

818

d. No. M. 6953

Vol. 35, No. 5

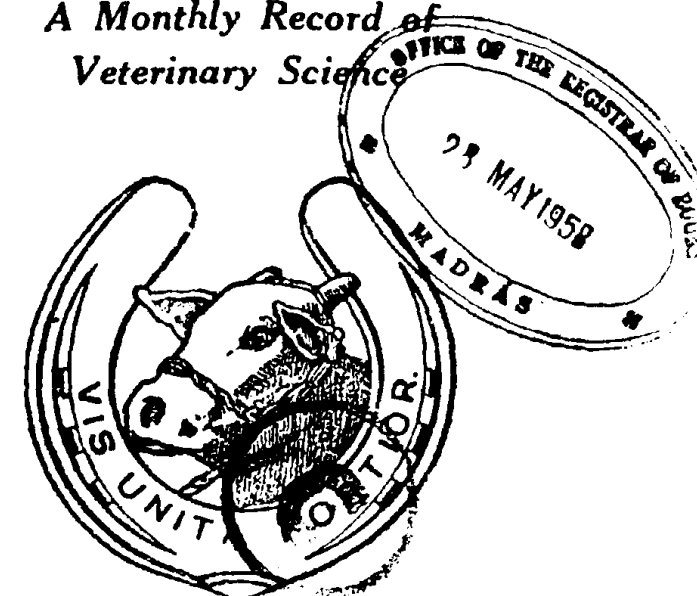
818

MAY, 1958

THE INDIAN VETERINARY JOURNAL

(The Journal of the All-India Veterinary Association)

*A Monthly Record of
Veterinary Science*



(ESTD. 1924)

OFFICE:

23, FIRST STREET,
VIDYODAYA EAST, T'NAGAR,
MADRAS-17, (S. INDIA)

JL

KZ m2, N24743

N58.35.5

79609

TO OUR CONTRIBUTORS

1. THE INDIAN VETERINARY JOURNAL is intended for the publication of papers on Original work, General and Clinical articles, Extracts, Reviews, Association News and other cognate matters pertaining to animal health and disease and the progress of Veterinary Science and the profession in general. The Editor, in his work of assessing papers received for publication, is assisted in an honorary capacity by a large number of Scientists working in various parts of India.
2. Papers are accepted for publication on the understanding that they have neither been published before nor are being considered for publication elsewhere.
3. Matter for publication should always be typed and sent in duplicate. The type-scripts should be on one side of the paper only with double spacing and one inch margin on the left side. They should be sent after careful revision and correction and without over-writings. Otherwise they are liable to be not considered.
4. Names of authors should be followed by their academic qualifications. Their official address or otherwise should also be stated to enable correspondents to communicate with them direct if they so desire.
5. The papers must be concise and not unnecessarily elaborate. To achieve this object extensive summaries of all available literature with numerous references should be avoided, wherever possible. *The bulk of the paper should record the actual work done by the author or authors.* If papers submitted are considered to be of excessive length, they may be returned to the authors for necessary reduction and re-submission. Papers are accepted subject to the right of minor editorial revision, if considered necessary. No reasons will be given in cases of non-acceptance of articles.
6. A copy of the page-proof will be sent to the author, only in cases where it is found necessary and it should be returned without delay, duly corrected. Extensive changes in the matter are not permissible at that stage.
7. Order for extra reprints should be placed at the time of the initial submission of the paper. Otherwise only the usual number of complimentary reprints viz. 10 will be sent to each author up to a maximum of thirty, irrespective of the number of authors over three.
8. Drawings and diagrams should be in Indian Ink on stout white drawing paper or on Bristol board.
9. A small number of blocks illustrating articles are normally paid for by the Journal; but the authors may however be required to pay the entire cost of blocks if they are far too many for a single article. Half-tone photographs should be included only when they are found essential and they should be on glossy paper, bringing out the differences clearly.
10. The number and size of tables, charts and plates should be strictly restricted as the cost of publication is mounting up every day. Coloured plates will not be reproduced, except under exceptional circumstances or when the author is willing to bear the entire cost.
11. Publication of group photographs of some news-value to the profession and of individuals will be undertaken only if space permits and the cost of blocks in such cases will be thankfully received from parties concerned.
12. Abbreviations and mode of references to Authors, years and journals should be on the model normally adopted in all international publications.

Note :—We request our Contributors to help us by observing the above rules, and they will then be facilitating early publication of their articles.

THE INDIAN VETERINARY JOURNAL

[THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION]

PUBLISHED MONTHLY

★

A Monthly Record of Veterinary Science
Devoted to the cause of the
Veterinary Profession

★

EDITOR

Rao Sahib T. VINAYAKA MUDALIAR, G.M.V.C.,

Office:—23, First Street, Vidyodaya East, T'Nagar,
Madras-17, (S. India)

✱

All communications should be addressed to the Editor.

Advertisements should be in the hands of the Editor on or before the 15th of the previous month.

Subscription payable in advance {	Rs. 8.00 per annum to Members of profession.
	Rs. 12.00 per annum to Government and all public institutions. Single copy Rs. 2.00.
	Foreign: 25sh. per annum. Single copy 3s. 6d.

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 close of that month.

ESMODIL

in

Digestive disturbances of domestic animals

"From the case records, it may be seen that Esmodil is effective in atonic conditions of the digestive tract, tympany and impaction. Injections of Esmodil stimulated peristalsis and tone of the gastric and intestinal musculature. There were no untoward results even in cases where the animal was in a very poor condition. No toxic symptoms were seen...."

—M. N. Dhandapani, *Ind. Vet. Jour.*, Jan., 1956, pp. 298-303.

Single s.c. injection usually effects a cure.

Bottles of 25 c.c.

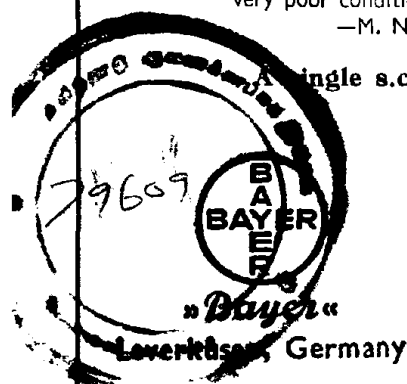
Sole Importers in India:

(Chowgule & Co., (Hind) Private Ltd.

P.O. Box 1478, Bombay-1.

BRANCHES:

P.O. Box 8943, Calcutta-13. P.O. Box 3738, Madras-2.



LATEST BOOKS RECEIVED ON VETERINARY SCIENCE AND ANIMAL HUSBANDRY

	Rs. nP.
LANDERS: Veterinary Toxicology	... 26-25
KAURA: Indian Breeds of Livestock	... 7-00
WINTERS: Animal Breeding	... 30-00
BLACK'S: Veterinary Dictionary 4th Edition Revised	... 26-25
MONNING: Veterinary Helminthology	... 30-00
ROBERTS: Veterinary Obstetrics & Genital Diseases	... 85-00
RICE & ANDREWS: Breeding & Improvement of Farm Animals	... 42-50
Handbook of Tropical Diseases in South Africa	... 125-00
Poultry Handbook (5 books in one)	... 24-30

Please send your orders without delay as the financial year is progressing fast



Ask for Complete List from Veterinary Book Department

BRITISH BOOK DEPOT

HAZRATGANJ, LUCKNOW (U.P.)

When writing to advertisers, please mention *The Indian Veterinary Journal*.

WHEN IGNORANCE WAS KNOWLEDGE AND SUPERSTITION GUIDED ACTION

The peasant had his own crude methods for diagnosis and treatment of farm animals.

The "Cow Doctor" too, then, was no better, and operated largely on hunches and never was sure of the results of his treatment.

Today their places have been taken over by progressive farmers and skilled Veterinarians. Behind the latter, in the fight against disease, stands the vast resources of modern research aided by industries exclusively devoted to Veterinary and Animal Husbandry professions.

In doing our part, to make your practice sure and scientific, we offer all that is best and latest in instruments, appliances and equipments for use in Veterinary Surgery, Obstetrics, Gynaecology, Artificial Insemination, Cattle Sterility and Poultry Husbandry.

Cirurgia De Lux Private Limited

Head Office:

24, CHOWRINGHEE ROAD,

CALCUTTA - 13.

(PHONE : 23 - 5552)

Branch Office:

Bombay Mutual Annexe Buildings,

4th Floor,

17, GUNBOW STREET,

FORT, BOMBAY - 1.

(PHONE : 263802)

Telegrams : "SURGIQUIP"

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

DERMO-QUINOL

(4% & 8% Iodochloro-oxyquinoline in a vanishing cream base)

for

- ★ SEBORRHOEIC DERMATITIS
- ★ IMPETIGO
- ★ IMPETIGINISED ECZEMA
- ★ ATHLETE'S FOOT
- ★ MONILIASIS
- ★ CHRONIC PARONYCHIA ETC.

For further particulars, please write to:

EAST INDIA PHARMACEUTICAL WORKS LTD.,
CALCUTTA - 26.

WANTED

By a leading British concern a qualified Veterinarian, preferably with field experience, for the post of a Veterinary Representative to work mainly in U. P. Knowledge of the local languages will be an important additional qualification.

Applications giving full details of qualifications, previous experience etc. to be sent immediately (at any rate to reach not later than 20th May 1958) to :—

Box No. 25

c/o THE INDIAN VETERINARY JOURNAL

MADRAS-17.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

The Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. 35

MAY, 1958

No. 5

CONTENTS

	PAGE
I. Editorial	
Bengal Lags Behind	... E-16
The Madras State Cattle Show	... E-18
The Reserve Fund	... E-19
II. General Articles	
The Anatomy of the Foetal Indian Elephant—Part VI. Viscera of Thorax, Abdomen and Pelvis.—By D. Mariappa	... 191
Studies in the Physiology of the Camel—(<i>Camelus dromedarius</i>) Part I. Cellular Blood Constituents.—By Balbir K. Soni and A. C. Aggarwala	... 209
Rinderpest and its control. Latest position with regard to vaccines employed.—By M. R. Dhanda and M. S. Menon	... 214
Haemonchosis in a camel.—By Dr. M. S. Purohit and K. R. Lodha	... 219
A case of Tuberculosis in a Giraffe (<i>Giraffa Camelopardalis</i>)—By B. Narsinga Rai and K. P. Chandrasekharan	... 221
Cerebrospinal Nematodiasis II. Transplantation of <i>S. Diplostata</i> into Experimental Hosts.—By D. A. Victor	... 224
Some Observations on the measurements of the female Genitalia of the Buffalo (<i>Bos. bubalis</i>)	... 227
Weaning of kids and lambs.—By T. M. Paul	... 230
III. Clinical Article	
Tetanus in a Mule.—By R. L. Gulati, O. P. Gautam and M. P. Sharma	... 234
IV. Abstracts	
Vaccination of cattle with B.C.G.	... 235
Human Infections with <i>vibrio foetus</i> and a closely related <i>vibrio</i>	... 236
V. News and Views	... 237
VI. Block Development Corner	
Grass Farming with sewage water in Madras.—By C. Rajasekhara Mudaliar	... 239
Farm News Releases	... 244
VII. Memoir	
T. Seshachalam Naidu	... 245
V. P. Nargunam Nadar	... 245
VIII. Announcements	
Degree of Master of Veterinary Science, Madras	... 245
Indian Dairy Yearbook	... 248
IX. Association News	
The All-India Veterinary Association.—The Reserve Fund—List of subscribers	... 249
The West Bengal Veterinary Association—Election of office-bearers for 1958	... 249
The Mysore Veterinary Medical Association	... 250
The Bihar Veterinary Association	... 250

ADVERTISEMENTS



**for the treatment of amphistome, paramphistome
and liver fluke infestation in cattle and sheep**

'Avlothane' brand of hexachloroethane dispersible powder is of the highest purity and is especially prepared for administration as a drench.

PACKINGS: Containers of 1 lb. and 7 lb.

Further information will be forwarded on request.

IMPERIAL CHEMICAL INDUSTRIES (INDIA) PRIVATE LTD.
Calcutta Bombay Madras New Delhi

Sole Distributors in India for

IMPERIAL CHEMICAL INDUSTRIES LIMITED, PHARMACEUTICALS DIVISION
WILMSLOW, CHESHIRE, ENGLAND

CV 52B

When writing to advertisers, please mention *The Indian Veterinary Journal*.

THE Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. 35

MAY, 1958

No. 5

Editorial

BENGAL LAGS BEHIND

In contemporary history nothing is brighter than the part played by Bengal in the 'Freedom struggle' of India. She has shown a genius for leadership, concerted action and fearlessness. Whether it be in the field of art, science, religion or industry, she led the way. Swami Vivekananda, Womesh Chandra Bannerjee, Surendranath Bannerjee, Rash Bihari Gosh, Rabindranath Tagore, Sir P. C. Ray, Sir Atul Mukerjee, Bepin Chandra Paul, C. R. Das etc. are all names to conjure with. They are household words even in the far off south. But it looks to us as if this pride of place is fast slipping out of her hands. True it is she has suffered grievously from political vivisection but that is no reason why she should lose heart and lose her sense of values in economic fields as well.

We confine ourselves to our own field of work—Animal Husbandry. It pains us to note that this work is still not in the hands of Veterinarians. We had written times without number that only Veterinarians are best suited for Animal Husbandry work in this land. We have quoted authorities like Dr. Norman Wright, Sir Thomas Dalling, *The Veterinary Record* of England etc. in support of this view. Almost all the States in India have found it necessary to place the Animal Husbandry work in the hands of Veterinarians. It is only Bengal that lags behind.

It is small wonder therefore that she figures so little in the matter of intensive development of her livestock. Dynamic planning and execution of work, in this field can come only through expert knowledge of what may be termed as the entire Animal Science. There is no good of making the Animal Husbandry work, a part-time job of an allied department. With hands too full with their own problems, the Animal Husbandry work assumes a secondary place in their hands and nothing can be more harmful to the development of Cattle Wealth of the land.

Here is what Dr. Norman Wright has stated in his report on the development of the Cattle and Dairy industries of India, in 1937.

"The Provincial Agricultural departments already have very wide field of Work." After enumerating several items of work expected of the Agricultural Officers, Dr. Wright says "Under these circumstances their interest in cattle improvement is bound to be a very minor one". He further points out "A similar position is also found in regard to the relative expenditures of the departments on livestock improvement. Table 42 shows that only 6 per cent of the expenditure included in the agricultural budget is allocated to Cattle improvement. Such work must obviously take a minor place in the departments' activities."

Dr. Norman Wright, himself not a Veterinarian, has left no point untouched in his learned report. He takes stock of the dual control practised in some of the states, viz., the disease side being looked after by the Veterinary Department and the breeding and management of livestock, by the Agricultural department. He comes to the conclusion "This dual control has been detrimental to cattle improvement" and he quotes the Royal Commission on Agriculture who said "Where the knowledge and instincts of the farmer and cattle breeder are combined with the professional training of the Veterinary Surgeon, the position is ideal." Dr. Wright finally comes to the conclusion "As a result of my inquiries and of the examination of a number of other relevant considerations, I consider that the unification of livestock improvement and Veterinary work into a single department of Animal Husbandry will ultimately be essential for the successful development of the Cattle industry."

Will not Bengal pay heed to such expert advice and immediately fall in line with the other states in India?

We invite a close study of the tremendous improvement brought about in the livestock wealth of states like Madras, the Punjab and Uttar Pradesh where Veterinarians have been at work for sometime now. A comparative study of 'Before and After', this work came into the hands of Veterinarians, will convince anyone of the worth of these scientific men. They take to it like fish to water.

What baffles us most is that with a person of the eminence of Dr. B. C. Roy and with his additional advantage of belonging to the sister profession of Medicine, such an anomaly should continue to exist in that home of patriots.

We are fully aware that there is a lot to be done in that state by way of livestock development. We appeal to the enlightened

Government of Bengal to take up this question immediately and permit the Veterinarians of that state to play their part fully and well.

THE MADRAS STATE CATTLE SHOW

For a second time in succession, the City of Madras had the unique privilege of witnessing the Annual State Cattle Show. Nothing was lacking to make it of immense benefit to the public at large, from educative point of view. Ladies and children in colourful costumes, escorted by the male members of their families, thronged into the show ground day after day. We overheard some one in the crowd saying "that with such beautiful specimens of cows and bulls, one gets the feeling that "Lakshmi" the Goddess of wealth, resides in this Show ground." True, true! What greater wealth can be bestowed on an agricultural country like India than cattle wealth? With the Animal Husbandry work in the hands of Veterinarians only during the last two decades, they have completely changed the complexion of the entire work. It is now part and parcel of the day to day life of the common people. Rural Cattle Shows, Calf rallies, Milking competitions and the parade of wonderful specimens of bulls have all now become common features of the village life. They ask for more Artificial Insemination Centres, more Veterinary Hospitals and they even understand something of the different systems of breeding. They take live interest in Animal Husbandry matters and the Veterinary Doctor is a '*persona-grata*' in every village home to day.

The Show was on a much bigger scale than in the last year. There were over 650 entries under cattle, over 1000 under poultry, and over 250 under sheep. The usual running commentary on the different breeds of cattle was given by the Director of Animal Husbandry which was very much appreciated by the public.

The Chief Minister of the State inaugurated the show and the Minister for Agriculture presided. The Minister for Finance unfurled the National Flag and all the other Ministers also patronised the Show on one day or other. His Excellency Shri Bishnuram Medhi presided over the function on the last day. Her Excellency Shrimathi Medhi distributed the prizes. The supreme championship for the best animal in the Show went to a Murrah Buffalo bull from the Government Farm at Orathanad and to a Kangayam cow belonging to the Pattagar of Palayakottai for an animal of the opposite sex.

The cultural programme arranged for the benefit of the public attracted large crowds. It was a unique success and we congratulate all the officers concerned.

THE RESERVE FUND

An event of great importance to the Veterinary profession in India, took place in August 1924. It was the birth of the *Indian Veterinary Journal*. Circumstances were positively hostile and yet the profession took that bold step and the lion-heartedness of the early pioneers cannot be too highly praised. Ever since then, the *I.V.J.* has toiled hard under very adverse circumstances. The *I.V.J.* lives to-day so that the profession could prosper and science advance.

And now the hat is sent round so as to place this journalistic venture on a sounder and firmer basis. The *I.V.J.* is a priceless possession of our profession. It has placed the Indian Veterinary Surgeon, on the map of the scientific world. Just pause and ponder over, how much we owe to this Journal both individually and collectively. Is it too much then to expect the profession to respond to the appeal issued for a Reserve Fund? We hope not.

Some enquiries have come to us asking us to indicate the extent of help expected. We do not want to put the members of the profession to any undue financial strain in these hard days. At the sametime, a certain amount of sacrifice is needed to make this fund a great success, so as to make it worthy of our profession. So we feel that the following scale of contribution will be quite reasonable. It could even be paid in two or three instalments.

Class I Officers	...	Rs. 100/- and above.
Class II Officers	...	Rs. 50/- and above.
All others	...	Rs. 25/- and above.

It is our ambition that no Veterinary Surgeon in this land should remain without contributing to this fund. Brick by brick, this great edifice of our's should begin to rise higher and higher. On the success or otherwise of this venture, the solidarity of our profession depends. "Pay and Prosper" is the slogan we pass on to the members of our Profession.

Jai Hind!

T. VINAYAKA MUDALIAR,
Editor,
The Indian Veterinary Journal,
and
General Secretary, A.I.V.A.

14-4-58. }
Madras-17. }

(List of contributors published under Association News)

General Articles

THE ANATOMY OF THE FOETAL INDIAN ELEPHANT

Part VI: Viscera of Thorax, Abdomen and Pelvis

By

D. MARIAPPA, G.M.V.C.,
Professor of Anatomy, Madras Veterinary College.

Introduction

Numerous references on the viscera of the elephant are available. Watson (1885) has described the female genitalia. Steel (1885) has made general observations on the organs. Evans (1910) has briefly given an account of the organs of the Indian elephant. Todd (1913) has described the respiratory system. Patterson and Dun (1898) have dealt with the urinogenital organs of the female. Miall and Greenwood (1878) have described the viscera of the Indian elephant. Retzer (1912) has remarked on the anatomy of the heart. Hill (1936) has reported on the cardiac anatomy of the elephant. Benedict (1936) has made some general observations on the organs of the elephant. Eales (1929) has described the viscera of thorax and abdomen. Schulte (1937) has dealt with the urinogenital organs of the male. Rajagopal (1956) has made a detailed study of the viscera in four foetal specimens.

In the present study, several observations made by previous workers are confirmed and quite a good number of details not noted by others are recorded.

THE THORAX

Thoracic Cavity

The thoracic cavity is like a truncated cone, greatly compressed laterally and with the base cut off very obliquely. The inlet is small like a narrow triangle, sloping downward and backward. The posterior wall is formed by the strongly convex diaphragm, its line of attachment to the ribs being very oblique rendering the dorsal part of the cavity very long and ventral part of the cavity very small.

Dimensions:

Length—antero-posterior—27.5 cms.

Vertical diameter (at VI Rib)—25.0 cms.

Transverse diameter (at XII Rib)—27.5 cms.

Pleurae

The parietal pleura is very thick and adherent to the visceral pleura, completely obliterating the pleural cavity. The parietal pleura is easily separable from the walls due to the abundance of endothoracic fascia. From the mediastinum, the pulmonary ligaments extend from the hilus of the lungs backwards.

Lungs

The foetal lungs are dense, compact and dark red, with distinct surface lobulation due to the abundance of interlobular tissue.

The *left lung* (Fig. 1 A) is smaller weighing 1050 grams. It extends from III rib to XIV rib. The anterior thin concave border of its apical lobe contacts the left lobe of thymus and completely covers the heart. The dorsal border is convex, thick and rounded. The base is oval, concave, adapted to the diaphragm and the apex is small and pointed. The apical, cardiac and diaphragmatic lobes are marked by deep fissures, the opposing walls of which are adherent. The mediastinal face has the hilus nearer to the apex. (Fig. 1 A') The detached lung shows in the upper part of the hilus, the semicircular bronchus; in front of, below and lateral to it is the pulmonary artery; anterior pulmonary vein is below the artery and posterior pulmonary vein is medial to and below the bronchus. In front of the hilus is the large cardiac impression; above, an oblique groove for the left precaval vein; above this along the dorsal border is a groove, deep in front and shallow behind for the aorta. Behind the hilus and below the aortic impression is a groove for oesophagus. Unlike in other animals, the cardiac notch is absent in the left lung and the heart does not contact the left chest wall.

