. Price 15s.

During the last few years, quite a volume of literature has grown on the various tests employed in the detection of early pregnancy in animals, and the clinician as well as the Research worker has been hard put to it in getting at the latest and reliable methods for his information and guidance. Consequently there has not been a correct appreciation of these tests and the Laboratory worker and the clinician were going in their own way, each relying on his own methods. This has been unsatisfactory as, in the early stages of pregnancy, neither the clinical methods nor the laboratory methods could be said to be infallible. A combination of the methods is the most desirable approach and we therefore, welcome this publication of the Commonwealth Agricultural Bureaux. This handy volume contains a review of the various tests employed in the detection of early pregnancy not only in animals but also in women, although the clinical methods of the latter are omitted. The tests have been classified "according to their basis puhormonal, enzymic, other bio-chemical, immunological and physiological phenomena", with an assessment of their 'accuracy under different conditions and for different species'.

We are sure that this review would be a great value to the members of the Veterinary profession engaged in general practice or in research work.

'PHENOVIS'

brand

PHENOTHIAZINE

Originally prepared in Great Britain in the research laboratories of I.C.I., 'Phenovis' is now established as the best anthelmintic for sheep, goats, cattle and horses. It is most conveniently given as a drench, made by mixing 'Phenovis' dispersible powder with water, or the powder may be mixed in the food. This last method is most convenient for dosing horses.

PACKINGS

Cartons of 30 grammes — Tins of 1 lb. and 7 lb.

'Phenovis' literature and further information are available on request.



**IMPERIAL CHEMICAL
INDUSTRIES (INDIA) LTD.**

Calcutta Bombay Madras Cochin New Delhi Kanpur

Represented in Pakistan, Burma and Ceylon by
IMPERIAL CHEMICAL INDUSTRIES (Export) LTD.
Karachi Rangoon Colombo

VET. 3

When writing to advertisers, please mention this Journal.



T.C.F. VITAMIN B-COMPLEX FOR INJECTION

The early administration of high doses of T.C.F. Vitamin B-Complex in distemper prevents complications particularly the nervous form, and the whole course of the disease is favourably influenced.

T.C.F. KUBISMIDE

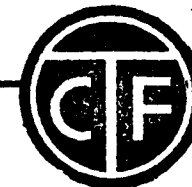
KURCHI BISMUTH IODIDE

For therapy of intestinal disorders, to be given in half tablets or less according to body weight, in a bolus.

T.C.F. BISMUDERM

A dry dusting powder, for skin affections and wound treatment.

Also suitable for polo ponies.



TEDDINGTON CHEMICAL FACTORY LTD., BOMBAY

Sole Distributors:

W. T. SURÉN & CO., LTD., P. O. BOX 229, BOMBAY, 1.

Branches:

CALCUTTA: P. O. BOX 672

MADRAS: P. O. BOX 1286

S. C. 23

When writing to advertisers, please mention this Journal.

We Manufacture all kinds of Veterinary and Surgical Instruments in Stainless Steel Chromium and Nickel Plated and import all sundries along with Roux Syringes, Needles and Veterinary Thermometers, Etc.

Please consult us before ordering elsewhere
We invite your Enquiries for Everything in the Line.



The Sunbeam Surgical Company,

MANUFACTURERS OF MODERN HOSPITAL EQUIPMENTS
AND SPECIALISTS IN VETERINARY, ANIMAL HUSBANDRY
AND LABORATORY SUPPLIES.

2, RAJAMMAL STREET,
(Opposite :—Hindi Prachar Sabha)
T. Nagar, Madras 17.

Grams : SCALPAL

Reliable Veterinary Products

For Passive Immunisation

TETANUS ANTITOXIC SERUM

2000 and 6000 I. U.

For Active Immunisation

TETANUS ANATOXIN

in 25 c.c. and 50 c.c. phials

For Active Leucocytosis

NUCLEIN

10% Solution of Nucleinic Acid in 5 c.c. Ampoules

BENGAL CHEMICAL

CALCUTTA

::

::

BOMBAY

When writing to advertisers, please mention this Journal.



DR. PANGAL'S
VETERINARY INSTITUTE

26, WALLAJAH ROAD
MOUNT ROAD,
MADRAS, 2.