The *right lung* (B Fig 1) is larger weighing 1070 grams. It extends from II rib to XIV rib. The apical, cardiac and diaphragmatic lobes are marked by deep fissures. The apex is round and thin. It has a large cardiac notch exposing the heart to contact the right chestwall from II to IV ribs. On the mediastinal face, the hilus is nearer to the apex. (Fig 1 B') The disposition of structures in the hilus is the same as in the left lung. In front of the hilus is the cardiac impression; above, in front of the hilus is an oblique groove downward and backward for the right precaval vein; above it along the dorsal border is the impression of the aorta. Mediastinal lobe is quadrilateral, separated from the diaphragmatic lobe by a deep wide groove in which pass the post-caval vein and the right phrenic nerve.

Heart

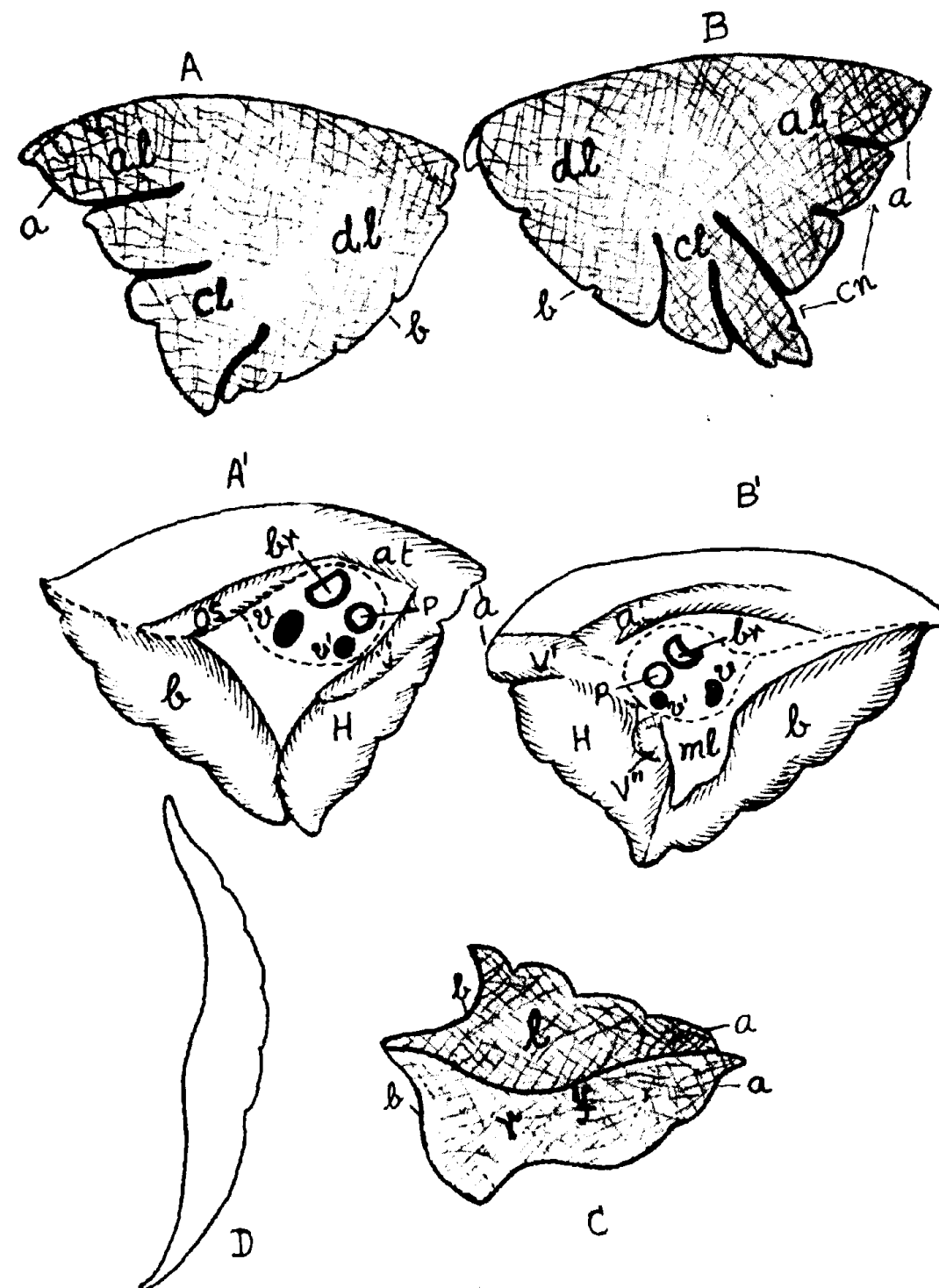
The heart is large, situated in the middle mediastinum with its long axis directed downward and backward, so that the base looks

The Anatomy of the Foetal Indian Elephant

Part VI: Viscera of Thorax, Abdomen and Pelvis

By -

D. MARIAPPA, G.M.V.C.



The Anatomy of the Foetal Indian Elephant

Part VI: Viscera of Thorax, Abdomen and Pelvis

By

D. MARIAPPA, G.M.V.C.

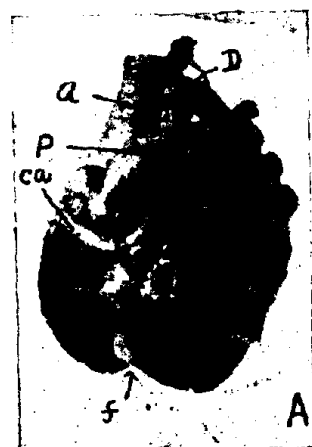


Fig. 2

THE ANATOMY OF THE FOETAL INDIAN ELEPHANT

193

dorsally and forward extending from I to V rib and the apex directed downward and backward resting on IV interchondral space. On the left side it is completely covered by the thymus and the left lung. But on the right side it is exposed between the right lobe of the thymus and the cardiac notch of the right lung, contacting the right chest wall from II to IV rib.

Pericardium.—It is adherent to the mediastinal pleura and to the diaphragmatic pleura over the tendinous centre below the phrenic nerves. Below the bifid apex, it detaches two fibrous bands—*pericardio-cophrenic ligaments* attached to the sternal part of the diaphragm as in the dog. On the base of the heart, it extends covering the great arterial and venous trunks.

Sub-epicardial fat.—It is yellow, found along longitudinal and transverse sulci, incisura cordis, bases of aorta and pulmonary artery. From the transverse sulcus it extends over the upper parts of ventricles, little on the left side but more on the right side.

External form of the heart.—(Fig. 2 A)—The heart is large and ovoid. Its greatest length is on the left side measuring 12 cms. from the appendix to the apex. Its greatest width is behind (base) measuring 12 cms. The auricles and their appendices are large—those of the right being larger. The left ventricle is larger both above and below so that the left apex projects 1 cm. lower in level than the right and is more rounded. The apex of the heart is *bifid*—*incisura cordis* separating the two apices of the ventricles.

Chambers of the Heart

Right auricle.—Its capacity is greater than that of the ventricle and its wall is thin. The appendix is large and demarcated from sinus venosus by the lower border of right precaval vein which opens above and in front. The opening is guarded by a large *right valve*. The postcaval vein opens behind through the posterior wall slightly at a lower level than the former. Its opening is guarded by the large *Eustachian valve* (fig. 2 B) which projects like a shelf 1.5 cms. wide, from the interauricular septum. The left precaval vein opens below the opening of the postcaval vein. It has no valve, but the eustachian valve overhangs its opening. *Intervenous crest* is a large crescentic muscular ridge. Lateral to its base is the muscular ridge—*Crista terminalis*. The appendix forms two blind pouches that encircle the base of pulmonary artery on the right side. The *musculae pectinati* are numerous—large and small.

A semi tunnel (fig. 2 B) for the blood to pass directly from the postcaval vein to the foramen ovale is formed by the interauricular

septum, eustachian valve, right valve (of precaval vein) and intervenous crest.

Left auricle.—Its wall is very thin. The dorsal wall of sinus venosus is covered above by the pulmonary artery and its branches. In this wall there are the openings of two pairs of pulmonary veins. The interauricular septum is thin, membranous and in front has the *Foramen ovale* which has a vertical diameter of 1.5 cms. and a transverse diameter of 1 cm. The appendix is well defined by its borders and the left precaval vein.

Right ventricle.—Its cavity is small and there are no moderator bands. The wall is thinner than that of the left. The *trabeculae corneae* form two large *musculi papillares*—one on the septal wall and the other on the lateral wall. The auriculo-ventricular opening is circular having a diameter of 5 cms. The *tricuspid valve* consists of septal, posterior and lateral cusps having short, few, thin, *chordae tendinae* attaching them to the musculi papillares. The septal cusp is attached to the septal musculi papillaris, whereas the posterior and lateral cusps are attached to both the musculi papillares. The interventricular septum with its musculi papillaris bulges into the cavity rendering it crescentic in section. *Crista supraventricularis* is a short, thick and concave ridge. Opening of pulmonary artery is circular having a diameter of 1.5 cms. It is guarded by the *pulmonary valve* composed of three large semilunar cusps. Of these one is anterior, one left posterior and the third right posterior. The wall of the ventricle is 8 m.m. thick and at the apex the cavity of ventricle extends upto the incisura cordis and not lower down as it may appear from the exterior.

Left ventricle.—The wall is 2 cms. thick but at the apex is thin so that the cavity does not extend beyond the incisura cordis. The auriculo-ventricular opening is circular and slightly larger than the right. The *bicuspid valve* has two large cups—septal and lateral. The *trabeculae corneae* are thick forming two large *musculi papillares*—septal and lateral. Each cusp is attached by numerous thick *chordae tendinae* to both the musculi papillares. The cavity of the ventricle is oval in section, wider towards the ventricular septum. The aortic opening is circular with a diameter of 1.5 cms. The *aortic valve* is composed of three large semilunar cusps—one cusp is posterior and the other two being right anterior and left anterior. Their free margins have no corpora auranti. The right anterior sinus of valsalva has the origin of the single coronary artery. The interventricular septum is 2.5 cms. thick and the aortic wall is twice as thick as that of the pulmonary artery.

Thymus

(Fig. 1-C)

The thymus is large and pyramidal, situated in the anterior mediastinum, covering the anterior face of the heart and roots of great blood vessels, filling up the space between the thoracic inlet and the heart. It is 15 cms long and 7.5 cms. wide. The ventral face is convex, adapting itself to the floor and sides of the thorax and dorsal face is concave related to the heart. It consists of two lobes, both pyramidal, left one being larger. The median fissure dividing the lobes is evident only posteriorly. The anterior ends of the lobes form a median pointed projection which extends 4 cms. in front of the thoracic inlet below the bicarotid trunk, contacting the thyroid. The anterior border of the base of the left lobe is deeply concave and the lateral border is cut by a number of small notches. Anterior border of the base of the right lobe is convex and lateral border is concave in front and convex behind. The apex of right lobe projects beyond that of the left. The connective tissue capsule dips in, to divide the gland into number of polygonal lobules.

Trachea

The trachea extends from the cricoid cartilage of the larynx to its bifurcation into bronchi at V thoracic vertebra. It is 14 cms. long; the cervical part is 6 cms. and the thoracic part is 8 cms. The cervical part at its origin for about 3 cms. is compressed laterally so that, the dorsal ends of rings are close together and the vertical diameter (2.3 cms.) is more than its transverse diameter (1.8 cms). Afterwards it is compressed dorso-ventrally so that, the ends of rings are farther apart, the deficiency being filled up by the *membrana transversa* containing the *trachealis muscle* consisting mostly of transverse plain muscle fibres. There are 28 rings of cartilage in its wall; cervical part has 12 rings and thoracic part has 16 rings.

The thoracic part has a transverse diameter of 2.2 cms. It is placed ventral to oesophagus in the dorsal mediastinum, to the right of brachiocephalic trunk and arch of the aorta, covered on its right face by the right anterior precaval vein. Behind the aortic arch, pulmonary artery is ventral to trachea. The internal face of trachea has fine longitudinal mucous folds.

Bronchi

The *left bronchus* has 6 rings. After entering the hilus, it detaches ventrally a bronchus to the cardiac lobe and dorsally a bronchus to the apical lobe, the stem bronchus passing into the diaphragmatic lobe. Of these, the first to arise is the apical bronchus, which passes dorsal to the pulmonary artery. Its origin is 1.25 cms. within the hilus. Then about 2 cms within the hilus the cardiac bronchus arises and passes ventral to

the pulmonary artery. The bronchi within the lung have small plates of cartilage immediately at their origin and later their walls are membranous.

The right bronchus has 6 rings. 1.25 cms within the hilus, it detaches at the same level three bronchi; dorsally the apical bronchus which passes dorsal to the pulmonary artery, laterally the cardiac bronchus that passes ventral to the artery and ventrally the bronchus to the mediastinal lobe. The stem bronchus passes into the diaphragmatic lobe.

Note:—In animals including the elephant, the pulmonary artery of each lung is placed lateral to and slightly ventral to the stem bronchus. Thus, the apical bronchus after its origin, naturally passes dorsal to the artery to reach the apical lobe and hence is *eparterial* in both the lungs. unlike in primates.

Oesophagus

It is a thick walled musculomembranous tube, compressed dorso-ventrally, extending from the auditus oesophagi to the stomach. It is 30 cms. long and 1.8 cms. wide. In the neck, it is related behind to longus colli and in front to the trachea. The cervical part is 8 cms; the thoracic part 20 cms and the abdominal part is 2 cms in length. At its origin over cricoid, it is median in position for the length of a vertebra or two and then it is deflected to the left on the dorsolateral face of trachea upto II thoracic vertebra. The thoracic part is in the dorsal mediastinum, above the trachea and to the right of brachio-cephalic trunk and aortic arch. Behind the aortic arch, the vagus nerves reach its lateral faces to form the dorsal and ventral oesophageal trunks which run on its dorsal and ventral faces. The muscular coat is made up of striated muscle throughout as in the ox and dog. It is made up of a thin layer of outer longitudinal fibres and an inner thick layer of circular fibres as in other animals.

THE ABDOMEN

The Abdominal cavity.—The abdomen is greatly compressed on the sides like the thorax. By the very oblique manner of attachment of the costal rim of the diaphragm, it is rendered more capacious at the expense of the thoracic cavity. In the floor is a large median umbilical opening for the umbilical cord. The flank is very narrow unlike in other animals, due to the last rib being in close relation to the iliac crest.

The Peritoneum.—The peritoneum is very thick due to the presence of a thick layer of fat. The greater omentum is very thin, lace like and devoid of fat. It is very extensive, attached to the greater curvature of the stomach and the origin of the duodenum. It covers the intestinal

mass completely, below and on the sides. The spleen is intercalated in it along the greater curvature of the stomach. The lesser omentum is small, connecting the lesser curvature of the stomach to the visceral face of the liver. It becomes continuous with the common mesentery at the first part of the duodenum. The Common mesentery is large and holds the coils of small and large intestine. Along the mesenteric blood vessels and lacteals are found numerous haemolymph glands and few lymphatic glands. The *Epiploic foramen* is not apparent.

Stomach

It is a simple elongated sac placed vertically behind the left part of diaphragm and liver, with the *Saccus caecus* at the lumbocostal angle, ventral to the left kidney in front of the loop of colon, its pyloric end being ventral, resting on the abdominal floor to the right of the umbilical vein, below the right notch of the right lobe of liver. Its long axis is oblique, directed from left to right. In front of left kidney, it is adherent to the diaphragm. The saccus caecus, with the dorsal end of spleen is adherent to the ventral face of left kidney. Along its greater curvature, the spleen is intercalated in the greater omentum, separated by a narrow interval above and greater interval below. At its cardiac end, it is attached to the visceral face of liver round the portal fissure by the lesser omentum. *Cardia* is an oblique slit. 1 cm. long, from whose margin, fine transverse folds of mucous membrane extend into the saccus caecus, but not to its right. The *Cardiac sphincter* is thick. The mucous membrane in the rest of the area has no folds. In the saccus caecus there are numerous large folds. *Pylorus* is a small round opening about 8 mm in diameter. The *pyloric sphincter* is thick and the margin of the opening is puckered.

Small intestines

Duodenum is 45 cms. long and 3 cms. wide. It arises from the pylorus to the right of umbilical vein and ventral to the right notch of liver. Immediately it passes up behind the right lobe of liver and forms a cork screw like spiral and forms a bend below the portal vein. Into the convexity of the bend, the hepatic receptacle opens. It then forms a loop, in the concavity of which, the colon passes from below upward and bends over the loop. The anterior mesenteric artery is in the concavity of the loop. It then passes to the left over the base of caecum below and the stomach in front. Thereafter it descends as the jejunum into the origin of the common mesentery. The bend of duodenum is held in a small mesentery attached in front to the liver. For about 15 cms. from the pylorus its mucous membrane has no folds. Thereafter it forms longitudinal and transverse folds forming cells of rhomboid pattern like the cells of the honey-comb. (Fig. 2D) A few solitary glands and payers patches are seen. The *hepatic receptacle* opens 25 cms. away

from pylorus. The hepatic duct forms a receptacle (Fig 4C) in the wall of duodenum after receiving the major pancreatic duct, and opens on the summit of a large conical papilla on the lateral wall. At the same level on the medial wall is another small papilla on the summit of which is the opening of minor pancreatic duct (Fig. 2C) The interior of the hepatic receptacle has numerous mucous folds.

Jejunum is 330 cms. (11 feet) long and 3.5 cms. wide. It is held in coils by the mesentery both on the left and right sides of the abdomen. The coils rest on the floor with those of colon above them. There are few haemolymph glands in this part of the mesentery. Folds of mucous membrane are as in duodenum.

Ileum is the last 30 cms. (one foot) of small intestine having a diameter of 3 cms. It opens into the anterior part of caecum from below and on right side by forming a conical projection of 2 cms. height (Fig. 3B) The *ileo-caecal orifice* is 4 mm in diameter and folds radiate from its margin. The mucous folds are predominantly longitudinal (Fig. 2E)

Large Intestine

Caecum is 15 cms. long and 7 cms. wide. It has three muscular bands—*taeniae caeci* and three rows of sacculations on its walls (Fig. 3-A). The *taeniae* are—one dorsal, one ventral and the third left. In front, the base is continuous with the colon as in the ox. From the base, the body extends backward to the left iliac region and terminates in the pointed apex. The base is connected to the visceral face of stomach. About its middle in front, it is connected to ileum by a peritoneal fold—*ileocaecal fold*. Through the floor of the base on the right side, the ileum projects and opens into it. In front of *ileocaecal orifice*, a large circular orifice—*Caecocolic orifice* is guarded by a thick fold of mucous membrane which forms large longitudinal and oblique folds. (Fig. 3 B).

Colon is 270 cms. (9 ft) long and its diameter varies from 5 to 8 cms, the widest part forming a large loop below the left kidney. It is held in coils by the common mesentery in the left and right parts of abdomen, overlying the coils of small intestine. The terminal part passes from below upward through the loop of duodenum, bends over the loop and passes backward into the pelvis as rectum. There are two muscular bands—*taeniae coli* and two rows of sacculations on its walls as in the small colon of the horse. (Fig. 3 A). The bands are along its attached and free borders and they are evident at the initial and terminal parts and the widest part forming the loop. At the other parts they are less evident. The mucous membrane in front of the ileocolic orifice is devoid of folds for a short distance. Thereafter it forms large

The Anatomy of the Foetal Indian Elephant

Part VI: Viscera of Thorax, Abdomen and Pelvis

By

D. MARIAPPA, G.M.V.C.

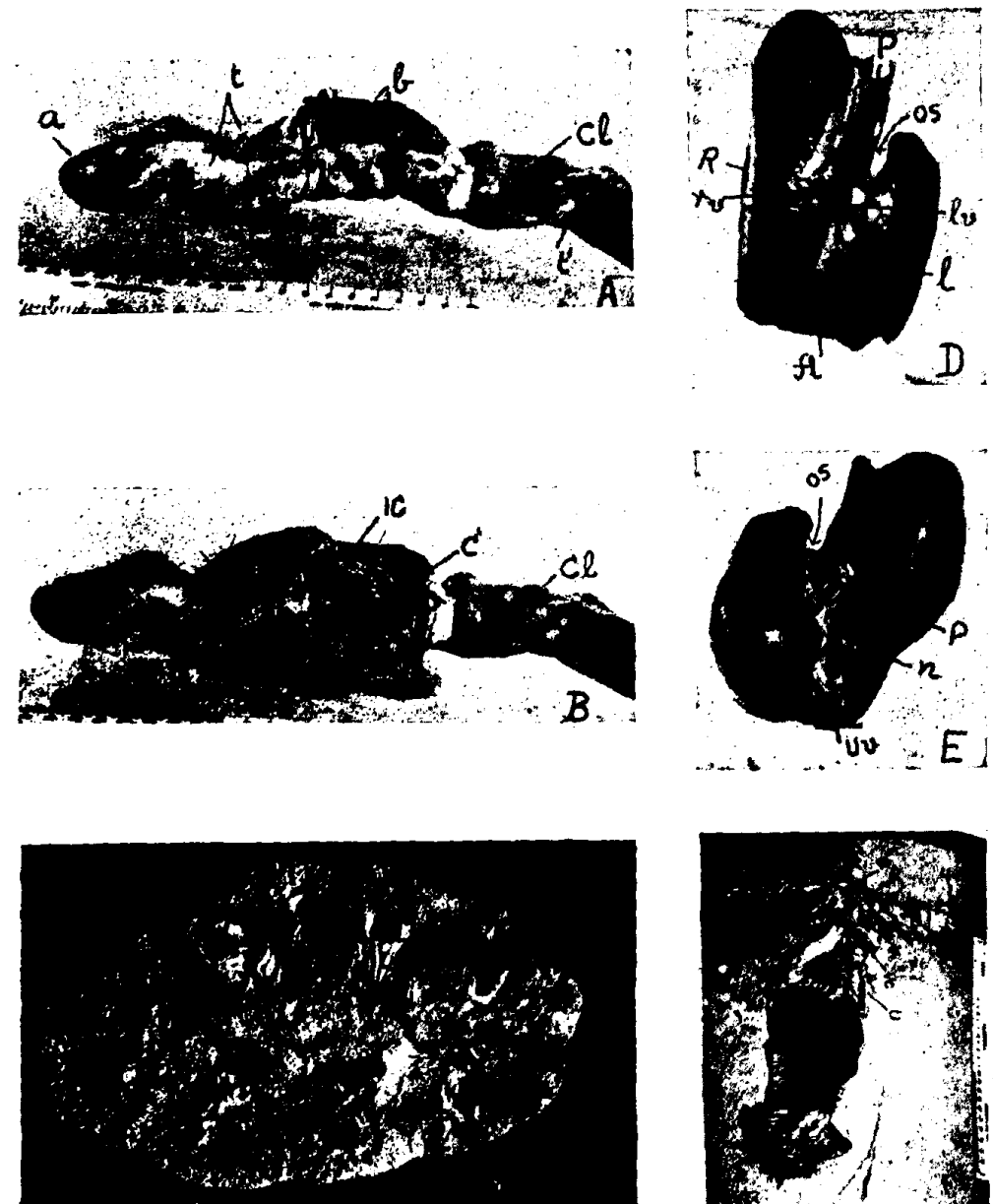


Fig. 3

The Anatomy of the Foetal Indian Elephant

Part VI: Viscera of Thorax, Abdomen and Pelvis

By

D. MARIAPPA, G.M.V.C.

THE ANATOMY OF THE FOETAL INDIAN ELEPHANT

199

transverse folds and the terminal part shows numerous closely set fine folds. (Fig. 2-F). Numerous haemolymph glands are present in the mesentery and the arterial arch is close to the bowel.

Liver

(Fig. 3-D)

The liver weighs 2.17 kilo-grams and is reddish brown in colour. Its diaphragmatic face is strongly convex and the visceral face is deeply concave. The deep umbilical fissure divides the gland into a larger right lobe and a smaller left lobe. The posterior border of the left lobe corresponds to VIII rib and below it rests on the costal cartilages. The right lobe is very extensive, its posterior border parallels the asternal cartilages, and contacts the abdominal floor below and the left kidney above. Its right border shows below a deep wide notch dividing it into a small right central lobe and a large right lateral lobe. Visceral face of the left lobe (Fig. 3-E) has the gastric impression. On the dorsal border between the lobes is a deep groove for oesophagus. The right lobe here, shows medially an oblique groove for the postcaval vein. Portal fissure is a deep depression on the right lobe. Below the fissure, in a small depression is the hepatic duct. A large haemolymph gland is found at the fissure.

The *falciform ligament* extends on the abdominal floor from the umbilicus to the umbilical fissure having the umbilical vein in its free concave margin. The ligament extends on the anterior face of liver and splits into two *coronary ligaments* which extend upto the oesophageal notch and attach the lobes to the diaphragm.

The gall bladder is absent. The hepatic duct receives the major pancreatic duct, enters the wall of duodenum in which it expands and forms an elongated oval *receptacle* which is 2 cms. long and 1 cm. wide, and opens on the summit of a large conical papilla on the lateral wall, 25 cms. from the pylorus. The receptacle has numerous mucous folds forming irregular compartments.

Pancreas

The pancreas is small, transversely elongated and is placed in the mesoduodenum. It is 5 cms. long and 1.5 cms. wide, dark brown and lobulated. The major pancreatic duct joins the hepatic duct before it enters the duodenal wall to expand into the receptacle. (Fig. 4-C.) The minor duct opens on the summit of a small papilla on the medial wall of duodenum at the same level as the hepatic receptacle and separated from it by the width of 3 cms. (Fig. 2-C.)

Spleen

(Fig. 1-E)

It is dark red, elongated and pointed at both ends and wide in the middle. It is 25 cms. long, 5 cms. wide and weighs 107 grams. It is

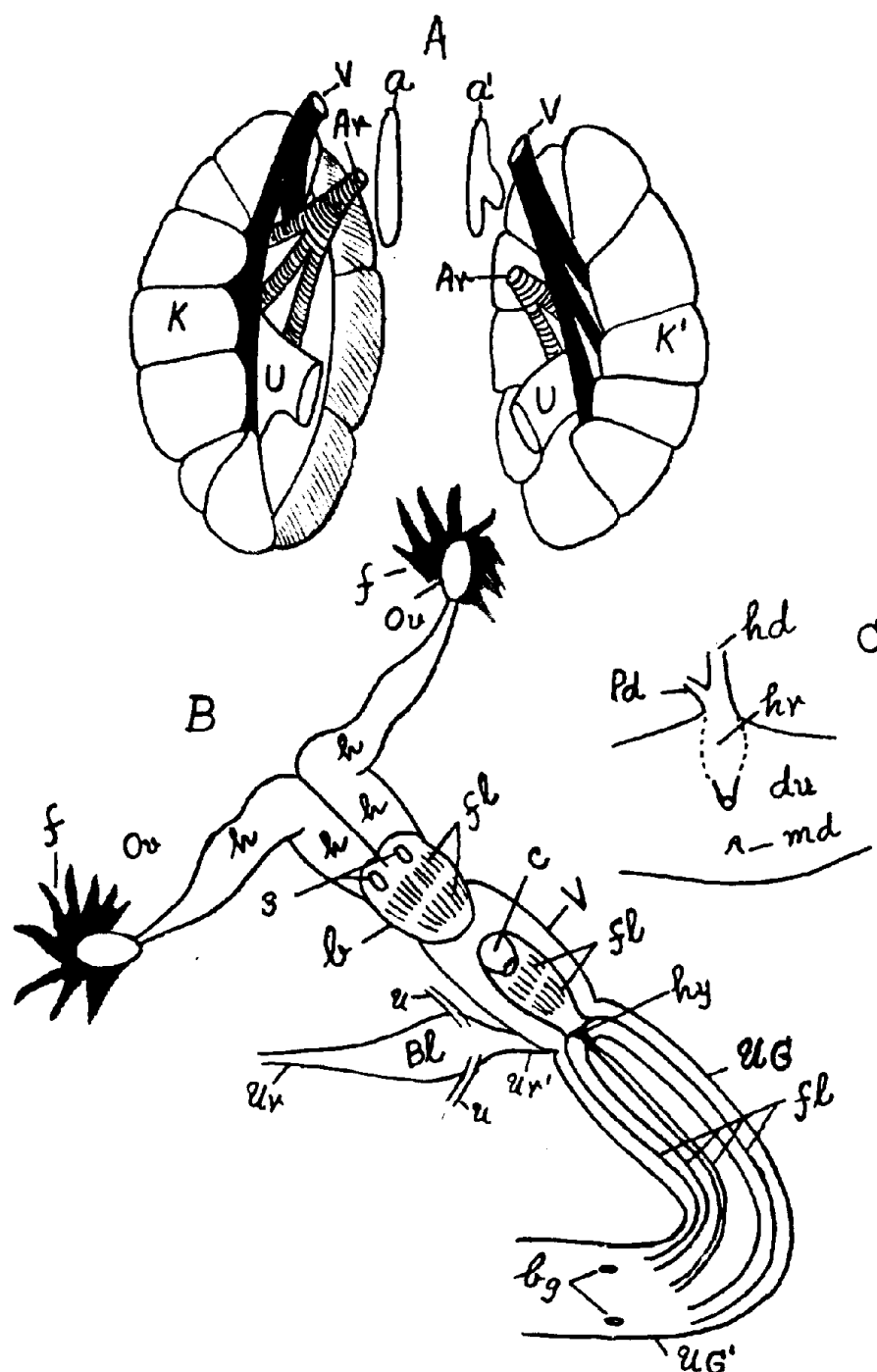


Fig. 4

nearly vertical in position related to the left abdominal wall. Its anterior concave border is related to the greater curvature of stomach. The posterior border is convex, thin, with a number of small notches. The left end is thin and pointed; right end is thick and round. Its visceral face has the long hilus for the splenic vessels close to the anterior border. It is intercalated between the two layers of greater omentum along the greater curvature of stomach separated by a narrow interval above and a wider interval below.

Kidneys

(Fig. 4-A)

The kidneys are lobulated as in the adult elephant. They are covered by a dense layer of connective tissue with fat. After removal of this capsule of fat the surface lobulation which is deep becomes evident. Ventral face is covered by peritoneum and they are 5 cms. apart. They are dark brown in colour.

Left kidney (Fig. 4. A-K) is smaller, 10 cms. long, 7.5 cms. wide, 5 cms. thick and weighs 190 grams. It is placed in front of the iliac crest, ventral to the vertebral ends of last four ribs. The anterior pole is round and the posterior pole is pointed. The dorsal face is convex and ventral face is flat covered by peritoneum. Lateral border is convex and the medial border is straight having the hilus. The lobules are separated by deep grooves. There are 12 lobules; 10 lobules arranged all round and 2 lobules in the centre. The bases of lobules are towards the periphery and their apices are towards the hilus. Frontal section of the kidney (Fig. 3.C) shows the cortex, narrow and pale. The marginal zone is narrow and contains numerous large blood vessels. The medulla is wider and consists of *renal pyramids*. Each renal pyramid has an apex-*renal papilla* which is embraced by a *calyx minor*. The calyces minores unite to form *Calyces majores*, which are three: one from the anterior part of kidney, one from the posterior part and the third from the central lobules. The anterior calyx major receives more calyces minores. The three calyces majores open into a funnel shaped *renal pelvis* which is continued by the ureter that leaves the hilus.

In the hilus, ureter has the renal artery medially and the renal vein laterally. Artery divides into five branches which enter the hilus. The veins are larger and more in number than the arteries.

Right kidney (Fig. 4. A-K') is larger than left, compressed dorsoventrally, and weighs 210 grams. It is situated under the vertebral ends of last three ribs and extends under the iliac crest into the iliac fossa for a distance of 4 cms. and hence is behind the left kidney. It has 15 lobules; 10 arranged all round and 5 in the centre. Lateral border is more convex than the medial. The anterior pole is pointed and the posterior pole is round. The hilus is near the medial border. As

in the left there are there calyces majores. The renal artery divides into 4 branches which enter the hilus. The veins are more in number than the arteries.

Ureters

They are small round tubes passing backward from the hilus and held in peritoneal folds. They curve downward and backward and then descend vertically to reach the dorsal face of the posterior part of the urinary bladder lying at the pelvic inlet. They are 3 cms. apart on the bladder. The left ureter is 20 cms. long and 3 mm wide, right ureter being slightly shorter. They pass through the dorsal wall obliquely and open by slit like openings into the posterior part of the bladder.

Adrenals

(Fig. 4-A)

Left Adrenal is small, pyramidal, with the apex in front and the dented base behind, lying ventral to the anterior pole of the left kidney and dorsal to the postcaval vein. It is 4 cms. long, 1 cm. wide, 1 cm. thick and weighs 5 grams. Adrenal artery reaches the gland from below, whereas the adrenal plexus reaches it from above.

Right Adrenal is larger, elongated, 5 cms. long, 1 cm. wide, 1 cm. thick and weighs 8 grams. It is situated along the medial border of the anterior pole of the right kidney and to the right of postcaval vein.

THE PELVIS

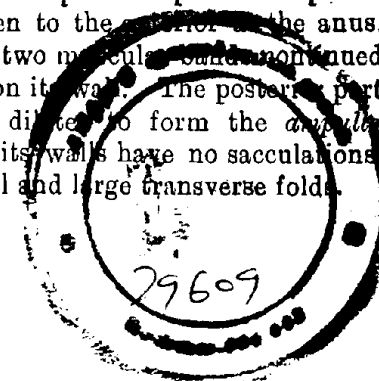
The Pelvic cavity is small in the foetus, 17 cms. long having a transverse diameter of 8 cms. and a vertical diameter of 10 cms. at the inlet. The outlet is about 4 cms. wide. The floor is very narrow and the upper part of the cavity is wider. The inlet is oval in outline in an oblique plane downward and forward making an angle of 45° with the spine.

The Peritoneum of abdomen extends into the pelvis dorsally upto II sacral body to cover the rectum. But ventrally it does not extend far inside, but covers the bladder and uterus only for a short distance above the pubis. The *vesicopubic pouch* is 2 cms. deep. The *vesicogenital pouch* and *rectogenital pouch* are larger and deeper.

Rectum

The terminal colon enters the dorsal part of pelvis and passes back as a straight tube-the rectum, to open to the exterior at the anus. It is 25 cms. long. The anterior part has two mucous folds continued from colon and two rows of sacculations on its wall. The posterior part about 15 cms. which is retraperitoneal, dilates to form the *ampulla recti* which has a diameter of 10 cms. and its walls have no sacculations. The mucous membrane forms longitudinal and large transverse folds.

36
KZ m2. 112 m
11.2.37



Anus

The anus is situated below the root of the tail. Its lumen-anal canal is 5 cms. long and 5.5 cms. wide. Its internal opening into the ampulla has a number of radiating folds of mucous membrane. Its external orifice is contracted forming a round prominence with a central depression.

Ovaries

(Fig. 4-B)

The ovaries are situated in the abdomen in front of the pelvic inlet, ventral to the iliac crest and the posterior poles of kidneys. Each is an oval body, flat on sides, with a straight anterior border and a convex posterior border. Each ovary has in front a *fat body* (Fig. 3, F & 4-B) consisting of a number of long peritoneal fringes with yellow fat as seen in lower vertebrates-amphibia. Each ovary is 2.5 cms. long and 1.8 cms. wide. It is enclosed in a thin brown vascular *ovarian bursa* which opens in front by a slit of 1 cm. in length. The hilus is in the middle of the anterior border. The *Mesovarium* contains blood vessels and connects the ventral face of the kidney to the anterior border above the hilus. The anterior border below the hilus is connected to the anterior end of the uterine horn by the *ovarian ligament* which contains plenty of plain fibres. At the hilus the ovary is lobulated showing 6-8 round eminences. In the ovarian bursa the fimbriated end of the oviduct is placed behind the ovary with its ostium in close relation with it. The ostium is a slit of 4 mm length with mucous folds radiating into the bursa.

Oviducts

Each is a tortuous tube, 3 cms. long, in the anterior part of the broad ligament of the uterus, extending from the ovary to the uterine horn. The tube is 3 mm in diameter to start with from the fimbriated end, forms three bends and is reduced in diameter to 1 mm at its end opening into the end of the uterine horn.

Uterus

(Fig. 4-B)

The body of *uterus* is placed on the posterior part of the bladder at the pelvic inlet. It is 2.5 cms. long and 2.5 cms. wide. From the body in front, arise the two *cornua* or *horns* which are united to each other for about 3 cms. giving a false appearance to the body being longer. Each horn is 15 cms. long and 2 cms. wide to start with but gradually becomes narrow and pointed at its ovarian end. After the horn parts company with the other, it passes transversely and then passes upward and forward to reach the ovary in front of the pelvic inlet. It opens into the body by a vertical slit of 1.25 cms. length. The *cervix* or *os uterus* is 3.75 cms. long and 2.5 cms. wide, its wall being 0.5 cm. thick. It opens into the body in front by a narrow opening of 0.75 cm. width.

It opens behind into the vagina by a circular opening of 1 cm. diameter. Its lumen—the *cervical canal* is straight with longitudinal folds of mucous membrane. *Fornix vaginae* is all round the *os uterus*. The mucous membrane of the body forms four rows of longitudinal folds on the floor. In the horn it forms thick wide ridges.

Vagina

(Fig. 4-B)

The vagina is a musculo-membranous tube, 6.5 cms. long and 3.75 cms. wide. On the floor the mucous membrane forms two rows of large longitudinal folds. In front it is attached to the *os uterus* in a manner, forming *fornix vaginae* all round. Behind, it narrows and forms a constriction at the level of the superior ischiatic spine, to open into the urinogenital canal by a small round opening of 0.5 cm diameter. The urethra passes through the floor of vagina obliquely for about 2.5 cms. and opens into a diverticulum of urinogenital canal below the vaginal constriction. The urethral meatus is 4 mm in diameter.

Urinogenital Canal

(Fig. 4-B)

It is a long wide musculomembranous tube extending from the vaginal constriction to the vulvar cleft between the thighs. It consists of a pelvic and an extrapelvic part.

The pelvic part is 5 cms. long and 3.75 cms. wide, compressed dorsoventrally, lying on the pelvic floor and related dorsally to rectum. Below the vaginal constriction, it forms a ventral diverticulum. At the opening of the vaginal constriction, the mucous membrane forms a thick ridge projecting like a shelf that overhangs the diverticulum. From this shelf, two pairs of large mucous folds pass back into the wall of urinogenital canal. The dorsal pair of folds with the shelf form a crescentic ridge—the *hymen*. The dorsal folds pass into the roof of the canal and the ventral folds into its lateral walls. On the floor of the canal are two median folds. All these six folds continue into the extrapelvic part for about 5 cms. below the ischial arch (Fig 3 F & 4-B).

The extrapelvic part bends over the ischial arch, runs downward and forward to open at the vulvar cleft. It is 18 cms. long and 6 cms. wide. It is suspended from the pelvic symphysis by an elastic double fold-suspensory ligament. It opens into the posterior part of the vulvar cleft behind the glans clitoris by a round opening of 1 cm. diameter. About 6 cms. below the ischial arch, there are two canals in the posterior wall, close to the median line. They open below by large slits of 3 mm width. The dorsal ends of the canals are blind. These are described by others as *Bartholins glands*. (Fig. 4-B.) The right canal is 2.3 cms. long and the left is 2 cms. long. The mucous

membrane of the floor below the ischial arch has few longitudinal folds and thereafter the lower part of the canal has no folds.

Vulva

The vulva is situated between the thighs, 8 cms behind the umbilicus. *Labia vulva* are 7.5 cms. long and *vulvar cleft* faces downward and backward. The skin round the vulva is soft, pliable and hairless. In the anterior part of the cleft is *fossa clitoridis* which is 1.25 cms. deep and 2.5 cms long. From the fossa about 2 cms. length of *glans clitoridis* projects downward and forward. Posterior part of the cleft has the opening of the genital canal behind the *glans clitoridis*.

Clitoris

The clitoris is very long consisting of a root, body and the *glans*. The root has two *crura*-each being 5 cms. long and 1 cm. thick and round, attached to the side of the ischial arch. The *crura* unite below to form the *body-corpus clitoridis* which is 15 cms. long and 1.5 cms. thick extending in the anterior wall of the genital canal. The *glans clitoridis* is 2.5 cms. long and 1.5 cms. thick, placed in the *fossa clitoridis* in the anterior part of the vulvar cleft. Its ventral face has the deep *urethral groove* extending upto the tip.

Bladder

(Fig. 4-B)

The urinary bladder is small and pyriform, lying at the pelvic inlet. Most of the anterior part of *fundus* extends on the abdominal floor. It is 12 cms. long and 5 cms. wide. The fundus becomes narrow in front and its anterior end is continued by the *urachus* to the umbilicus. The posterior part of fundus on the pelvic floor is wider and forms the neck or *cervix* which opens behind into the urethra. *Trigonum vesicae* in front has two slit like openings of ureters 1.5 cms apart and 1.5 cms behind them is the internal urethral orifice. Mucous membrane of the trigone is pale and devoid of folds. Lateral to the bladder are the peritoneal folds-*lateral ligaments* of bladder containing the umbilical arteries. A median *umbilical fold* on the floor of abdomen has the *urachus* in its free margin.

Urachus

(Fig. 4-B)

The *urachus* extends from the vertex of the bladder to the umbilicus. For about 5 cms. after its origin it is triangular in section with the sides being 6 mm wide. Thereafter it becomes flattened and very narrow, being reduced to 3 mm in diameter and the wall is very thin. It runs along the posterior border of the right umbilical artery with the left artery by its side. The *urachus* in the abdomen is 15 cms. long and extra-abdominal part is very narrow and thin walled opening into the allantois.

Urethra

It is a short wide thick walled tube, 3 cms. long and 2 cms. wide with a lumen 1 cm. wide. It arises from the neck of the bladder and passes in the floor of vagina obliquely for about 2 cms and opens into the diverticulum of the urino-genital canal. The urethral meatus is 8 mm. wide.

Discussion

The obliteration of the pleural cavities in the later stage of foetus as observed by several workers is confirmed in this study. In the early stage they are present as noted by Eales (1929) in her specimen of the African species of 21.0 cm. C. R. length. Rajagopal (1956) has recorded progressive obliteration of the cavities in the smaller specimens and total disappearance in the larger specimen. Some of the previous workers as Moulin (cited by Blair 1910) and Mojisisovics (cited by Eales 1929) have regarded such condition as pathological and Vasse (1917) cited by Eales (1929) claimed that the cavity existed in an African elephant examined by him immediately after death.

Rajagopal (1956) has studied the intrapulmonary bronchi and their relations to the pulmonary artery in foetus F 3 only. According to him, each bronchus divides into two main branches, cranial and a caudal. The right bronchus divides sooner than the left bronchus and its cranial branch is the *eparterial bronchus*. The caudal branch of the right bronchus and both branches of the left bronchus are *hyarterial*. He has illustrated the lungs (not in their natural position) showing the structures in the hilus to agree with the description. In this study, the intrapulmonary bronchi and their relations to the pulmonary artery are found to be similar to what obtains in other animals as ox and horse. The apical bronchi of both the lungs (in their natural position) are *eparterial*. The apical bronchus of the left lung is *not hyarterial* as reported by him, unless the lung is viewed in an unnatural position with the base ventral and apex dorsal, as illustrated by him.

Rajagopal (1956) has reported that the cavities of the ventricles extend into the apices below the level of *incisura cordis*. In this specimen, the cavities stop at the level of *incisura cordis*. The valves in the right auricle described by Miall and Greenwood (1929) and Rajagopal are similar to what is observed in this study, though they have not emphasised the large extensive eustachian valve forming a semitunnel.