A Few of Dr. Pangal's specialities to all
Lovers of Horses, Cattle and Dogs.

1. "Race Horse Brand" Equitone. A valuable Blood Tonic and conditioner for Race Horses, Polo Ponies, Hunters, etc. Quite indispensable to keep the horses in hard work always fit.
Price per 2 lb. tin Rs. 5.
2. "Tendon Lotion" For Inflamed and Sprained Tendons, Ligaments and joints in Horses.
Price per lb. bottle Rs. 2.
3. "Electric Mange Cure" An excellent remedy for all kinds of Mange and is a specific for Follicular Mange. Acts like magic.
Price per bottle Rs. 2.
4. "Scented Pulvex". Tick specific. A wonderful Tick destroyer.
Price per tin Rs. 1-4
5. "Canatone" Vitamin Mineral Food for dogs.
Price per 1½ lb. tin Rs. 1-8.
6. "Cough Electuary". A Specific for Cough and Catarrh in Horses.
Price per lb. Rs. 8.
7. "Bovotone". Best Tonic Powder for cattle containing Minerals and Vitamins.
Price per 2 lb. tin Rs. 2.
8. "Mange Dressing" A specific for all kinds of Mange.
Price per big bottle Rs. 3. Small bottle Rs. 1-8.
9. "Dr. Pangal's Resolvin" Indicated in absorbing—without firing—Splints, Ring bones, Spavins, Enlarged Joints, Sprained Tendons and Ligaments; and cures Sore Shins, Capped Elbows and Hocks.
Price per 4 oz. bottle Rs. 8.
10. "Dhum Dhum". A specific for Dhum, i.e., heavy breathing so common in horses. Acts like magic.
Price per 2 lb. bottle Rs. 6. 1 lb. bottle Rs. 3.
11. Anodyne Paste for Horses.—Indicated in treating swollen joints, inflamed tendons and ligaments (Work not disturbed).
Price per 3 lb. tin Rs. 4.

For Other Specialities, Please Apply For Literature.

When writing to advertisers, please mention this Journal.

2

'M & B 693' BRAND
SULPHAPYRIDINE

‘THIAZAMIDE’
TRADE MARK BRAND
SULPHATHIAZOLE

‘THALAZOLE’ BRAND
PHTHALYLSULPHATHIAZOLE

'M & B 493' and 'Thiazamide'—highly potent compounds within the systemically active group of sulphonamide drugs—merit special consideration in the treatment of generalised bacterial infections, in which they have proved to be consistently effective.

• **Thalazole** has been accepted by the veterinary profession as the compound of choice in bacterial infections of the intestinal tract. Compared with other sulphonamides the amount absorbed is remarkably small, permitting maximum drug concentration at the site of infection.

Fully detailed literature on the complete range of sulphonamide drugs is available on application to our Veterinary Department.

Supplies— M & B 693 tablets available in containers of :
20 x 0.50 Gm., 250 x 0.50 Gm., 1000 x 0.50 Gm.
Powder available in containers of 25 and 500 Gm.

• **THIAZAMIDE** tablets available in containers of :
20 x 0.50 Gm., 50 x 0.50 Gm., 250 x 0.50 Gm.
Powder available in containers of 25 Gm.

• **THALAZOLE** tablets available in containers of :
50 x 0.50 Gm., 250 x 0.50 Gm.

MAY &  BAKER

BOMBAY · CALCUTTA · LUCKNOW · MADRAS · KARACHI · LAMORE · COLOMBO

Printed by T. Kanasbiran, at The Paramount Press, (Proprietors: Jays & Co.) High Road,
Triplicane and published by Dr. P. Srinivasa Rao, G.M.V.C., Editor, The Indian
Veterinary Journal, 26, Wallajah Road, Mount Road, Madras-2.

[illegible]

தமிழ்நாடு -ஆவணக்காப்பக நூலகம்,
எழும்பு, சென்னை-600 008.

புவனைத்தாள்.

செ. எண் :

ப. எண் :

வழங்கிய நாள். (1)	திரும்பிய நாள். (2)	வழங்கிய நாள். (1)	திரும்பிய நாள். (2)