Rajagopal (1956) after discussing the pattern of muscle fibres in the oesophagus as described by others, concludes that, in the elephant, horse and ox, two sets of spiral fibres are present, but the longitudinal layer is present throughout in the elephant, whereas in the horse and ox, it is present chiefly at the ends. In this specimen, it

is observed that the pattern of the muscle fibres is similar to that of ox, horse, dog and other animals, consisting of an outer layer of longitudinal fibres and an inner layer of circular fibres. It is striated muscle throughout as in the ox and dog.

Rajagopal (1956) has observed that the accessory pancreatic duct opened 3.5 cms. distal to the opening of bile duct. In this specimen the minor pancreatic duct opens on the opposite wall, at the same level as the bile duct.

Three *taeniae caeci* and three rows of sacculations in the walls of caecum as observed by Miall and Greenwood agrees with this study, but Rajagopal (1956) says that three *taeniae* are present but sacculations are absent in the foetuses. Sacculations of the walls of the bowel is due to the *taeniae*. Two *taeniae coli* and two rows of sacculations in the walls of colon noted in this specimen have not been observed by others.

The number of renal lobules noted by Rajagopal are few in each kidney, whereas they are 12–15 in this specimen which is 8 cms. larger than F 2 and 8 cms. smaller than F 3 and F 4 of his specimens. He states that there are no renal papillae in the foetuses and agrees with Schulte (1937) who did not find the papillae in his adult specimen. In this study, a frontal section of the kidney has revealed that each renal lobule has its renal pyramid and renal papilla resembling the kidney of the ox.

The ovaries are slightly lobulated in this specimen as reported by Watson and Forbes (cited by Watson) in their Indian and African species and also by Rajagopal. Each has a *fat body* in front, which is not reported by others.

The mucous folds of uterus, vagina and urinogenital canal agree in general with the observations of Rajagopal.

Watson described a complete septum in his specimen dividing the uterus and vagina into right and left halves so that vagina opened by two orifices into urinogenital canal. This specimen and those of Rajagopal do not show this condition.

Summary

1. The pleural cavities in the elephant undergo progressive obliteration in early stages of the foetus and totally disappear in the later half of foetal life.

2. Unlike in man, the apical bronchi of both lungs are *eparterial* as seen in other animals.

3. The eustachian valve is very large and extensive forming a semitunnel.

4. The cavities of ventricles do not extend into the apices beyond the incisura cordis. There are no moderator bands.

5. The oesophagus has striated muscle throughout as in the ox and dog. The pattern of arrangement is similar to that in the ox, horse, dog and other animals, consisting of an outer longitudinal and an inner circular layer.

6. The minor pancreatic duct opens at the same level as the bile duct in the opposite wall.

7. There *taeniae caeci* and three rows of sacculations in the walls of caecum and two *taeniae coli* and two rows of sacculations in the walls of colon are noted.

8. Foetal kidneys have more number of renal lobules than the adult. Each lobule has a *renal pyramid* and a *renal papilla*, resembling the structure of the kidney of the ox.

9. The ovaries are slightly lobulated and placed in bursa as in bitch. Each has a *fat body* in front.

10. The exact pattern of mucous folds in uterus, vagina and urinogenital canal has been noted.

11. In the elephant, the clitoris is enormously developed in relation to the urinogenital canal.

EXPLANATION TO FIGURES

Fig. 1. A: Left lung and B: right lung, lateral view: a, apex; b, base; al, apical lobe; cl, cardiac lobe; dl, diaphragmatic lobe; cn, cardiac notch.

" A': Left lung & B': right lung, medial view: a, apex; b, base; H, Cardiac impression; V, groove for left precaval vein; V', groove for right precaval vein; at, groove for aorta; V'' groove for postcaval vein and right phrenic nerve; br, bronchus; P, pulmonary artery; v, posterior pulmonary vein; v' anterior pulmonary vein. Interrupted line indicates mediastinal reflection.

" C: Ventral view of thymus; a, apex; b, base; l, left lobe; r, right lobe; f, median fissure.
D: Lateral view of spleen.

Fig. 2. A: Anterior view of the heart: a, aorta; D, ductus arteriosus; P, pulmonary artery; r, right ventricle; l, left ventricle; f, incisura cordis, ca, coronary artery.

" B: A, right auricle opened; E, eustachian valve.

" C: Duodenum opened. Arrow above shows the large papilla with the opening of hepatic receptacle and the arrow below shows the small papilla with the opening of minor pancreatic duct.

" D: Duodenum opened showing the pattern of mucous folds.

" E: Ileum opened showing the pattern of mucous folds.

" F: Terminal part of colon showing the pattern of mucous folds.

Fig. 3. A: Caecum & Colon; a, apex of caecum; b, base of caecum; c, body of caecum; cl, colon; t, *taeniae caeci*; t', *taeniae coli*.

" B: Caecum opened: C, caecum; IC, ileocaecal opening; C', caecocolic opening cl, colon.

" C: Frontal section of right kidney: C, cortex; M, marginal zone with blood vessels; P, renal pyramid; p, renal papilla; m, calyx minor.

- Fig. 3. D: Anterior view of liver: P, postcaval vein opened; os, oesophageal notch; l, left lobe; R, right lobe; lv, left hepatic vein; rv, right hepatic vein; fl, falciform ligament.
- " E: Visceral face of liver; os, oesophageal notch; P, section of portal vein; n, notch; uv, umbilical vein.
- " F: Uterus, vagina and urinogenital canal opened showing mucous folds; f, fat body; b, body of uterus; os, cervix; v, vagina; vc, vaginal constriction; U, urinogenital canal.
- Fig. 4. A: Ventral view of kidneys: K, right kidney; K', left kidney; V, renal vein, Ar, renal artery; U, ureter; a, right adrenal and a' left adrenal.
- " B: genitalia: f, fat body; ov, ovary; horn of uterus; s, slits for horns opening into body; b, body of uterus; fl, mucous folds; U, cervix uterus; V, vagina; hy, hymen; Ug, urinogenital canal - pelvic part; Ug' - extra pelvic part; bg, slits - openings of Bartholin's glands, Bl, bladder; u, ureter; Ur, urachus; Ur' urethra.

REFERENCES

1. Benedict, F. G. (1936) ... "The Physiology of the Elephant" Carnegie Institute of Washington.
2. Eales, N. B. (1929) ... "The Anatomy of a Foetal African Elephant, *Elephas africanus* (*Loxodonta africana*), Part III, The contents of the Thorax and Abdomen and the Skeleton", *Trans. Roy. Soc. Edin.*, LVI, Part I, 208-246.
3. Evans, G. H. (1910) ... "Elephants and their diseases" Rangoon.
4. Gray's Anatomy (1956) ... Descriptive and Applied, 31st edition.
5. Hill, W. C. O. (1936) ... "Studies on the Cardiac Anatomy of the Elephant. 1. The Coronary blood vessels", *J. Anat. Lond.*, LXX, 386-398.
6. Miall, L. C. and Greenwood, ... The Anatomy of the Indian Elephant, London, 1878.
7. Patterson, A. M. and Dun, R. C. (1898) ... "The genito-urinary system of the female Indian Elephant", *J. Anat. & Physiol.*, XXXII (N. S. XII) 583-604.
8. Retzer, R. (1912) ... "The Anatomy of the heart of the Indian Elephant" *Anat. Record*, Vol. VI, 75-90.
9. Rajagopal, M. D. (1956) ... Unpublished Thesis, submitted for Part I of the Ph.D. Degree in Anatomy of the University of Madras.
10. Steel, J. H. (1885) ... "A manual of the diseases of the Elephant and of his management and uses" Madras, 1885.
11. Schulte, T. L. (1937) ... "The Genito-urinary system of the *Elephas Indicus* Male", *Am. Journ. Anat.* 61, No. 1, 131-153.
12. Sisson, S., and Grossman, J. D. (1956) ... The Anatomy of the Domestic Animals.
13. Todd, T. W. (1913) ... "Notes on the Respiratory System of the Elephant", *Anat. Anz.*, Bd. 60, 241-263.
14. Watson, M. (1885) ... "On the Anatomy of the female organs of Proboscidea", *Trans. Zool. Soc. Lond.*, XI, 111-130.

STUDIES IN THE PHYSIOLOGY OF THE CAMEL

(Camelus dromedarius)

Part I. Cellular Blood Constituents

By

BALBIR K. SONI¹

and

A. C. AGGARWALA²

Rajasthan College of Veterinary Science and Animal Husbandry, Bikaner.

Camel, "the Ship of the Desert", is the main if not the only means of transport in the desert areas of India, China, Africa and Middle-East countries. In spite of the modern advances in the field of mechanisation of transport, no machine has yet been able to replace this 'queer' looking animal for carrying heavy loads and persons from place to place in the deserts.

Due to inadequate facilities for scientific work in the areas where this animal is in use, hardly any detailed investigation work has been done to study the physiology of the camel. The oft-quoted book of Leese (1927) — A Treatise on the one-humped camel in health and disease — deals mainly with camel husbandry. Recently, however, the workers at the Duke University, Durham (U.S.A.), in collaboration with the Centre de Recherches, Sahariannes, Beni Abbes, Algeria, have done some excellent work on the water-balance of the camel which is reported in various issues of the *American Journal of Physiology*.

Since there was not enough information forthcoming in the available literature about the physiology of the camel, a series of experiments has been planned on this subject.

The blood constituents of the different species of domestic and other animals have been studied by a number of investigators in different countries, but the authors have not come across any work on the Haematology of the camel. For routine laboratory tests, the determination of red and white cell numbers, differential leucocyte count and the haemoglobin concentration are some of the items generally done. This paper reports a study made to determine the values of these cellular constituents of camel blood.

(1) Dr. Balbir K. Soni, B.V.Sc., M.Sc., Ph., D., Professor of Physiology & Biochemistry, Rajasthan College of Veterinary Science & Animal Husbandry, Bikaner.

(2) Lt. Col. A. C. Aggarwala, B.Sc. (Hons.); M.R.C.V.S., A.I.R.O., P.V.S. (Class I Betd.), Principal and Professor of Veterinary Medicine, Rajasthan College of Veterinary Science & Animal Husbandry, Bikaner.

Experimental

In all, 95 adult male camels (*camelus dromedarius*) of ages varying from 5 years to 16 years, were used in this study that was conducted in the months of May, June and July 1957. Fresh blood collected from the left jugular vein of the camels in the sitting position was used for the determination of Haemoglobin, Total cell-count and differential leucocytic count.

Haemoglobin expressed as grams per 100 c.c. was determined by the EKKA Brand of Haemoglobinometer and N/10 Hydrochloric acid was used as the diluting fluid.

The total cell-count was done in the counting chamber with improved double Neubauer Ruling. Hayem solution (composed of distilled water 200 ml., sodium chloride 1 gram, sodium sulphate 5 grams and mercuric chloride 0.5 gm.) was used as diluting fluid for erythrocytes, and 5% glacial acetic acid tinged with methylene blue was the diluting fluid used for the count of leucocytes.

The differential count of leucocytes was done from the smears prepared from fresh blood stained by Leishman's stain. A total of 100 leucocytes was counted, and thus the percentage of neutrophils, lymphocytes, monocytes, eosinophils and basophils was determined.

Results and Discussions

Haemoglobin: In the 95 normal adult male camels the Haemoglobin values varied from 11 to 22 gms per 100 ml. of fresh blood. This averages to 15.52 gms. per 100 ml. with a standard deviation of ± 2.43 . When compared with the Haemoglobin content of the blood of other animals, this value for the camel is rather on the high side. The average for cows is reported as 12.03 (Miller, 1931), sheep 12.4 ± 1.4 (Holman, 1946), and dog 13.01 (Mayerson, 1930). The figures 14.69 ± 1.56 reported by Hansen *et al* (1950) for the Thoroughbred stallion and 14.323 ± 1.651 for mules reported by Sastri and Dhanda (1953) seem to closely approximate those of the camel.

The frequency distribution (Fig. 1) shows that about 88% of the animals under study had their Haemoglobin content between 13 to 17 gm./100 ml. of blood.

Total Cell-count: The erythrocytes which were elliptical and bi-concave averaged 8.2 ± 2.22 millions/cu. mm. of blood, the values varying from 5 to 13 millions/cu. mm. The frequency distribution (Fig. 2) in this case indicates that about 77% of the camels whose blood was examined had erythrocyte count between 6 to 9 millions/per cu. mm. A similar variation and frequency distribution has been reported by Mayerson (1930) for the erythrocyte count in the blood of normal dogs.

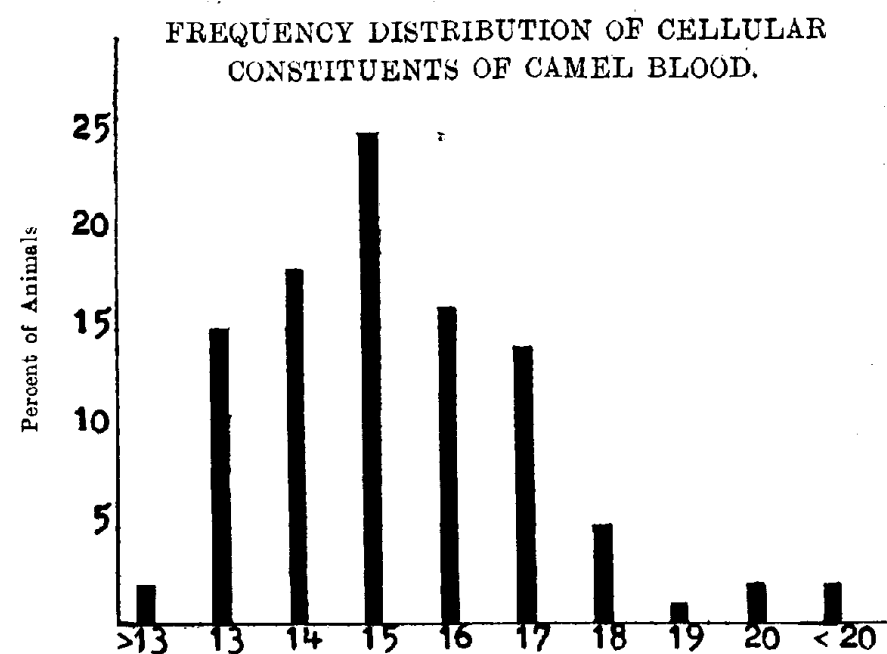


Fig. 1. Haemoglobin (gm. per 100 ml.)

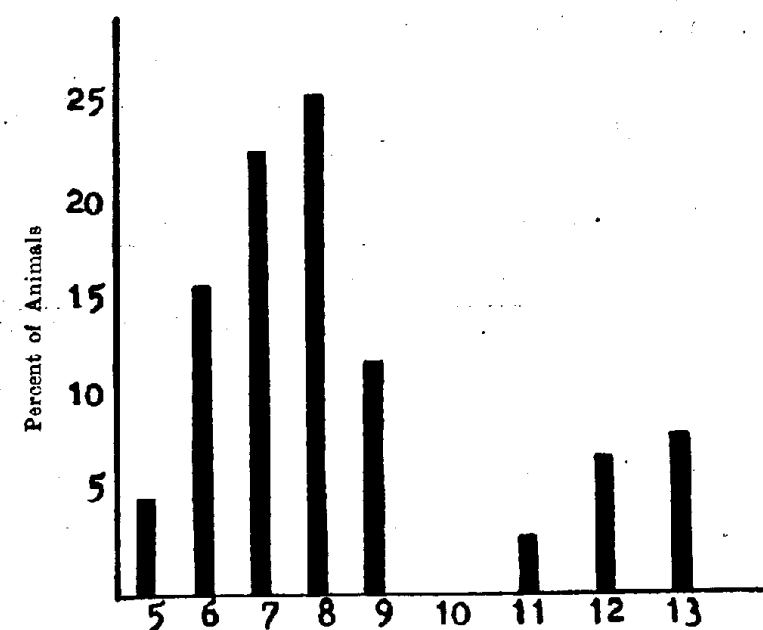


Fig. 2. Erythrocytes Count (Millions per cu. mm.)

FREQUENCY DISTRIBUTION OF CELLULAR CONSTITUENTS OF CAMEL BLOOD.

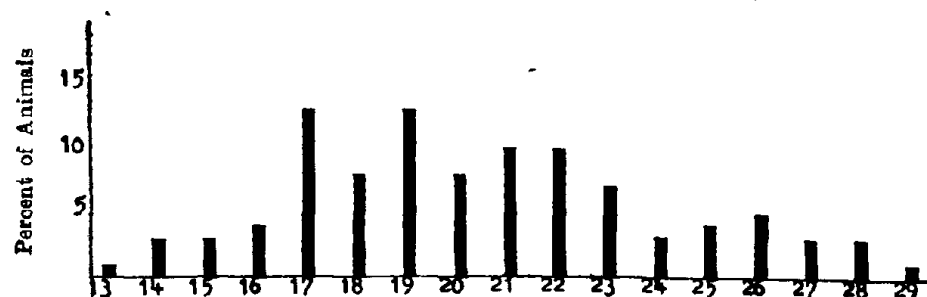


Fig. 3. Leucocyte Count (Thousands per cu. mm.)

The total leucocyte counts of the camels varied from 13 to 29 thousands per cubic millimeter with an average of 20.07 thousands and a standard deviation of ± 3.58 thousands. This wide range of the leucocyte count does not seem to be peculiar to this animal alone because the data of Albritton (1955) show that the ranges of variation for different animals, such as horse, cattle, pig and chicken are quite considerable; in the case of chicken, it is 16 to 40 thousands per cubic millimeter. The frequency distribution (Fig. 3) is quite similar to the one reported by Mayerson (1930) for dogs and shows that about 80% of camels had a leucocyte count between 17 to 23 thousands/cu. mm.

Differential Count of Leucocytes: The table below gives the average and standard deviation in percentage of different leucocytes in camel blood and compares the same with similar values for other ruminants, as collected by Trautman and Fiebiger (1952).

Mean and Standard Deviations in Percentage of Different Leucocytes.

Types of Leucocytes	Camel		Ox		Sheep	
	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Lymphocytes ...	46.0	± 9.7	52.0	± 15.0	68.0	± 10.0
Neutrophils ...	38.7	± 8.8	30.0	± 10.0	24.0	± 9.0
Monocytes ...	5.7	± 3.3	7.0	± 4.0	3.0	± 2.7
Eosinophils ...	9.5	± 4.7	10.0	± 7.0	4.0	± 4.5
Basophils ...	>1	—	—	—	—	—

The camel blood, like that of other ruminants, pre-dominates in lymphocytes. This is different from that of monogastric animals, like

man, horse, dog and cat, where the neutrophils are the commonest leucocytes.

The standard deviations of the values of camel blood which are measure of the expected variability in the results are not higher than those reported for the ox and sheep, showing that the camel has practically the same or even smaller range of variability as compared to the ox and sheep.

Summary

The average values along with the standard deviation of the different cellular constituents of camel blood are presented. The following table gives the averages and 95% ranges calculated by the use of standard deviation of the various cellular constituents studied. By this method which is also adopted by Albritton (1955), the information on variability is presented in an easily comprehensible and directly usable form and there is no need to perform calculations as is necessary when only the standard deviations are reported.

	Average	"95 % range"
Haemoglobin ...	15.5 gms./100 c.c.	10.6-20.8
Total Erythrocytes ...	8.2 millions/cu. mm.	3.8-12.6
Total Leucocytes ...	20.07 thousand/cu. mm.	12.9-27.2
Percentage of Lymphocytes ...	46.0 %	26.5-65.4
Neutrophils ...	38.7 %	21.1-56.8
Monocytes ...	5.7 %	0-12.3
Eosinophils ...	9.5 %	0-18.9
Basophils ...	>1	—

In the absence of any other such report on camel's blood, the authors are unable to compare their results with other similar work. The results are, however, compared with the values obtained in the case of other farm and laboratory animals by different investigators.

Acknowledgements

The authors are indebted to Major A. S. Thapar without whose help this study would not have been possible. Thanks are also due to Messrs. Krishnan Lal Rao, B.V.Sc., A. P. Asopa, B.Sc., LL.B., G.B.V.C., and P. D. Mathur, B.V.Sc., for their assistance in taking blood samples.

REFERENCES

- Albritton, E. C., ed. ... Standard Values of Blood. Philadelphia 1955.
- Hansen, M. F., et al ... Six Blood Values in Thorough-bred Stallions, Mares in foal, barren Mares and Weanlings. Ky. Agr. Exp. Sta. Bull, 555, 1950.
- Holman, H. H., ... Clinical Haematology. In Boddie's Diagnostic Methods in Veterinary Medicine, Ed. 2, Edinburgh, 1946.

- Lesse, A. S., ... A Treatise on the One-humped Camel in Health and Disease. Lincolnshire, 1927.
- Mayerson, H. S., ... Anat. Rec. 47, 239.
- Miller, W. T., ... The Blood Picture in Healthy Cattle and Cattle Affected with Johne's Disease. Thesis Cornell University, 1931 (Quoted by Dukes, H. H., The Physiology of Domestic Animals. Ithaca, 1955).
- Sastri, G. A., and Dhanda, M. R., 1953. Ind. Vet. Journ. 29, 395.
- Trautman, A., and Fiebiger, J., ... Fundamentals of Histology of Domestic Animals. Ithaca, 1952.

RINDERPEST AND ITS CONTROL

LATEST POSITION WITH REGARD TO VACCINES EMPLOYED

By

M. R. DHANDA

and

M. S. MENON,

Indian Veterinary Research Institute, Mukteswar-Kumaon.

Rinderpest in India still stands out as a deadly disease of cattle, buffaloes, sheep and goats taking a fairly heavy toll every year and affecting all types of animals, mostly the young and healthy stock in good condition, thus resulting in huge economic loss. Although cattle and buffaloes are principal sufferers, sheep and goats and even camels sometimes get the disease, not infrequently in the form of outbreaks.

India has launched a campaign for the mass vaccination of live-stock against rinderpest with the ultimate object of its eradication from the country. The work of mass vaccination was first started on 1-10-54 in the form of a pilot project in the States of Andhra, parts of Coorg, Mysore and Hyderabad and certain districts of Bombay. Madras, Kerala and a portion of Mysore being free from the disease, were left out of the pilot project with quarantine stations established in strategic places to prevent fresh infection.

The work progressed very satisfactorily in all the states and as many as 63,77,980 heads of cattle and buffaloes were vaccinated up to the end of 31st March, 1956.

Advent of New Vaccine Strains.—With the recent advances in attenuated strains of rinderpest virus viz., goat-adapted rinderpest virus, lapinised rinderpest virus and the lapinised-avianised rinderpest virus the veterinary profession has at its disposal all the means for not only combating this scourge but also for eradicating it completely from this country.

Varying susceptibilities.—Experience has shown that there is a great variation in the susceptibility of cattle and buffaloes as it seems to vary not only in different species, but from breed to breed within the species and also from one individual animal to another. Therefore, no single vaccine could be safe or economical for immunising the entire animal population with such varying susceptibilities.

In some countries like Egypt, goat-adapted virus could be used for vaccinating most of the animals susceptible to rinderpest, but in other countries like, China, Japan, and Korea where some breeds of animals exist which do not stand goat-adapted virus and which exhibit severe reaction with a certain percentage of mortality even to an inoculation with lapinised rinderpest vaccine, which is much milder than the goat-adapted strain and which hardly produces any reaction even in European and European cross-bred and hill cattle in India. This lapinised strain has proved to be quite safe for animals of varying susceptibility in most parts of the World excepting Black Japanese Cattle, water buffaloes of China and Korean cattle which are hyper-susceptible to rinderpest. In order to protect such animals against rinderpest a still milder strain, lapinised-avianised vaccine had to be evolved.

Position in India.—In India, we are in a happy position as most of our plains cattle and buffaloes and even some hill cattle and also those in hilly valleys can tolerate the goat adapted virus admirably well. However, there still are certain breeds like, the pure European and European-cross bred cattle and Ladak valley cattle, which react severely to goat-adapted virus and for the prophylactic vaccination of these animals we need a vaccine milder than the goat tissue vaccine.

The Goat adapted virus.—The Mukteswar goat-adapted strain, evolved by Edwards in 1927, has been in use in India ever since 1931. Although in early stages, it often proved too strong for certain types of cattle and buffaloes in India resulting in severe reaction in some breeds, notably the European and hill cattle and buffaloes, it has lately undergone further attenuation to a very considerable extent with the result that it is now considered quite safe for most of the cattle and buffaloes met with in the Indian plains and also for hill cattle in certain tracts such as those in the hills of Kumaon region, Himachal and the Punjab States and in the valley of Kashmir. Being a strain quite fixed in its characters, especially in regard to its virulence and antigenicity, it provides a highly suitable product for the prophylactic vaccination of all cattle and buffaloes met within the regions indicated above. The tissues of the goats used for the production of the vaccine have a high virus content and render vaccine production quite an economical proposition with the result that a dose of freeze-dried vaccine costs as little as 7 pies. In a freeze-dried form, the vaccine is quite stable and can be safely

transported on ice to places of vaccination. Under refrigeration conditions the vaccine remains viable for long periods thus ensuring its delivery in the field in a fully potent form. The immunity conferred by the product is so strong and durable that the vaccinated animals can withstand without showing any visible reaction a challenge with highly virulent virus which will cause death of susceptible animals in a matter of days.

Thus, in the goat-adapted vaccine, in a freeze-dried form we have a highly effective weapon for prophylactic vaccination of a majority of the cattle and buffaloes met with in the plains of India and a product which can, with considerable success be employed for controlling outbreaks of the disease in their early stages through the play of interference phenomenon.

It must be mentioned here, however, that instances have been brought to the notice of the authors when the product was reported to have failed to afford protection against the disease. The authors cannot help to point out that such failures cannot but be attributed to the vaccine becoming inert due to improper handling either during storage, transport or reconstitution and inoculation. The fact that the vaccine is a live virus suspension liable to deterioration as a result of exposure to atmospheric conditions must not be lost sight of in handling the product.

Lapinised Rinderpest Vaccine.—Since its receipt in India in 1948 at its 795th passage level the Nakamura III strain of lapinised virus has been the subject of intensive research at Mukteswar. It has undergone about 845 further serial passages in rabbits and has reached its 1640th passage. During this period the virus has got completely 'fixed' in its characters, having acquired a high degree of virulence for the rabbit species and lost its virulence completely for other species of animals susceptible to rinderpest such as cattle, buffaloes, goats, sheep etc. The most remarkable feature of this mutation, however, is that the strain retains its antigenicity to the fullest extent. Extensive trials carried out throughout India over a period of several years involving nearly 30,000 animals have shown that the vaccine is quite safe for the various species of animals, susceptible to rinderpest as well as for all breeds of cattle and buffaloes met with in India including the highly susceptible European and European cross-bred animals and animals of hilly tracts including those of Ladakh valley. The vaccine is, also, absolutely safe for animals of all age groups including lactating cows and buffaloes and animals in advanced pregnancy. Neither appreciable reduction in milk yield in lactating animals nor abortion in pregnant animals have been noticed during our extensive trials. The immunity conferred by its use, has, on tests, been found to be lasting for at

least 5 years, the longest period so far tested, which is quite satisfactory, indeed.

It would thus appear that this strain of rinderpest virus is ideal for adoption for mass immunisation work. However, the large scale production of this vaccine is beset with great difficulties due to the large numbers of rabbits required for its production since breeding of rabbits in sufficient numbers free from disease is an equally difficult proposition.

Lapinised Goat-Reactor Virus.—The idea of using virus from the tissues of reactor goats inoculated with lapinised virus has not met with success as the virus does not attain a sufficient titre in the tissues of goats even after several serial passages.

Lapinised-avianised Virus.—This strain of rinderpest virus has been evolved by adapting the rabbit strain to grow and propagate in the developing chick embryo. For proper adaptation, the virus had to be passaged first on the membranes, and then the whole embryo by the inoculation of the virus through the intravenous route. In initial stages the tissues of the infected embryo showed very low titres, not more than 1:200, but as a result of regular serial passages, a titre of up to 1:64000 has been attained which would render vaccine production quite economical. It has been estimated that about 100 doses of vaccine in a freeze-dried form can be obtained from a single egg. The virus seems to be milder than the lapinised virus and thus can be safely used for vaccinating all susceptible stock in the country. It appears that the strain would be a good substitute to lapinised virus. Some field trials have been carried out with this new product and the results of such tests so far indicate that the vaccine is absolutely safe for all species of animals and confers quite solid immunity as judged by the fact that on challenge with a highly virulent virus the vaccinated animals prove absolutely refractory, while the controls almost invariably succumb.

It may be seen from the above brief account of different rinderpest vaccines that:

1. All plains cattle and buffaloes as well as animals in the hilly regions of Kumaon, Kangra, Himachal Pradesh and the Punjab hills up to a height of about 4500 to 5000 feet can be safely vaccinated with the freeze-dried goat tissue vaccine and
2. All European and European cross-bred animals and cattle and buffaloes in the higher regions, say above 5000 feet, should be vaccinated with lapinised or lapinised-avianised freeze-dried vaccine, whichever can be produced easily.

Difficulties in the Field.—The most important consideration in mass immunisation of cattle in a vast country like India with its varying

climatic conditions is the question of transport of vaccine in a viable form and of fully safeguarding against a loss of its potency up to the time it is inoculated into the animal since the success of the campaign would depend primarily on this one issue. In order to ensure this, it is necessary to store the vaccine under ideal conditions. The freeze-dried vaccine can be stored in bulk in a deep freeze cabinet over long periods without, in any way, impairing its potency. This should be done either at the Production Centre or at a Central Distribution Centre in the State from where the vaccine should be distributed to scenes of operation on ice in thermos flasks. For immediate use, the vaccine must be reconstituted in cool saline and the whole of the reconstituted vaccine should be used up within a period of two hours. At no stage after it leaves the Distribution Centre, up to the time it is actually injected into an animal, should the vaccine be exposed to direct sun or kept under conditions where the temperature may go beyond 25°C (77°F). Even at this temperature, it should not be allowed to remain for more than 2 hours.

Another important point to be borne in mind is that the vaccine as issued from all Centres of production should have a uniform potency so that the product issued for immunisation has a full complement of at least 40 minimum infective doses per vaccinating dose. This can be ensured by regularly testing, at least, every fifth batch of vaccine to determine its titre at the Production Centre and at least every tenth batch at Mukteswar on hill cattle, which have a uniform susceptibility to rinderpest and are the most suitable cattle for testing the vaccine. Titrations carried out on non-descript buffalo calves having great individual variations in susceptibility may often give erratic results and thus result in the issue of a product whose potency cannot be fully guaranteed.

In difficult localities having inadequate transport facilities, the progress of work would necessarily be slow but in order to ensure the success of the campaign it is necessary that all possible precautions should be taken to achieve effective immunisation and to this effect proper education of the field staff is absolutely necessary.

In order to further ensure proper immunisation, challenge of a small proportion of animals out of those vaccinated in different localities at suitable intervals with a virulent culture is highly desirable. Needless to say that such tests should be carried out under properly controlled conditions and by highly technical staff so as to prevent the spread of infection from such places although the actual danger of this may be very little in view of the fact that tests would invariably be carried out in areas where mass vaccination has been carried out.

Summary

After making a brief comment on different rinderpest vaccines it is concluded that no single vaccine can be used safely for immunising all the cattle population against rinderpest. It has been further discussed that the bulk of the plains cattle and some hill cattle can be safely vaccinated with freeze-dried goat adapted virus.

For the vaccination of more susceptible stock and animals in advanced pregnancy vaccines prepared from milder strains like lapinised rinderpest virus or lapinised-avianised virus should be employed.

Though lapinised virus is quite satisfactory in all respects it is not economical to be used for mass vaccinations, due to its high cost of production. Lapinised-avianised vaccine will prove a good substitute to lapinised vaccine for immunisation of more susceptible stock against rinderpest. The desirability of titrating freeze-dried goat tissue vaccine produced at various Centres in highly susceptible hill cattle to get a product of uniform potency is stressed.

Attention is also invited to the necessity of observing proper precautions in regard to the storage, distribution and reconstitution for use, of the vaccines so as to ensure effective immunisation as the success of the eradication campaign essentially depends on these factors.

HAEMONCHOSIS IN A CAMEL

By

DR. M. S. PUROHIT, G.B.V.C., (Pat.), M.Sc., Ph.D. (Michigan),
and

K. R. LODHA, G.B.V.C. (Bomb.), D.V.P. (Madras).

Animals which live under unhygienic and insanitary conditions are predisposed to various parasitic infestations and the camel is not an exception to it. The north-west region of Rajasthan is almost an arid-zone and camels graze in this area on trees and bushes and yet the possibilities of parasitic infestations in this animal are many. It is for the first time that the authors have been able to record a case of *Haemonchosis in Camel* in the Civil Veterinary Hospital, Bikaner.

Rudolph (1803) was the first to discover certain strongyloid worms in the stomach of ruminants and he named them as *Strongylus contortus*. This remained to be a single genus affecting various ruminants for several years till Ransom and his associates (1911) conducted certain experiments and recorded various differences in these parasites affecting different species of animals. These workers found out marked differences in the length of the spicules, the distance of the hooks from the tips of the spicules and the shape and size of the appendages of the genital cone,

Similar differences were recorded in the vulvar processes of the females and in the end they described that the strains affecting the sheep and cattle are different ones. Those affecting the sheep were named *H. contortus*, and the parasites of cattle as *H. placei*. Experiments of Ross (1936) and his co-workers proved various differences in the morphology, physiology and cytology of the two varieties and they were confirmed as two different strains.

Railliet and Henry (1909) were the first to record *Haemonchus* parasites in the abomasum of camels in India and they named them as *H. longistipes*. Travassos (1914 & 37) described *H. similis* (Syn. of *H. contortus*) in the abomasum of sheep, goats and cattle in various parts of India.

This genus has since long been established as a common cause of parasitic gastritis in various domestic animals (ruminants). As described by Cameron (1934) it is a very common, most highly pathogenic and the largest strongyle of the ruminants.

Haemonchosis in sheep in Rajasthan was studied by Rathore *et al* (1954) but these workers neither recorded nor reported any such case in camels. The authors are the first to record *Haemonchosis* in camel.

Materials and Methods

A camel calf of 2½ years age was admitted in the Civil Veterinary Hospital, Bikaner for the treatment of a compound fracture of the left femur. During the period of treatment the animal was weak and debilitated which was thought to be due to the after effects of the fracture. As the fracture did not show any response to the treatment, the animal was finally destroyed by humane method and post-mortem conducted.

When the stomach was opened the abomasum was found completely packed up with helminths; a few nematodes were also present in the large intestines. The parasites of the abomasum were identified as *Haemonchus longistipes* and those of the large intestines as *Trichuris globulosa*.

Observations

1. The animal was very weak, anaemic and emaciated.
2. The visible mucus-membrane was pale.
3. The abomasum was fully packed up with *Haemonchus* worms (Fig. 1). It was highly congested and showed ecchymosis of the mucosa. Abomastitis with shallow ulcers were also observed. The adult worms might have attacked the mucosa by piercing it with their buccal-lancets and sucked blood.

REFERENCES

1. Bhalerao G. D. (1935), ... Helminth Parasitology of the Domesticated Animals in India, 231-33, Manager of Govt. Publications Delhi.
2. Davies G. O., Gaiger & Davies' ... Veterinary Pathology & Bacteriology 4th Ed. (1957), 626, 34. Bailliere Tindall & Co., Convent Garden, London. W.C. 2.
3. Geoffrey Lapage, ... Monning's Veterinary Helminthology, 4th Ed. (1956) 228. London. Bailliere Tindall & Cox., 7, Henrietta street.
4. Railliet, A. and Henry, A. (1909) ... Sur Lal Classification. Strongylidae I. Metastrongylidae. O.R. Soc. Biol. 66, 85-88.
5. Ransom B. H. (1911) ... "The Nematodes Parasitic in Alimentary Tract of cattle, sheep and other ruminants U.S. Dept. Agric. Bur. An. In. Bull. No. 127-1-132.
6. Rathor G. S., ... Sankaranarayan N. S., Mathur P. D. (1954) *Haemonchosis in Sheep in Rajasthan and its Control, The Indian Journal, of Veterinary Science & Animal Husbandry. Vol. 25 1-15.*
7. Ross I. C. and Gordon, ... H. Mel. 1936—International Parasitic Diseases of Sheep. Angus and Robertson Ltd., Sydney.
8. Thomas W. M. Cameron, ... The Parasites of Domestic Animals 2nd Ed. (1951), 16, 99-100. Adam & Charles Black 4, 5 & 6 Soho Square London W. 1.
9. Travassos L. (1914 & 37) ... "Revisão da Família Trichostrongylidae Leiper, 1912", Mem. Inst. Oswaldo Cruz, No. 1.

*A CASE OF TUBERCULOSIS IN A GIRAFFE (*Giraffa camelopardalis*)

By

B. NARASINGA RAI and K. P. CHANDRASEKHARAN
(Madras Veterinary College)

Introduction

Tuberculosis is rarely encountered in wild animals living under feral conditions but its frequent occurrence in wild animals under captivity has been recorded by various workers. In this country the disease has been encountered in elephants, monkeys, spotted deer, llama, nilgai, binturong, sambar, antelope, Arabian gazelle, Malayan tapir, (Soparkar 1924), (Liston and Soparkar, 1934). According to English observations, in England tuberculosis has been encountered in monkeys, gnu, antelope, blesbok and peccary (Griffith 1911, 1928, ¹, ². Wilson and Miles, 1955).

In recent years we have had occasions to observe the disease in monkeys (Nair and Murthy 1951), bear, deer and a giraffe among the

*Paper presented to the Indian Science Congress, held in Madras, January 1958.

animals in the zoological gardens, Madras. In the last mentioned animal, *viz.* giraffe, tuberculosis appears to be practically unknown and it was considered worthwhile to record a case of tuberculosis in a giraffe.

Case history:—Giraffe 'Victor' aged 12 years belonging to the zoological gardens, Madras and in good condition was reported to be suffering from diarrhoea. Though it recovered from diarrhoea by treatment with Thalazole (M & B) the animal began to lose condition and died late in June 1955.

Autopsy:—The animal showed emaciation and characteristic tuberculous lesions were noticed in the lung and associated lymphatic glands. No other organ examined showed any gross abnormality. All the lobes of the lungs were riddled with caseating nodules of varying sizes, many of which were confluent and softened in the centre. No calcification was to be seen. In the lungs beside these lesions a number of lemon sized hydatid cysts were also present. The cysts were independent of the tubercular lesions.

The microscopical examination of the smears from the caseating lesions revealed numerous acid fast bacteria, indistinguishable morphologically from *Mycobacterium tuberculosis*.

Histopathological findings:—Sections revealed extensive caseo-necrotic areas surrounded by endothelial cells and lymphocytes. A number of giant cells of the Langhan's type could be seen at the periphery of the caseo-necrotic areas. Severe fibroblastic reaction around the caseo-necrotic areas and interlobular septa was evident. Thickening of the pleura was present. The lung tissue in between the lesions showed patchy emphysema.

Bacteriological examination:—Cultures on plain and glycerinated egg were made directly from the lesion and pure cultures were obtained in about a month's time. After a few subcultures, cultural reactions of the organism were studied in glycerinated and non-glycerinated coagulated egg and coagulated serum.

The organism was found to be *ergogenic*, giving luxuriant growth in glycerinated egg medium and showed an orange creamy pigment in coagulated serum media.

Further biological test was conducted using altogether four guinea pigs and an equal number of rabbits. Progressive disease with the lesions in the lymph glands, lungs, liver and spleen was noticed in the guinea pigs whereas rabbits were found healthy and did not lose weight. They were sacrificed after 2 months and on careful autopsy two small tubercles were noticed in the lungs and none in the kidneys.

The above observations indicated that the strain involved was of the human type. These findings were later confirmed by the Indian Veterinary Research Institute, Mukteswar to which place pure cultures were forwarded for typing.

Discussion

Though tuberculosis in the various zoo animals has been reported from time to time the present paper appears to be the first record of tuberculosis in a giraffe. Further in true ruminants like giraffe one would have normally expected bovine type of tubercle bacillus to cause such extensive lesions.

Reports of the human type of tubercle bacillus causing disease in domestic herbivorous animals are rare and even in such cases lesions are generally not progressive. Occasional infection of cattle from tuberculous attendants has been reported by Neilsen and Plum 1940. A rather extensive infection of cattle by the human type of bacillus was reported by Hillermark in Sweden, in which the organism was isolated from cattle which had been in close contact with persons having open lesions of tuberculosis. Hence it is noteworthy that human type of tubercle bacillus should cause severe and progressive pulmonary tuberculosis in a giraffe. It is reasonable to assume that infection in this case had occurred either through tuberculous attendants or visitors to the zoo or through feed contaminated with tuberculous material. This naturally points to the hazards to which occasionally animals are exposed to infection from human sources. In this connection we might further emphasize that the animal health hazard from human sources has invariably been lost sight of and often only the transmission of infectious agents from animals has been stressed in the past.

Summary

1. A case of tuberculosis in a giraffe caused by the human strain of *Mycobacterium tuberculosis* has been recorded.

2. A review of the available literature showed the extremely infrequent occurrence of tuberculosis in a giraffe. It is probable that this is the first record of tuberculosis in a giraffe and what is more interesting and noteworthy is that the strain isolated proved to be of the human type.

3. Progressive and extensive caseo-necrotic lesions were observed in the lungs. Besides a number of hydatid cysts unconnected with tubercular lesion were also present. The possibility of infection here arising from human source is indicated and the animal health hazard from human sources especially among zoo animals is discussed.

Acknowledgments

The authors wish to thank Sri Bertie A. D'Souza for the encouragement and to Dr. D. Pattabhiraman, Director of Animal Husbandry for permitting the publication of this article.

REFERENCES

1. Griffith, A. S. (1911) ... Royal Commission on Tuberculosis, Final Report.
2. do. (1928) ... *J. Comp. Path.* Vol. 41, pp. 58 & 109.
3. do. (1928) ... *J. of Hyg. (Camb.)* Vol. 88, pp. 198.
4. Hillermark (1945) ... *Vet. Tidsskr.* Vol. 85, pp. 545.
5. Liston and Soparkar (1924) ... *Ind. Jour. Med. Research.* Vol. II, pp. 671.
6. Neilsen, F. W. and Plum, N. (1940) ... *Vet. Jour.* Vol. 96, pp. 6.
7. Nair, K. P. C. and Murthy, D. K. (1951) ... *Ind. Vety. Jour.*
8. Soparkar, M. B. (1924) ... *Ind. Jour. Med. Research.* Vol. II, pp. 681.
9. Wilson and Miles (1955) ... Topley and Wilson's Principles of Bacteriology and Immunity, 4th Edn.

CEREBROSPINAL NEMATODIASIS. II. TRANSPLANTATION OF *S. Digitata* INTO EXPERIMENTAL HOSTS

By

D. A. VICTOR, G.M.V.C., B.V.Sc.,
Veterinary College, Madras.

In a prior publication, Anantaraman and Victor (1957) had identified the *Setaria* occurring in Zebu cattle and buffaloes in India as *Setaria digitata*. *S. digitata* were commonly encountered in cattle in the abattoirs while none could be seen in the goat or sheep. It is our aim to study the behaviour of these worms in the normal and abnormal hosts through experimental infections and cast more light on the causation and incidence of "Lumbar Paralysis" in India. Recognizing the difficulty of securing a naturally infected cattle-donor for transmission of the infection through the mosquito *Armigeres*, direct implantation of live adult *S. digitata* obtained from the peritoneum of cattle into the peritoneal cavity of experimental animals was attempted. Williams (1955) had transplanted adult *Setaria cervi* from cattle into the peritoneum of rabbits and demonstrated microfilariae in their peripheral blood in 56 hours. According to Dr C. Sholo's information, conveyed in person, Oguni in Japan appears to have obtained similar results with *Setaria digitata* in rabbits, but that paper has not been traceable for reference.

Experiment No. 1 - Male Goat

On 17-12-56, a number of filarial worms were recovered alive from the peritoneum of a she-buffalo. They were transported in physiological

saline to the laboratory and identified as *Setaria digitata*. Within forty-five minutes thereafter, while they were active, 4 males and 23 females were carefully introduced into the peritoneal cavity of a male goat aged 11 months, through a trocar. The inside of the trocar was rinsed with normal saline after the worms were pushed in gently. The wound was sealed with Collodion. The animal stood the operation well and there was no observable reaction. Auricular bloodsmears were taken at intervals of four hours after the second day. Both wet films and smears stained by Leishman's method were carefully examined for microfilariae. The blood smears did not reveal microfilaria at any time. On 4-9-57 the animal was destroyed and autopsied. The peritoneum, diaphragm, lungs and liver were subjected to a thorough examination. No lesions could be detected. Of the worms there was no trace at all.

Experiment No. 2 - Female Goat

On 17-12-56, a number of *Setaria* were obtained from the peritoneum of a bullock (Zebu). Three male and 21 female *Setaria digitata* were introduced into the peritoneal cavity of a female kid, aged 11 months, through the trocar as before. The blood of the goat, in wet and stained smears, were examined periodically till 11-9-57 when the goat was sacrificed. At no time did the blood smears reveal any microfilaria. The peritoneal cavity, diaphragm, liver and lungs showed no abnormality, and no *Setaria* was seen.

Experiment No. 3 - Rabbit

S. digitata were obtained from a bullock (Zebu) on 15-6-57. Six males and 12 females were put into the peritoneal cavity of a rabbit through an incision on the abdomen. The incision on the parietal layer of the peritoneum was closed with catgut and the outer incision was sutured with silk ligature. As a safety measure, Strepto-penicillin (200,000 units) was injected subcutaneously. The rabbit appeared off-colour and was off-feed the next day. The Strepto-penicillin injection was repeated then, and the rabbit made an uneventful recovery. The blood smears were examined every 4 hours from the 24th hour after the operation till the 28th day when the rabbit was killed on 11-7-57. Blood smears remained uniformly negative. On autopsy, no *Setaria* could be seen. No lesions were noticed in any of the internal organs. However, three small pea-sized nodules were found attached to the omentum which were found to contain only some caseous material.

Discussion

Analysing the results of the experiments, it is clear that the worms have failed to establish themselves in any of the three hosts. It is inexplicable in the case of the rabbit, with which Williams (1955) had considerable success employing *S. cervi* of cattle. Nevertheless, as

only one rabbit is was experimented upon, no conclusion should be drawn until a larger number is involved in the study.

Explanations are possible, on the contrary, with regard to the failure in the goats. These animals are, by nature, unfamiliar hosts to *S. digitata*, and all the pathogenic reactions culminating in lumbar paralysis in the sheep and goats are only an expression of the incompatibility between this parasite and these hosts. As even adult worms transported into the new environment failed to maintain themselves in it, the resistance of the goat to *S. digitata* is confirmed.

The next investigation will be conducted on the same lines with bovines and rabbits as the hosts.

Summary

Anantaraman and Victor (1957) identified the *Setaria* commonly occurring in bovines in India as *S. digitata*, the species associated with Lumbar Paralysis in unusual hosts. Experimental infections were contemplated, and transplantation of adult worms from bovines into experimental hosts, viz, rabbit and two goats, was carried out. The blood of these animals was examined consistently for microfilaria, over a long period, but only in vain.

These animals were autopsied ultimately and no trace of the adult worms was available. The failure of the worms to establish themselves in the rabbit is inexplicable, particularly as Williams (1955) succeeded in detecting the microfilariae of *S. cervi* in rabbits after transplantation. Lumbar paralysis is an evidence of the goats being refractory to *S. digitata* and the present experiment confirms the resistance on its part to this species of the worm.

Similar experiments with more rabbits and bovines are to be undertaken.

Acknowledgment

This work was done under the supervision of Mr. M. Anantaraman, Helminthology Research Officer, Madras Veterinary College, whose guidance is gratefully acknowledged. Mr. Bertie A. D'Souza, Principal, Madras Veterinary College, Madras, had shown sustained interest in this investigation, and the author expresses his gratitude to him.

REFERENCES

1. Anantaraman, M., and Victor, D.A. (1957) ... Cerebrospinal Nematodiasis. I. *Setaria* of Bovines in India". *Ind. Vety. Jour.* Vol. 34, (3), 165-171.
2. Williams, H.E. (1955) ... Studies on the bovine filarid, *Setaria cervi* (Rudophi, 1919). *Parasitology* 45, (1, 2), 56-62.

SOME OBSERVATIONS ON THE MEASUREMENTS OF THE FEMALE GENITALIA OF THE BUFFALO (*BOS BUBALIS*)

By

S. DAMODARAN, G.M.V.C., B.V.Sc., M.Sc.,
Madras Veterinary College.

Introduction

Few data are available regarding the measurements of the female reproductive organs of the buffalo except for the observations of Polding and Lall (1945) on some parts of the genitalia in Murrah buffaloes and Hafez (1954) in Egyptian buffaloes. The need for the data arose while investigating the genital disorders of the she-buffalo.

Materials and Methods

The female genital organs were collected, in the course of a year, from 15 non-descript, nulliparous buffaloes between 2½ to 3½ years of age, at the Bareilly abattoir.

The entire female reproductive organs were separated from the pelvic viscera by dissection after sawing through the pelvic symphysis. The broad ligaments and the loose connective tissue and fat surrounding the vulva and the retroperitoneal part of the vagina were removed, as far as possible. The flexures of the fallopian tubes were straightened out by freeing them from the mesosalpinx.

A thin wire (fuse wire) was used for measuring the length of the vulva, cornua uteri and fallopian tubes and the readings noted against a scale while the remaining measurements were made with a vernier calipers. The measurements were made as described by De Lange (1950) except for the alterations mentioned below. The length of the vulva and vagina was measured from the ventral vulvar commissure to the hymeneal border and from this border to the vagino-cervical junction respectively. The width of the vagina was noted by measuring the external diameter at its middle. The thickness of the vaginal and cervical wall was measured from the peritoneal to the mucous surface at about the mid-vagina and mid-cervix respectively. The width of the fallopian tube was noted by measuring the external diameter at the tubo-ampullary and tubo-uterine junctions. The total weights of the genitalia and the individual weights of the ovaries were recorded. The genitalia were weighed after removing the vagina with the vulva at the fornix since these structures contain variable amounts of loose retroperitoneal connective tissue and fat which will erroneously influence the weight. The data regarding the measurements and weights of the female genital organs of the buffalo are presented in the table appended.

TABLE SHOWING
Measurements and weights of the female genitalia of the buffalo.

Part of the genitalia	Minimum	Maximum	Mean with standard error	Coefficient of variability (percent)	't' value	
(A) Left ovary:						
Length	1.71 cms.	2.76 cms.	2.38 $\pm$ 0.08 cms.	12.61	Length 0.791 Width 0.532 Thick- ness 0.821 Weight 0.503	
Width	1.05 "	2.14 "	1.58 $\pm$ 0.08 "	19.62		
Thickness	0.92 "	1.73 "	1.23 $\pm$ 0.07 "	29.58		
Weight	1.284 gms.	4.512 gms.	2.73 $\pm$ 0.25 gms.	85.16		
Right ovary:						
Length	1.67 cms.	2.92 cms.	2.28 $\pm$ 0.10 cms.	16.67	Length 0.487 W.A.E. 0.751 W.U.E. 0.850	
Width	1.06 "	2.06 "	1.52 $\pm$ 0.08 "	19.78		
Thickness	0.90 "	1.66 "	1.20 $\pm$ 0.06 "	17.46		
Weight	1.330 gms.	4.200 gms.	2.56 $\pm$ 0.23 gms.	84.77		
(B) Left Fallopian tube:						
Length	16.90 cms.	25.80 cms.	20.07 $\pm$ 0.66 cms.	12.81	Length 0.487 W.A.E. 0.751 W.U.E. 0.850	
Width at ampullary extremity	0.40 "	0.61 "	0.50 $\pm$ 0.02 "	14.00		
Width at uterine extremity	0.20 "	0.30 "	0.25 $\pm$ 0.01 "	12.00		
Right Fallopian tube:						
Length	15.10 "	25.10 "	19.59 $\pm$ 0.73 "	14.40	Length 0.229 Width 0.181 Thick- ness 0.340	
Width at ampullary extremity	0.43 "	0.65 "	0.52 $\pm$ 0.02 "	15.88		
Width at uterine extremity	0.21 "	0.28 "	0.26 $\pm$ 0.01 "	11.54		
(C) Left cornu uteri:						
Length	19.00 "	36.70 "	26.97 $\pm$ 1.61 "	23.17	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	2.15 "	3.84 "	2.84 $\pm$ 0.12 "	16.55		
Thickness	0.32 "	0.54 "	0.42 $\pm$ 0.02 "	16.67		
Right cornu uteri:						
Length	17.60 "	35.60 "	26.48 $\pm$ 1.72 "	25.27	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	2.15 "	3.76 "	2.82 $\pm$ 0.09 "	12.77		
Thickness	0.80 "	0.62 "	0.43 $\pm$ 0.02 "	20.98		
Corpus uteri:						
Length	0.46 cms.	1.17 cms.	0.74 $\pm$ 0.06 cms.	33.78	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	2.66 "	4.50 "	3.22 $\pm$ 0.16 "	18.94		
Thickness	0.46 "	0.98 "	0.67 $\pm$ 0.04 "	25.00		
(D) Cervix uteri:						
Length	4.55 "	8.10 "	6.84 $\pm$ 0.26 "	16.88	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	2.45 "	3.56 "	2.86 $\pm$ 0.08 "	10.84		
Thickness	0.54 "	1.81 "	0.91 $\pm$ 0.08 "	32.97		
(E) Vagina:						
Length	15.50 "	24.70 "	19.26 $\pm$ 0.67 "	13.50	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	5.11 "	9.10 "	7.48 $\pm$ 0.27 "	13.90		
Thickness	0.21 "	0.85 "	0.26 $\pm$ 0.01 "	15.38		
(F) Vulva:						
Length	11.20 "	14.20 "	12.92 $\pm$ 0.29 "	8.67	Length 0.229 Width 0.181 Thick- ness 0.340	
Width	8.00 "	11.91 "	9.80 $\pm$ 0.31 "	12.45		
(G) Total weight of the genitalia						
	121 gms.	386 gms.	238.80 $\pm$ 22.54 gms.			

N.B. W.A.E. — Width at ampullary extremity.
W.U.E. — Width at uterine extremity.

Observations

Judging from the coefficient of variation, the weight of the ovary is found to be most variable. The thickness is more variable than the width in the left ovary and reverse is the case in the right ovary while the length is least variable in both the ovaries. This is due to the developing Graafian follicle or corpus luteum distending either the width or the thickness of the ovary and seldom the length. In the cow, the right ovary is usually reported to be larger and heavier than the left (Kunge, 1932; Okljesa, 1934; Polding and Lall, 1945; Hess, Zieger, cited by Sisson, 1953). However, in the buffalo, no significant difference is seen in the size and weights of the two ovaries when tested statistically.

The fallopian tube at the ampullary extremity is twice as wide as at the uterine extremity. The tubal width is found to be most variable at the ampullary extremity and least at the uterine extremity. The length of the cornua uteri and corpus uteri is most variable and the width, the least. There is no significant difference in the measurements of the fallopian tubes and cornua uteri of the left and the right side when tested statistically. In the cervix uteri, the thickness is most variable and the width, the least. The thickness of the vagina is most variable and the length, the least. In the vulva, the width is found to be more variable than the length.

The measurements of the genitalia of the non-descript buffaloes reported here accord with those of Murrah buffaloes reported by Polding and Lall (1945) but differ from those of Egyptian buffaloes reported by Hafez (1954). The ovaries of Egyptian buffaloes are heavier, their weights varying from 4.3 gms. to 6.8 gms. during non-pregnancy while in Indian buffaloes the range is 1.3 gms. to 4.5 gms. with a mean weight of 2.73 ± 0.25 gms. Hafez (1954) states that there is no uterine body in the Egyptian buffalo. In the genitalia examined, a distinct corpus uteri can be recognised anterior to the cervix and the cornua uteri open into it. It is, however, very small and the mean length is 0.74 ± 0.06 cms. The length of the cervix ranges from 4.55 cms. to 8.10 cms. in the Indian buffalo as against 5.2 to 6.0 cms. in the Egyptian buffalo. The cervix is a little longer in the Indian buffalo as the mean length, which is 6.34 ± 0.28 cms. is a little more than even the maximum length in the Egyptian buffalo.

Summary

1. The measurements of the female reproductive organs of the buffalo are reported.
2. There is statistically no significant difference in the measurements of the left and right ovaries.

3. The ovary of the Egyptian buffalo is heavier than that of the Indian buffalo.

4. The cervix of the Indian buffalo is a little longer than that of the Egyptian buffalo.

Acknowledgements

Grateful thanks are due to the Indian Council of Agricultural Research, New Delhi for the grant of a Research Fellowship in Pathology: to Dr. S. Dutta (Retd.) Director, Indian Veterinary Research Institute, Izatnagar, for encouragement; to Dr. V. N. Murthy, Assistant Research Officer, Indian Veterinary Research Institute, Izatnagar, for the statistical analysis and the Director of Animal Husbandry, Madras for permission to publish this article.

REFERENCES

1. De Lange, M. (1950) ... *The Onderstepoort, J. Vet. Sci. & Anim. Indus.*, 24, 125.
2. Hafez, E. S. E. (1954) ... *Vet. Rec.* 66, 264.
3. Hess, cit. Sisson, S. (1953).
4. Okljesa, B. (1934) ... *Vet. Archiv.*, 4, 284. (Abst.) *Vet. Bull.* 4, 781.
5. Polding, J.B. & Lal, H.K. (1945)... *Indian J. Vet. Sci. & Anim. Husband.* 15, 178.
6. Runge, S. (1932) ... *Wiadom. wet.*, 11, 156. (Abst.) *Vet. Bull.*, 4, 281.
7. Sisson, S. (1953) ... *The Anatomy of Domestic Animals.* Philadelphia, W. B. Saunders Co.
8. Zieger cit. Sisson, S. (1953).

WEANING OF KIDS AND LAMBS

By

T. M. PAUL, M.Sc., Ph.D.,
National Dairy Research Institute,
Karnal, (Punjab).

Weaning of the young one from its dam and bringing it up by hand is not very much known in India. Except on a few Government dairy farms, weaning as such is not practised and it is unheard of so far as the villages are concerned. While this is the position with regard to cow and buffalo calves, no attempt seems to have been made in India to wean kids and lambs and bring them up by hand-feeding. Indian goats and sheep do not yield much milk. So, when the milk of these animals is needed for any special purpose like infant feeding etc., it will be a great advantage if the kids and lambs could be weaned and brought up on any other milk or 'calf' starters. Besides, the dam's milk yield will also be known accurately and the kid or lamb can be given a known quantity of milk or calf-meal as required. Also the complete stripping

Haemonchosis in a Camel

By

DR. M. S. PUROHIT AND K. R. LODHA



[To face page 220]

Weaning of Kids and Lambs

By

DR. T. M. PAUL



Fig. 1.



Fig. 2.

IN MEMORIUM



Sri T. SESHACHALAM NAIDU,
whose sad demise took place on 2-11-57.

[To face page 245]

of the animals by hand, helps in increasing the milk-yield and persistency of the dam. Besides, hand-reared kids and lambs are more tame and make very good pets at home for children to play with. Another obvious advantage of weaning kids and lambs is that those not wanted for breeding purposes can be disposed of and expenses on rearing them till the end of the dam's lactation, can be saved. In connection with a study of the composition of their milk I had an opportunity of managing a flock of sheep and goats at the Southern Regional Station at the National Dairy Research Institute, at Bangalore. Mainly due to the first reason *i.e.*, as all the dam's milk was required for the study of the composition of the milk and milk fat, I had to wean all the kids and lambs at birth, although, it involved additional labour. But at the same time, valuable experience was gained in goat and sheep husbandry and the kids and lambs were none the worse for it. In fact, they thrived better as they could be taught to eat grains and grass sooner and in greater quantities. The procedure adopted and experience gained in this connection are outlined below.

Only one breed each of goats and sheep, namely Surti goats and Kaithiawar sheep, both fairly good milkers among the Indian breeds, were weaned in this case. In both the cases of kids and lambs, the young one was removed as soon as it was dropped and licked dry by the mother. The young kid or lamb was then put in a separate, well-ventilated room close to the goat pen. For the first few days, a big wooden box with plenty of straw for bedding, without the top and left on its side was provided for the kid or lamb to lie down, well-protected from chill winds etc. Proximity of the young one led to frequent calling out by the mother for a couple of days, but both the mother and young one settled down sooner than expected.

The mother goat or sheep was milked within 3 hours of the birth of the young one, and thereafter every morning and evening. Eight ounces of this warm colostrum were given to the young kid or lamb from a pail or an ordinary bottle with a teat used for infant-feeding as shown in figures 1 and 2. Bottle-feeding did not involve any initial difficulty except frequent replacement of the teats and occasional spilling of the milk teats being torn or pulled off by the kid or lamb. On the other hand, pail-feeding needed more patience and training in so far as the kid or lamb is to be taught to suck a finger immersed in milk, till it got used to drinking milk without the help of any finger. But in the long run, pail-feeding was easier, and besides, the cleaning of the pail was easier than cleaning of the bottle and teat. Also the pail-fed kids and lambs thrived as well as the bottle fed ones and hence pail feeding was adopted, as a routine practice in bringing up all the kids and lambs required for breeding. In fact only the females were brought up and

most of the male kids and lambs were given away as they were not needed for milking their dams.

The amount of the colostrum the young kid or lamb received varied according to the size and condition of the young one and the yield of its dam. As far as possible, 8 ozs. of the dam's colostrum itself were given to the kid or lamb both morning and evening for the entire colostrum period of a week. But whenever the dam's colostrum was wanted for analytical purposes, only what was left was given to the kid or lamb and the deficiency was made up by cow's or buffalo's colostrum milked the same day but warmed up to 101° over hot water immediately before feeding. There were occasions when the dam's yield of colostrum was not enough even for analytical purposes. In these cases the kids and lambs were brought up entirely on cow's or buffalo's colostrum. When fresh cow's or buffalo's colostrum was not available, material preserved in cold store was warmed to 101°F and fed to kids and lambs. After the colostrum period, the kids and lambs were fed about 10-12 ozs. of cow's and buffalo's milk respectively at 101°F. This was gradually increased to 1 lb. by the end of the 2nd week and continued at that rate throughout the 3rd and 4th weeks, with a view to give the animal a good start in life. During the fifth week, whole milk was gradually replaced by separated milk and by the end of the sixth week, the animals were completely on skim milk. During the same period the kids and lambs were given small quantities of grain mixture composed of equal quantities of wheat bran, crushed oats, Bengal gram and groundnut cake, and fresh tender grass or lucerne to nibble at. This combination of skim milk, grains and grass was continued upto the end of the 8th week. By this time, the kids and lambs were able to eat 4 ozs. of grain mixture each time, morning and evening and some grass. Besides, they were allowed some grazing also. During the 9th week, the skim milk was gradually cut off, so much so, by the 10th week the animals were entirely on grain mixture and green grass, besides grazing. The quantity of grains was increased depending upon the size and condition of the kids and lambs, but never more than what it could eat up in 10-15 minutes. Grass and water were always before the animals except when they were out on grazing.

The above system of rearing kids and lambs was found quite successful in our hands. The saving of all the dams' milk for the experimental purposes and rearing the kids and lambs by hand on cow's and buffalo's milk respectively did not in any way affect the growth rate, condition, maturity or performance of the kids and lambs. Because of the similarity in composition of cow's and buffalo's milk to that of goat and sheep respectively, kids and lambs were given cow's and buffalo's milk respectively. Even this may not be necessary, as we ourselves have

noticed no bad effects when either cow's or buffalo's milk was fed to both kids and lambs. Regularity of feeding, feeding the milk at the correct temperature of 101°F, keeping the bottles and pails clean, and giving the kids and lambs a good start in the first 3-4 weeks of their life are the important points in rearing them by hand. Feeding of skim milk which has passed through so many contaminated vessels and the separator, may also cause bloating occasionally. This can easily be avoided if all the skim milk fed to kids and lambs is boiled before feeding. Also the gradual replacement of whole-milk by skim-milk is important, as otherwise, digestive troubles may occur and give a set back to the growth of kids and lambs. No difficulty was experienced in the milking of the dams as they stood quietly and let down all the milk if they were given the grain mixture while milking.

A New Year Offer

The Silver Jubilee Number of the *Indian Veterinary Journal* (July 1949) is offered to the Members of the profession and students at a concessional rate of Rs. 3/- (Reduced from Rs. 5/-) Postage 50 nP. extra. Only a limited number of copies are available. Hurry up to avoid disappointment! It contains the genesis and growth of (1) all the State Veterinary Departments in India and Pakistan; (2) all the Veterinary Colleges in India; (3) the Indian Army Remount and Veterinary Services; (4) the I. V. R. I., (5) the A.I.V.A., (6) the *Indian Veterinary Journal*, as well as highly complimentary messages from all over the world.

There are special professional articles by Dr. G. Lapage; Dr. J. O. L. King; Dr. S. Datta; Dr. M. R. Dhanda and Dr. V. R. Rajagopalan; Dr. S. G. Iyer and Dr. C. S. Balakrishnan and Dr. S. N. Yeravdekar.

It is a historical document of great value which ought to be in the Library of every Veterinarian.

LOOK SHARP!

LOOK SHARP!

Apply to the Editor I.V.J.

TO OUR SUBSCRIBERS

1. Please note that the I.V.J. is released punctually on the 5th and 6th of every month so as to enable you to watch the date and receive it safely, as otherwise losses are reported often which we are not able to account for.

2. Please report non-receipt of a particular issue before that month closes.

3. Please do not fail to intimate immediately any change in your address. Do not expect your Journal to be re-directed from your old address. It is rarely done. Please write legibly or in block letters.

4. Please note subscriptions are payable in advance. The official year of the Journal is the Calendar year.

5. Please note down our correct address, as many communications are still sent to our old address.

Clinical Article

TETANUS IN A MULE

By

R. L. GULATI, O. P. GAUTAM and M. P. SHARMA,

*Department of Veterinary Medicine,
Punjab College of Veterinary Science & Animal Husbandry, Hissar.*

Till recently, Tetanus was considered to be a formidable disease and when once the symptoms of 'Lock Jaw' appeared, it was very difficult to effect a cure. The introduction of 'Largactil' (M & B) (Chlorpromazine hydro-chloride) has given some hope of successfully treating such cases.

Various workers have tried this drug successfully but the recent record is that of Tait and Ryan - in *Australian Veterinary Journal*, when two cases of Tetanus in horses, were treated with Chlorpromazine in combination with procaine penicillin. There was no 'trismus' in the first case and there is no mention about it in the second one. The case that is now recorded in this article showed well marked trismus and was treated successfully.

The subject was a valuable mule of six years of age belonging to Shri Bhagwan Dass of Hissar. It was brought to this hospital on 10-1-58 with the history that it had gone "all-stiff" during the last three days and did not take anything since that morning.

On examination, it was found to be a typical case of Tetanus. There was spasm of the muscles of the neck and back, with general stiffness and the animal moved with great difficulty. There was hypersensitiveness, the membrane-nictitans protruding at the slightest excitement. There was trismus with tongue slightly protruding. The neck was extended, ears were erect and tail was slightly raised. Temperature was 101° F, pulse and respiration were 40 and 20 per minute respectively. There were many abrasions on different parts of the body but one suppurating gall, covered with a thick scab at the withers was possibly the seat of infection.

It was decided to put the case under treatment with 'Largactil' and Penicillin. 250 mgms of 'Largactil' were injected intravenously. This relieved the spasms in a few minutes, the excitability was reduced and the tongue was drawn in. The mule was offered some water and it took it. The owner got encouraged with this instantaneous relief and was gladly agreeable to meet the cost of Anti-Tetanus serum. 60,000 international units of A. T. S. were injected intravenously and

four million units of Procaine Penicillin intramuscularly. All the wounds were cleaned and thoroughly disinfected with Tincture of Iodine.

The animal was put in a comfortable room, protected from light and 240 mgms of 'Largactil' was repeated in the afternoon by the intravenous route. Next day the owner reported some progress and the treatment with Procaine Penicillin in a single dose of 4 million units intramuscularly and 'Largactil' 250 mgms. morning and evening intravenously was repeated. Careful attention to the wounds was given.

This treatment was continued up to 18th January i.e., for a continuous period of nine days. At the end of this period, the animal was walking comfortably and feeding well. Belladonna electuary was continued for a few days more and after eighteen days from the onset of the attack, the animal could be put to light work.

Summary

1. A fairly advanced case of Tetanus was treated with 'Largactil' and Penicillin.
2. Largactil was administered in two equal doses of 250 mgms. each intravenously each day.
3. A. T. S. was combined with the treatment because the animal was valuable and the owner wanted a risk-proof treatment.

Our thanks are due to Shri P. N. Nanda, M.B.C.V.S., Principal of the College for his valuable suggestions and guidance.

REFERENCE

- Tait A. R. and Ryan F.B. ... *Aust. Vety. Journal*, 33—9—1957
as quoted by "M & B Library Service".

Abstracts

Vaccination of Cattle with B.C.G.—By T. M. DOYLE and P. STUART,
The British Veterinary Journal Vol. 114, No. 1, Pages 3-10.

The authors record their trials and observations with B.C.G. Vaccine in a herd of Shorthorn Cattle which showed heavy Tuberculosis infection.

As an alternative to elimination of reactors by tuberculin testing, B.C.G. Vaccination was advised to build up a Tuberculosis-free herd. Each calf received 100 mg. of Vaccine within ten days of its birth, again at 6 months of age and thereafter once a year. Initial vaccines of B.C.G. grown on Herrold's solid egg medium were found to cause

protein shock on repeated inoculation. For subsequent batches B.C.G. was grown on Sauton's medium. Vaccinations of calves were started in 1948 and were continued till 1949. Non-reactors under 2 years of age were also vaccinated. Calves were kept isolated and looked after separately till they entered the milking herd.

One year after last vaccination and after many of the non-vaccinated reactors had been disposed of, tuberculin testing was undertaken. Using I/D, mammalian and avian tuberculins, the differences in reaction between the two were recorded as mammalian excess. The first herd test in 1951 showed 35% of animals had a mammalian excess of 7 m.m. or more. This had come to 3% by 1954.

P. M. conducted on 25 animals between 1951-53 revealed that 10 had positive lesions while 15 were negative for T.B. 4 in the former and 7 in the latter, were in doubtful group. (7-10 m.m. mammalian excess).

Five years elapsed before tuberculin tests showed negative results. This may be due to multiple doses of vaccines or repeated natural infection. Due to speedy disposal of non-vaccinated reactors and paucity of data on the duration of sensitivity to multiple doses of vaccine, the efficacy of B.C.G. Vaccination cannot be judged in full in the present trial. The vaccine appears to have conferred good protection considering the gross initial infection.

Though T.B. can be eradicated in 5-8 years by the use of B.C.G. Vaccine, it is a slower method and there is also involved the Public Health question in retaining infected animals and by inducing sensitivity B. C. G. complicates the programme of eradication by tuberculin testing.

M. S. J.

Human Infections with *Vibrio Foetus* and a Closely Related *Vibrio*—By
ELIZABETH O. KING, *The Journal of Infectious Diseases*, Vol. 101,
No. 2, Sept-Oct '57.

Vibrio foetus infection in cattle was first recorded in England in 1909. Since then, the causative agent has been isolated from animals in various other countries. For years natural infections with this organism were thought to occur only in domestic animals, but several instances of human infection have been reported recently. The author studied the cultural and biochemical properties and serological relationship of 10 animal and 7 human strains of *Vibrio foetus*, 3 animal strains of *Vibrio bubulus*, and 4 human strains of a 'related *Vibrio*'. The human strains of both species, all blood isolates from the 11 cases referred to in this paper, were submitted for identification to the Diagnostic Bacteriology Unit of the Communicable Disease centre.

A careful study of the first 3 strains revealed characteristics quite similar to those reported in the written descriptions of the animal pathogen *Vibrio foetus*. For comparative purposes strains of *Vibrio foetus* isolated from animals were obtained.

The author discussed symptomatology of the 15 known human infections with *Vibrio foetus* and the 4 infections with the 'related *Vibrio*'. In the series of *Vibrio foetus* infections, fever was the only symptom common to all cases and it usually was of the undulating type. This led in several instances to the erroneous diagnosis of malaria or brucellosis. Complications following the protracted bacteraemia include abortion or premature birth in 3 cases, paralysis in 4, heart damage in 3 and Phlebitis in 1. Of the various drugs used, for therapy, chloromycetin and aureomycin were used successfully in 3 cases each.

The possible epidemiology of the disease in humans is discussed in the light of what is known concerning the disease in animals. Humans, according to the author, may acquire the infection in the following ways. (1) Direct contact with infected animals, (2) direct Venereal transmission between humans, and (3) contamination of food and water.

A. MUKERJI.

News and Views

Maharshi Karve is 100 years old! Pandit Nehru had flown to Bombay to personally felicitate him. Hardly can we spot out another such dedicated life. To serve in a great cause was his only mission in life. He had chosen women's education as his field. Dr. Dhondo Keshav Karve started his career as a Professor of Mathematics in Poona. Later he established the Widow Re-marriage Association in 1893 and Hindu Widows Home Association in 1895. He founded the S.N.D.T. Women's University which is flourishing even to this day. Next he championed the cause of Village education and toured widely in rural areas. There was nothing that he touched which he did not turn into gold. Such was his self-effacement, self-confidence and indomitable courage, so characteristic of the Maharashtrian race. Recognition came thick and fast. The people presented him with a purse of one lakh of rupees in 1949, when he touched his 91st birth-day. In 1955 he was awarded the Padma Vibushan title and in January of this year the highest award in the gift of the President of India "Bharat Ratna" was bestowed on him. He is a constructive genius who believes in work and not in talk. What a lesson to humanity at large! He has rightly earned the title of 'Maharshi' from the people. We pay our homage to this great son of India.

Extraction of Bran Oil:—The possibilities of extracting 300,000 tons of oil from rice bran were referred to by the Minister for Industry, Mr. Manubhai Shah, when he was asked by Mr. N. G. Goray what steps were being contemplated to encourage such extraction of rice bran oil. Mr. Shah said the Joint Standing Committee for Industry and Scientific Research had recently set up a sub-committee to go into the problems of extraction and to submit a project report. There was in Bombay a project capable of producing about 100 tons of rice bran oil. About its utility, the Minister said the oil could be used both for edible and non-edible purposes like soap-making—in fact, for all purposes that any other vegetable oil could be used.

Study of diseases of wild animals:—"A Veterinary Assistant Surgeon, specially appointed for a study of diseases and treatment of wild animals and birds in captivity, as also in forests and sanctuaries in the State will shortly begin work at the Madras Zoo", says a Press report. This is in accordance with the recommendations of the Seminar held at Bombay and the recommendations of the Interim Indian Veterinary Council at its last meeting. This is only a first step before probably a short course is introduced at the Madras Veterinary College on "Wild animals-in health and disease." We congratulate Madras on so promptly moving in the matter. We do not know if Bombay and Calcutta have made already a similar move; if not, let them hurry up.

Sex behaviour of breeding bulls:—The sex behaviour of breeding bulls under the influence of different systems of rearing is to be investigated under the orders of the Madras Government.

The Scheme is to be worked out at the Livestock Research Station, Hosur, for a period of three years.

The Indian Council of Agricultural Research, on whose behalf the investigation is being undertaken by the Madras Government, bears the entire expense which during the three years, will total up to a little over Rs. 70,000.

Indian Express, Dated April 3, 1958.

Nuclear Contamination of Milk:—London, March 22. Nobel Prize winner, Dr. R. L. M. Synge, said to-day that a child fed on cow's milk in western Britain, was getting 30 to 40 times more strontium into its bones than a child in rural east England. "Even if Hydrogen Bomb tests stopped to-morrow this will go on for the next 30 years", Dr. Synge, who shared the Nobel Prize for Chemistry in 1952, told a "science for peace" conference here. Latest figures showed that the amount of strontium—a dangerous by-product of Hydrogen Bombs—

in the bones of young infants was rising. More radio-active strontium was taken up by the leaves of plants in districts where there was a small amount of calcium or lime-stone in the soil, Dr. Synge said.

Milk Project for Madras:—Madras, March 21. Mr. Walter Nash, the Prime Minister of New Zealand, referred to the Aarey Milk Colony near Bombay, which the New Zealand Government had helped and expressed satisfaction at the working of the colony. Mr. Nash disclosed that the New Zealand Government was likely to assist a similar scheme, which the Madras Government was now working out.

Block Development Corner

[Articles under this section, should be more in the nature of simple 'talks' to rural folks and village level workers, on Animal Husbandry matters, and not loaded with scientific terms and theories.]

GRASS FARMING WITH SEWAGE WATER IN MADRAS*

By

C. RAJASEKHARA MUDALIAR, M.A.

Professor of Botany, Agricultural College Coimbatore, (Retired)

and

Superintendent Sewage Farm, Madras City.

The removal of sewage from human habitations appears to be an ancient problem. Metcalf (1935) states that archaeological discoveries in Asia—Mohenjo-Daro—on the west banks of the river Indus, is believed to be more than 5,000 years old; the excavated buildings in 'Mohenjo-Daro' revealed bath rooms with pipes leading the effluent from the latrines to drains laid outside the houses, and a larger sewer was laid along the street to carry away the sewage. Metcalf (*loc cite*), states that about the middle of the 16th century, the sewage of Bunzlau, a German town was used for irrigating cultivated lands, and that by 1870, about sixty towns in England had tried sewage irrigation. The two largest cities in the world that dispose of their sewage mainly by irrigation are, Berlin and Paris. In Paris in 1923, the volume of sewage was more than 200 million gallons per day, of which 120 mg. was used for irrigating 12,584 acres; while in Berlin in 1926, sewage Farms were treating about 150 m.g.d of sewage on 27,250 acres. In America, sewage irrigation was started very late in 1930.

[* Paper read at the Indian Science Congress Session held at Madras in Jan. '58]

Utilisation of sewage water for cultivation of fodder grasses and food crops is of recent origin in India. Talati (1955), states that in Kanpur, Lucknow and other big cities, utilisation of sewage water for cultivation of food crops has proved increasingly remunerative. In Madras State, sewage water was first harnessed for cultivation of grasses near Madras City, by opening in 1868 a sewage Farm in the northernmost part of the City; since then, cultivation of grasses with sewage water has been sporadic in many Municipalities and Panchayat Boards. The only concerted action on systematic basis was started by Madura Municipality of Madras State in 1925. Attracted by the phenomenal success of this venture, Coimbatore Municipality also took up this scheme in 1950. Bangalore Municipality started sewage farming in 1944. The Corporation of Madras has acquired 200 acres of land in the outskirts of the City in 1954 for Sewage Farming.

Materials and Method

The scheme for the utilisation of sewage of Madras City has been worked out in consultation with Dr. Talati, the Sewage Chemist of the Government of India. The sewage of the city has been decided to be diverted into four different directions, and four separate schemes have been worked out. The scheme No. 1 has been taken up for implementation in the 'second five-year plan'. In this scheme the discharge of sewage effluent amounting to about 10 cusecs is expected to irrigate an area of about 800 acres. The crops proposed to be grown under this scheme are, paddy as monsoon crop, bajri and 'tur' mixture (followed by maize), banana, sweet potato, perennial grasses, vegetables etc. Though 800 acres is the target in this scheme, only 200 acres have been acquired in the village of Selavoyal about 3 miles from Madras City. In this area, water table is about ten feet below ground level during the major part of the year; this area can be roughly divided into four groups, showing various gradations in soil texture, ranging from sandy to heavy silty clay. From a soil survey of the area it is seen that the top layers contain finer fractions than coarse, while the third foot is more sandy. Since the silt is more than clay, it is concluded that the soils of this area can be classified as silty-loam.

Sewage is pumped from a pumping station in the northern part of the city, and carried by 33" cast iron pipes laid for a distance of about 12,000 feet to the sewage farm. Provision has been made for treating the sewage for grit removal, and screening. The sewage was first let into the sewage farm by the middle of August 1957, but nurseries were started in June 1957 by utilising the water from one of the wells in the farm. After tractor-ploughing and disc-harrowing, the plots were laid out in convenient sizes (mostly 1/8 acre plots); one irrigation channel

for two rows of plots was provided; sub-soil drains with porous agricultural pipes were not provided, but 2 feet deep drainage channels were provided at convenient distances to remove all surplus sewage.

Rooted slips of 'Guinea grass' (*Panicum maximum*) were planted on ridges 2½ feet apart and 1½ feet between plants, and cuttings of 'water grass' (*Panicum barbinode*) were planted similarly about the third week of July.

Observations

From the very start the growth of Guinea grass was poor in spite of careful sewage irrigation and draining of surplus sewage, 'Water grass' established well, though its growth in the beginning was rather slow; after two or three irrigations with sewage, 'water grass' grew vigorously, covered the ground quickly, and suppressed the weeds, the most pernicious of which was *Cyperus rotundus*; this weed presents a big problem in sewage-farming in this area. As the growth of Guinea grass was poor, this weed practically suppressed the grass and two or three weedings had to be given with no substantial improvement. During heavy rains it has been found difficult to drain away surplus water quickly; under these conditions the performance of Guinea grass was very poor, while 'water grass' put up vigorous growth. In table No. 1 is given the number of plants that were planted in a plot and the number that have established for Guinea grass; the growth records such as height and the number of tillers are also given in this table. Table No. 2 gives the slips that have established and the percentage establishment to the total for water grass. Usually rooted slips are planted in the case of 'Guinea grass', but in the case of water grass, cuttings from tillers are planted. A trial was conducted to see whether there is any variation in the percentage of establishment, as between cuttings obtained from the bottom portion of the tillers, middle portion of the tillers, and the top tender portion of the tillers; in table No. 3 is given the establishment of tillers obtained from the three groups mentioned above.

Discussion

From table No. 1 it will be seen that in the case of Guinea grass, the establishment of slips varies from 25 to 37.5% whereas from table No. 2 it is seen that in the case of 'Water grass' establishment varies from 87.5% to 92.9%. From the growth records of Guinea grass given in table No. 1 it will be seen that the height varies from 2'-2" to 2'-5" and the number of tiller per plant from 3 to 9. In Coimbatore and Madurai sewage farms where Guinea grass is very successful the height varies from 5 to 6 feet and the tillers in each plant from 15 to 20, as gathered from unpublished reports obtained from these centres. At the sewage

farm at Madras City, the average height of water grass has been observed to vary from 5 to 6 feet; in the sewage farm at Bangalore where Water grass is successful, a record height of 6 to 8 feet has been noticed. It is also gathered from the unpublished reports from the sewage farm at Chidambaram Annamalai University, that Guinea grass was a total failure, while 'Water grass' was a great success.

TABLE I

*Growth measurements and establishment of Guinea grass.
Total planted in each row is 56.*

No. of row	No. of slips established	No. failed to establish	% establishment to total	Height	Tillers
1	15	41	27	2'-8"	5
2	16	40	29	2'-1"	3
3	21	35	38	2'-5"	6
4	16	40	29	2'-7"	8
5	17	39	30	2'-4"	6
6	14	42	25	2'-5"	7
7	20	36	36	2'-5"	8
8	21	35	38	2'-3"	7
9	17	39	30	2'-4"	6
10	12	44	21	2'-4"	6
11	15	41	27	2'-3"	8
12	15	41	27	2'-4"	9

TABLE II

*Establishment of Water Grass slips.
Total No. slips to the row—56.*

No. of rows	No. of slips established	No. failed to establish	% establishment to the total
1	50	6	89
2	49	7	88
3	51	5	91
4	48	8	86
5	50	6	89
6	51	5	91
7	52	4	93
8	48	8	86
9	50	6	89
10	51	5	91
11	48	8	86
12	49	7	88

At the sewage farm near Madras City, the soil is fine silty clay, and so also in Chidambaram it is heavy clay; in both these centres sub-soil drains have not been provided, and it will be seen that in both these centres 'Water grass' is very successful while Guinea grass has failed. In Coimbatore and Madurai farms the soil is clay loam and both

the centres have provided sub-soil drains, and it is seen that Guinea grass is very successful. In Bangalore farm also the soil is clay loam but there are no sub-soil drains. It is therefore clear that where the soil is heavy clay, Guinea grass does not thrive, and that Guinea grass requires good sub-soil drainage facilities for proper growth. It is also clear that 'Water grass' thrives very well in clay soils, and even if there are no sub-soil drains. It is seen that with regard to the establishment of Water grass cuttings, there appears to be no difference whether the cuttings are obtained from the bottom, middle or top portions of tillers.

TABLE III

*Establishment of 'Water Grass' cuttings taken from bottom, middle, and top portions of tillers,
Total No. slips to the row—25.*

No. of rows	Slips from bottom portion			Slips from middle portion			Slips from top portion		
	No. established	No. failed to establish	% to total						
1	24	1	96	21	4	94	24	1	96
2	25	—	100	23	2	92	24	1	96
3	24	1	86	22	3	88	23	2	92
4	25	—	100	22	3	88	23	2	92
5	25	—	100	24	1	96	24	1	96
6	25	6	100	24	1	96	28	2	92
7	24	1	96	23	2	92	24	1	96
8	23	2	92	24	1	96	24	1	96
9	24	1	96	23	2	92	23	2	92
10	23	2	92	24	1	96	23	2	92
11	23	2	92	22	3	88	28	2	92
12	23	2	92	23	2	92	24	1	96

Conclusions

(1) Heavy clay soils appear to be unsuitable for Guinea grass, while 'Water grass' thrives well under similar conditions.

(2) Guinea grass requires good drainage facilities such as sub-soil drains, in clay soils; while 'Water grass' puts up vigorous growth under similar conditions, and even when the fields are water-logged.

(3) Cuttings of water grass whether from bottom, middle or top portions of tillers, behave similarly in the matter of establishment after planting.

REFERENCES

1. Talati, R. P. (1955) ... *Indian Farming*, Dec. '55, Vol. 5.
2. Metcalf, L. (1935) ... *American Sewage Practice*, (McGraw Hill Book Co., New York, 1935.)

Hallo!

Have you sent in your contribution to the *I.V.J.* Reserve Fund?
It is given twice, if given quick!

Farm News Releases

Fodder Jowar Responds to Manuring.—*Jowar* grown for fodder responds very well to manuring.

It has been found that a dose of 50 pounds of nitrogen (250 pounds of ammonium sulphate) per acre increases the fodder yield by a 100 to 150 maunds, provided the soil has a good store of moisture.

Under unirrigated conditions, a 100 pounds of ammonium sulphate per acre are recommended for application, especially when the farmer is unable to apply sufficient quantity of cattle manure to the crop. The fertilizer is best applied at sowing time.—I.C.A.R. No. 18/58.

THE PRICE OF RE-PRINTS OF I. V. JOURNAL IS AS UNDER

No. of pages	No. OF REPRINTS.				
	25	50	100	200	300
1	Rs. 2-8-0	Rs. 3-0-0	Rs. 4-0-0	Rs. 5-0-0	Rs. 6-0-0
2	„ 3-8-0	„ 4-0-0	„ 5-0-0	„ 6-0-0	„ 7-0-0
3	„ 4-8-0	„ 5-8-0	„ 7-0-0	„ 9-0-0	„ 11-0-0
4-5	„ 6-8-0	„ 8-8-0	„ 11-8-0	„ 17-8-0	„ 23-8-0
6-7	„ 8-8-0	„ 10-8-0	„ 13-8-0	„ 19-8-0	„ 25-8-0
8-9	„ 10-8-0	„ 12-8-0	„ 15-8-0	„ 21-8-0	„ 27-8-0
10-11	„ 12-8-0	„ 14-8-0	„ 17-8-0	„ 23-8-0	„ 29-8-0
12-13	„ 14-8-0	„ 16-8-0	„ 19-8-0	„ 25-8-0	„ 31-8-0
14-16	„ 17-8-0	„ 19-8-0	„ 22-8-0	„ 22-8-0	„ 34-8-0

Postage is additional. Extra charge is made for reprints containing photo-prints on art paper. Normally re-prints are prepared *without covers* unless specifically ordered, in which case the actual cost of covers and their printing will be recovered.

MEMOIR

Late Sri THOTA SESHACHALAM NAIDU

We deeply regret to record the sad demise of Sri T. Seshachalam Naidu, who retired as Superintendent of the Livestock Research Station Lam, Guntur District. He was 62 years of age at the time of his death, on 2nd November 1957. He came out of a highly respectable family and after having had his training at the Agricultural College, Coimbatore, he joined as an Agricultural Demonstrator and worked in several places in that capacity in the old composite State of Madras. Later on, he was selected for livestock work and had his post-graduate training in Dairying at the Indian Dairy Research Institute. He was mainly responsible for bringing up the livestock farm at Lam, Guntur to its present high standard. His devotion to duty gained the approbation of all his Senior Officers. He had an eye for details and could command labour in a remarkable manner. He was a popular figure in social circles and was highly entertaining in conversation.

He leaves behind his aged mother and his wife, to whom we offer our heartfelt condolences.

Sri V. P. NARGUNAM NADAR

We are deeply grieved to record the premature death of Sri Victor Pandian Nargunam Nadar, B.V.Sc., at the early age of 39. He was one of the first batch of B.V.Sc's and after graduation, he joined the Animal Husbandry Department, Madras and served in several places in that state. He was a popular figure wherever he was and his death on 28th February 1958 came as a shock to many. He leaves behind his wife and six children. We offer our heart-felt condolences to them. May his soul rest in peace!

Announcements

I. The following is sent by the Principal, Madras Veterinary College

UNIVERSITY OF MADRAS
DEGREE OF MASTER OF VETERINARY SCIENCE
(M.V.Sc.)

REGULATIONS ISSUED

1. *Conditions of Admission.*—No Candidate shall be admitted to the Examination for the Degree of Master of Veterinary Science unless he produces satisfactory evidence to the effect that—

(i) he has passed the B.V.Sc. Degree Examination of this University or an examination of any other University recognized by the University as equivalent thereto.

(ii) has undergone a course of study extending over a period of two academic years in an institution recognized by or affiliated to the University.

2. *Course of Study.*—The course shall comprise the study of anyone of the following branches according to the syllabus prescribed from time to time. One of the subjects in the branch shall be taken as main subject and the other two as subsidiary subjects:—

BRANCH I
Anatomy.
Surgery.
Obstetrics and Diseases of
the reproductive system.

BRANCH II
Physiology.
Pharmacology and Materia
Medica.
Therapeutics.

BRANCH III
Pathology.
Bacteriology.
Parasitology.

BRANCH IV
Hygiene.
Preventive Medicine.
Meat and Milk Hygiene.

BRANCH V
Animal Genetics.
Animal Nutrition.
Dairy Science.

3. *Duration of the Course.*—The course for the Degree of Master of Veterinary Science shall extend over a period of two academic years—July to March each year and the examination shall be held once a year, in the month of April.

4. *Scheme of Examination.*—The Scheme of examination for all the branches shall be as follows:

Main Subject:	Hours.	Marks.
Paper I	3	100
Paper II	3	100
Practical I	3	50
Practical II	3	50
Oral	—	50
Subsidiary Subject I:		
Written	3	100
Practical	3	50
Oral	—	50
Subsidiary Subject II:		
Written	3	100
Practical	3	50
Oral	—	50
Dissertation	—	50
Total.		800

Note.—A dissertation will be on a topic chosen previously by the candidate in consultation with the Professor and within the ambit of the Main subject offered by the candidate. This dissertation shall not exceed 30 pages and should show evidence of the candidate's ability to collect pertinent data and draw conclusions therefrom.

5. *Attendance at Lectures.*—No candidate shall be eligible to sit for the examination unless he has put in at least 75 per cent of the attendance at lectures and practical classes and has been certified by the concerned Professors that he has attended the course of instruction both theoretical and practical in the subjects prescribed for the Branch chosen and has satisfactorily completed the course.

6. *Passing Minimum.*—A candidate shall be declared to have passed in the examination if he obtains not less than 50 per cent of the marks in the written, practical and *viva voce* examinations separately in each subject of the Branch chosen, and not less than 50 per cent in Dissertation. All other candidates shall be deemed to have failed in the examination.

7. *Classification of Successful Candidates.*—A candidate passing the whole examination at the first attempt and securing not less than 60 per cent of the total marks in the Branch shall be placed in the first class, and all other successful candidates shall be placed in the second class.

A candidate who secures not less than 75 per cent of the aggregate marks in any subject shall be declared to have passed the examination in that subject with distinction.

8. *Exemption from Re-examination.*—A candidate who fails in the examination but obtains the prescribed minimum marks for a pass in any subject shall be exempted from re-examination in that subject. He shall be credited with the marks obtained in the Dissertation. A candidate who fails in Dissertation shall be permitted to resubmit the same on a second occasion.

9. *Number of Appearance.*—No candidate shall be permitted to appear for the M.V.Sc. Degree examination on more than three occasions.

10. *Symbolic Representation.*—Symbolic representation shall be adopted in declaring the results and a statement of detailed marks shall not be furnished:

Symbol A will denote 60 per cent and above of the marks.

Symbol B will denote 50 per cent and above of the marks but below 60 per cent.

Symbol D will denote Distinction as having obtained not less than 75 per cent in that subject.

Symbol F will denote Failure.

A few priced copies of the reprint of this notification are available at the I.V.J. Office at 50 nP. each, inclusive of postage.

II. The following is sent by the Secretary of the I.C.A.R.

" INDIAN DAIRY YEARBOOK "

The Indian Council of Agricultural Research has undertaken to publish annually an Indian Dairy Yearbook containing salient features of the dairy industry in India. This Yearbook will contain information about livestock census; intensity of production of milk per sq. mile; distribution of dairy cattle in different areas; centres of export and prices for dairy cattle; milk production and consumption in India and other countries; prices of milk and its trend during the recent past; import of dairy products for the previous 50 years; quality standards for milk and milk products under Food Adulteration Acts and Agmark Schemes; statistics about organised milk and dairy schemes in various States together with requirements and present sources of supply of equipment with plans for their development etc. It will also contain list of officials and private persons engaged in the Dairy Industry and a list of manufacturers and dealers of dairy machinery in India and abroad as well.

The above information is being collected from the various Ministries and State Government and private institutions. However in order that the Yearbook may be as comprehensive as possible all those directly or indirectly connected with the Dairy Industry are requested to supply to the Secretary, Indian Council of Agricultural Research, New Delhi, such information as they think will be of value for the Yearbook.

In particular, persons who are trained in Dairying or are working in the Dairy field should kindly supply their particulars for inclusion in the Yearbook. They should give their names, date of birth, qualifications with years of passing, experience including main positions held and their present post.

Manufacturers and dealers of Dairy equipment should also supply information about the items manufactured or supplied by them for the industry.

All inquiries as to the form etc., in which the information is to be supplied may please be sent to the Secretary, Indian Council of Agricultural Research, New Delhi.

As it is desired that the Yearbook should be published during 1958, it is necessary that the statistical and other information are supplied by 15th May at the latest.

Business enquiries from advertisers, sale of cuts etc., will also be welcome.

Association News

The All-India Veterinary Association

THE I.V.J. RESERVE FUND

LIST OF SUBSCRIBERS

	Rs. nP.
1. Dr. M. S. Sastry, President, A.I.V.A.	... 100-00
2. " T. Vinayaka Mudaliar, Editor, I.V.J.	... 100-00
3. " P. Srinivasa Rao, Ex-Editor	... 116-00
4. " Bertie A. D'Souza, Principal, Madras Veterinary College	... 100-50
5. " C. Krishna Rao, Dy. Director, Hyderabad, A.P.	... 50-00
6. " D. Mariappa, Madras Veterinary College	... 50-00
7. " G. Venkatachalam, Agrl. College, Coimbatore	... 50-00
8. " P. Soundararajulu, Principal, Vety. College, Tirupati, A.P.	... 50-00
9. " M. S. Jayaraman, V.A.S., King Inst. Madras (in four instalments)...	30-00
10. " Capt. I. S. Malhotra, Assam	... 25-00
11. " M. K. Srinivasan, I.V.R.I.	... 25-00
12. " P. R. Nilakantan, I.V.R.I.	... 20-00
13. " P. K. Ramachandran, I.V.R.I.	... 10-00
14. " P. M. Joshi, Cambay, Bombay	... 10-00
15. " G. T. Reddy, Kalwakurti, A.P.	... 3-00

Cheques, money orders and all correspondence be addressed to the Editor, The Indian Veterinary Journal, Madras-17.

THE WEST BENGAL VETERINARY ASSOCIATION

(Affiliated to A.I.V.A.)

[Regd. with Joint Stock Companies Under Societies Act XXI of 1860.]

Annual General Meeting

The annual general meeting of the above Association was held on 6-4-58 in the registered office of the Association. Dr. M. R. Sen presided. The following office bearers have been elected to hold the office for the year 1958.

President :	— Dr. Ahad, G.B.V.C.
Vice Presidents :	— Dr. B. J. Banerjee, G.V.Sc., P.G. Dr. S. L. Sen, G.B.V.C.
Hony. General Secretary :	— A. Chatterjee, B.A., G.V.Sc., D.N.
Joint Secretaries :	— A. K. Chowdhury, M.Sc., G.V.Sc. D. K. Biswas, B.Sc., B.V.Sc.
Asst. Secretary :	— D. B. Mukherjee, B.Sc., G.V.Sc., P.G.
Treasurer :	— P. C. Sen Gupta, G.B.V.C.

Members :

G. M. Banerjee, G.B.V.C.	A. Chatterjee, B.V.Sc.
M. R. Sen, G.B.V.C.	Mrs. K. Dutta.
U. P. Saha, G.V.Sc.	M. Banerjee, G.B.V.C.
I. Kuruvilla, G.M.V.C., B.V.Sc.	P. K. Sinha, M.Sc., G.V.Sc.
S. C. Giri, G.V.Sc.	S. C. Gupta, G.B.V.C.
P. K. Bose, G.B.V.C.	D. B. Chatterjee, G.V.Sc., P.G., D.T.V.M.
H. L. Roy, G.V.Sc.	(Edin.)

The outgoing Secretary's report was read by Dr. B. J. Banerjee. It was also resolved that the Association should publish a journal, which should be an organ of the Association.

ANUPAM CHATTERJEE,
Hony. Secretary.

THE MYSORE VETERINARY MEDICAL ASSOCIATION

An emergent meeting of the Executive Committee was held on 24-4-58 at 5-30 p.m. The following resolution was passed :—

The Editor of the *Indian Veterinary Journal* be informed that in view of the fact, the date for the inauguration of the Silver Jubilee Celebrations of the Mysore Serum Institute has to be fixed in consultation with the Secretary to the Governor, who has at present informed that His Highness will not be free till the last week of July 1958, the exact date will be communicated to the *Indian Veterinary Journal* soon after this is finally settled. Steps are being taken to expedite the same.

Bangalore, }
24-4-58. }

R. D. NANJIAH,
Honorary Secretary.

[Note:—We regret to disappoint the profession once again. The All-India Veterinary Conference is scheduled to be held with the Silver Jubilee Celebrations. Editor, I.V.J.]

THE BIHAR VETERINARY ASSOCIATION

The following resolution was adopted at the Seventeenth Annual Conference of the above Association held at Patna on 9th February 1958.

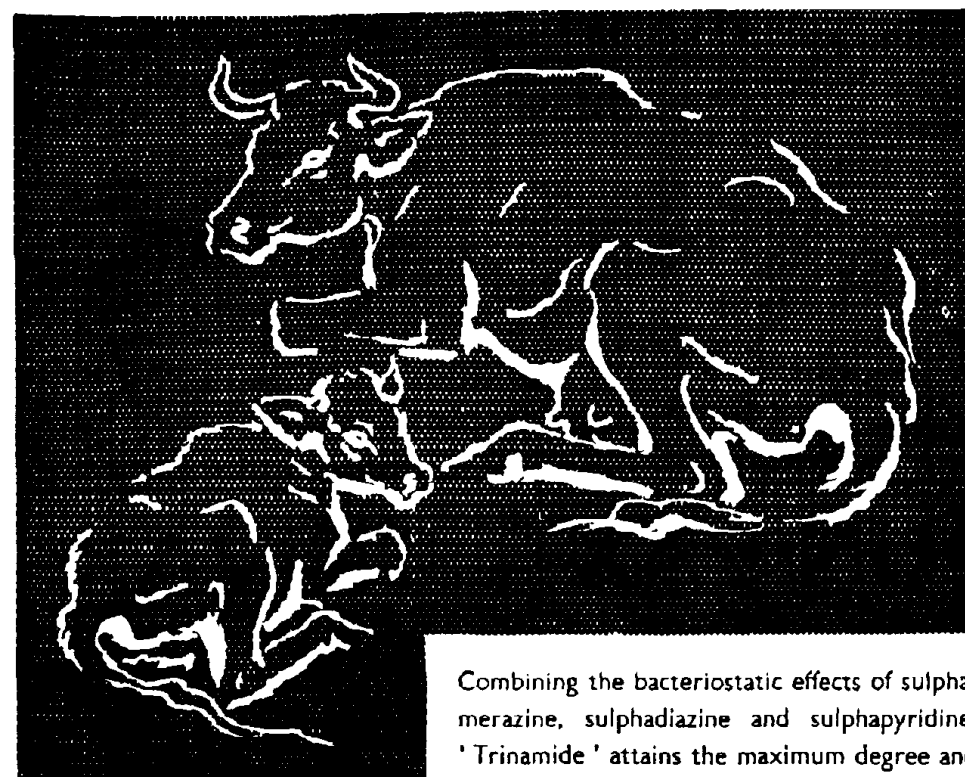
RESOLUTION No. 2

"Unanimously resolved that the All-India Veterinary Association be invited to hold its next session in Bihar on the occasion of the next annual general conference of Bihar Veterinary Association."

R. Y. PANDEY,
Secretary.

ADVERTISEMENTS

AN M&B SULPHONAMIDE PREPARATION for the treatment of BACTERIAL INFECTION



Combining the bacteriostatic effects of sulphamerazine, sulphadiazine and sulphapyridine, 'Trinamide' attains the maximum degree and range of activity against common animal pathogens, while reducing the risk of crystal deposition in the urinary tract. The product is readily absorbed after oral administration and therapeutic blood levels are maintained for prolonged periods of time. Treatment is based on a single daily administration of the drug and 'Trinamide' is therefore of special interest in large animal practice.

SUPPLIES

Containers of: 250x0.5 gramme tablets
20x5 gramme tablets



MANUFACTURED BY
MAY & BAKER LTD

TRINAMIDE
TRIPLE SULPHONAMIDE ASSOCIATION

VA160-78

Distributed by

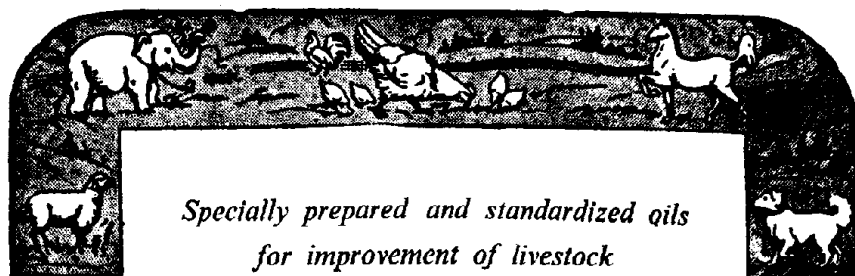
MAY & BAKER (INDIA) PRIVATE LTD • BOMBAY • CALCUTTA • GAUHATI • MADRAS • NEW DELHI

When writing to advertisers, please mention *The Indian Veterinary Journal*.

JL
KZ m2, N24
N58-35.5

ADVERTISEMENTS

**VETERINARY
VITAMIN
OIL**



*Specially prepared and standardized oils
for improvement of livestock*

UNIVAX

40,000 units of Vitamin A
4,000 units of Vitamin D
per fl oz

TRIVAX

1,60,000 units of Vitamin A
16,000 units of Vitamin D
per fl oz

Excellent sources of Vitamins A & D
for animal and poultry feeding. They
enrich milk, improve poultry products
and contribute to the well-being of
livestock.

Pamphlet gladly mailed on request

**GOVERNMENT OIL FACTORY
KOZHIKODE**

Department of Industries & Commerce
Kerala State.



When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

**B. C. P. W.
NOVOLEP**

A PREPARATION FOR EXTERNAL APPLICATION
ON WOUNDS AND SORES OF ANIMALS

CONTAINS DDS AND ALLIED ORGANIC COMPOUNDS

*NOVOLEP is an excellent fly repellent when
applied to wounds and sores. Specially useful
in the treatment of 'hump sore' and also
- 'foot sore' in Foot and Mouth disease. -*

USED EXTENSIVELY WITH CONSIDERABLE SUCCESS
IN BENGAL VETERINARY COLLEGE HOSPITAL

Available in Bottles of 4 ounce, 1 lb. and 10 lbs.

BENGAL CHEMICAL

CALCUTTA — BOMBAY — KANPUR

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**

An Indispensable Book

Hagan's **INFECTIOUS DISEASES OF DOMESTIC ANIMALS**,
3rd ed. 1957, 968p, 171 illus, (with special reference to
Etiology, Diagnosis and Biologic Therapy)
Sh. 84/- Rs. 52.50 nP. only per copy.

Order your requirements today

SVASTIK SALES COMPANY, SPECIALISTS IN VETERINARY BOOKS
PAREL • BOMBAY • 12

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

Veterinary & Animal Husbandry Made Easy

Read following publications in Hindi and aid in building New India,
Used extensively in Agricultural and Veterinary Colleges and Schools,
Stockmen and Stock Supervisor Centres, Basic Schools and
by Stock Owners all over Indian Union.

Second edition of PASU SANKARAMAX ROG CHIKITSHE.

Well corrected and up-to-date treatment. Great reduction in price.

1. PASU SANKARAMAX ROG CHIKITSHE
Deals in contagious diseases Rs. 3/-
2. PASU CHIKITSH BIGIN
Deals in non-contagious diseases, medicine, anatomy, etc. Rs. 1/14/-
3. PASU PALAN BIGAIN
Deals in Animal Husbandry Rs. 1/14/-

KUMAR SANTOSH SINGH,

C/O R. P. SINGH,

LECTURER, ANIMAL HUSBANDRY, AGRICULTURAL SCHOOL,

P.O. BODH GAYA, DT. GAYA, BIHAR.

MASTISIN: Economical and specific cure for
all forms of Mastitis, Pasturellosis,
Trypanosomiasis, Nasal Schistosomiasis, etc.

Mastisin is our best assistant where the anti-
biotics and sulphas have failed, is the opinion
of Veterinarians.

Available in 2-lbs packing with ointment Price
Rs. 6.25 for one full course.

CANCERINA: The only cure for cancerous
horn. Without internal treatment
cure is not possible, is the outcome of survey.

PRANAVA: External treatment for cancerous
horn. Highly appreciated as dress-
ing in many diseases. Still economical.

Full course for one animal is 6 lbs of Cancerina
and 3 lbs of Pranava. Lessens trouble. Price
Rs. 15.50.

Mastisin up to two courses is not possible to be
booked by rail. Postal orders must accompany
50% advance to cover postage. Give the nearest
railway station to get them cheaper.

Literature on demand.

DEEBEE BROTHERS

1706, KHADIA JALOWALI NAKA, AHMEDABAD

VETERINARY BOOKS Just received

	Rs.	ap.
DUKE's: Physiology of Domestic Animals 1957rp. Sh. 90/- 111td.	50	00
WRIGHT's: Veterinary Anaesthesia 1957 111td.	90	00
UDALL's: Practice of Veterinary Medicine 1954 Sh. 72/- 111td.	44	00
BVA: Handling of Animals & First Aid 1951 111td.	4	50
MUDALIAR: Handbook of Animal Husbandry & Dairying 1956 111td.	8	75
MERCK's: Veterinary Manual 1957rp. abt. 1400p. thumb-indexed	37	50
British Veterinary Codex 1953	33	75

Available from

SARCOR BOOK COMPANY

PALLIARAKAV ROAD, COCHIN 2, (S. India).

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

Telegram—CRESCENT

Telephone—34-3104

RINDERPEST ERADICATION SCHEME BRAND VACCINATED ANIMALS WITH "P.E.W. BRANDING INK"

A scientific chemical combination.

Produces a lasting and distinctly visible brand,
usable on Cattle and Buffaloes. Application very
easy, quick and absolutely economical. No wastage.
Already tried on one lakh of animals with great success.

It permeates into the layers of the skin evenly
over the branded area and forms an antiseptic dry
scab that peels off in a few weeks, leaving a well
defined easily visible brand mark. It does not
produce any open wound and thus serve as a source
of infection.

ALREADY SUPPLIED TO THE DIRECTOR OF VETERINARY
SERVICES AND ANIMAL HUSBANDRY,
WEST BENGAL.

TRY ON YOUR ANIMALS ALSO.

This can be supplied in any quantity along with
Branding Iron (as per specification), G.T.V. set and
G.T.V. Stainless Steel needle.

★

For further particulars, please apply to:

PAUL'S ELECTRO WORKS

39, JORAPUKER SQUARE

Post Box No. 11406

CALCUTTA-6

When writing to advertisers, please mention *The Indian Veterinary Journal*.

Burdizzo Castrators with Patent Cord-Stop at Jaws:



Beware of Imitation.

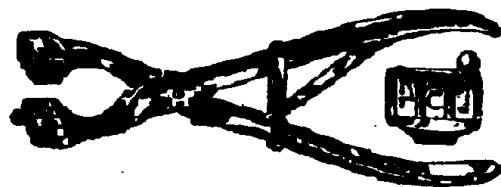
Do not be misled by spurious makes.

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 a 3 Space-Forceps, 2 Sets of Figures, Complete Alphabets, and Tattooing ink.

*Further particulars on request from the
Representatives and Distributors:—*

Dr. PANGAL'S VETERINARY INSTITUTE,
26, Wallajah Road, MADRAS 2, (S. India).

Printed by T. Kannabiran, at The Paramount Press, (Proprietors: Jaya & Co.) High Road,
Triplicane and published by Rao Sahib T. Vinayaka Mudaliar, O.M.V.O., Editor,
The Indian Veterinary Journal, 28, First Street, Vidyodaya East, T.Nagar, Madras-17.