

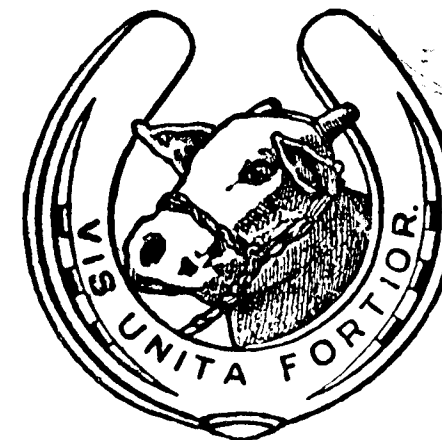
Vol. XXXII, No. 6

MAY, 1956

THE INDIAN VETERINARY JOURNAL

(The Journal of the All-India Veterinary Association)

*A Bi-Monthly Record of
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[THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION]

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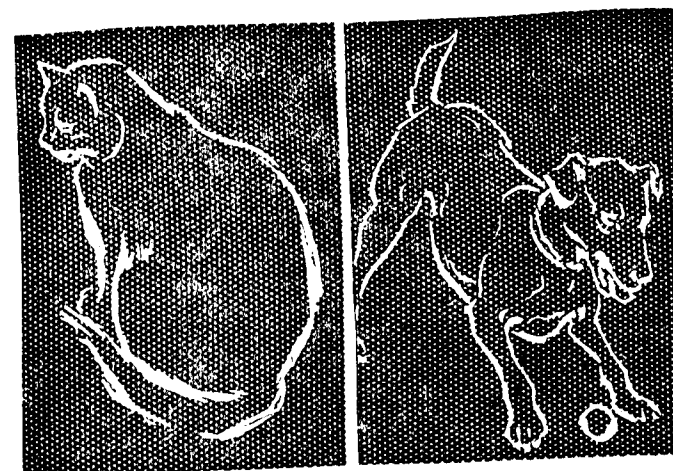
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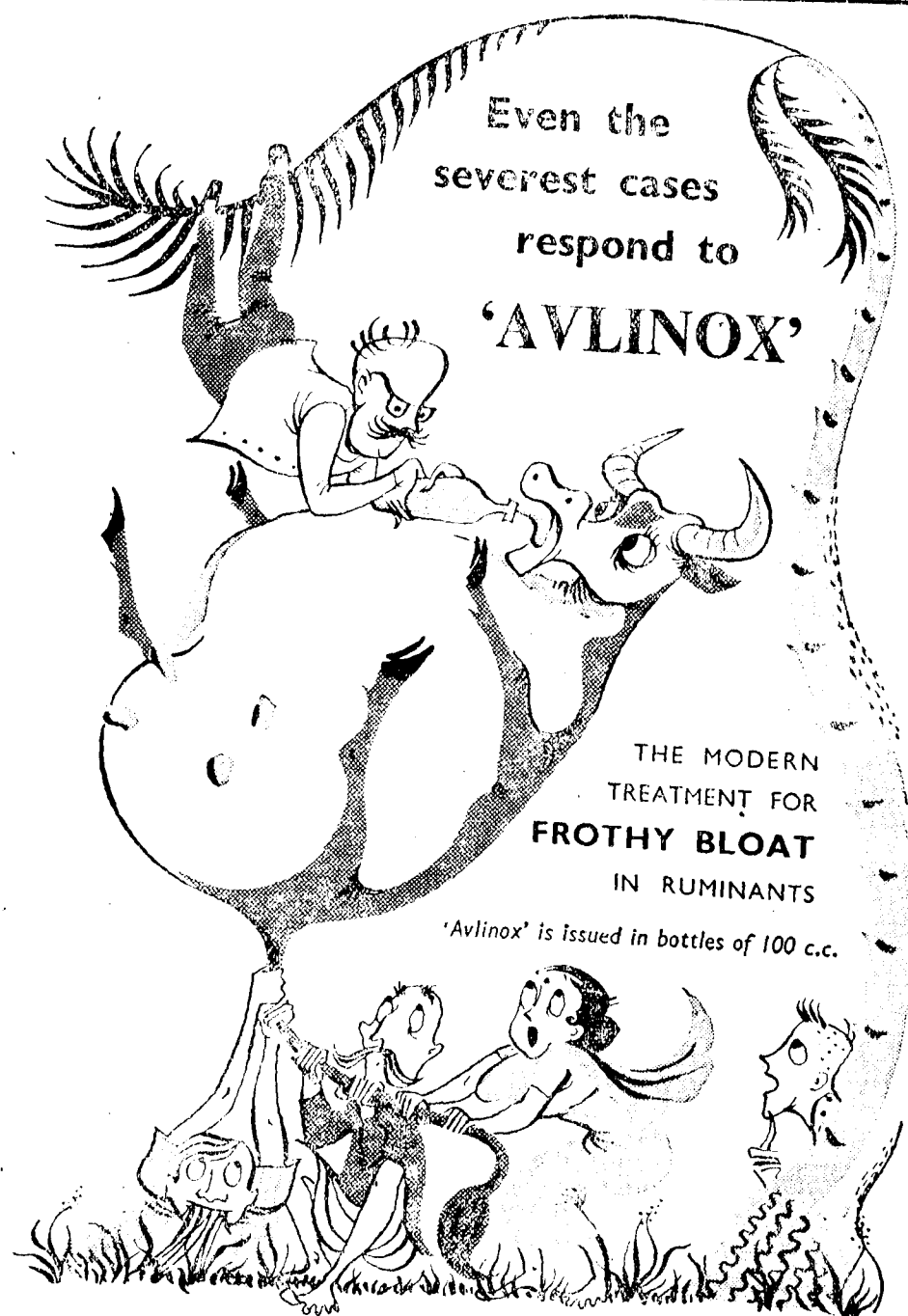
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THE Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. XXXII

MAY, 1956

No. 6

Editorial

RETROSPECT AND PROSPECT

THE BIRTH of the *Indian Veterinary Journal* about 33 years ago is now a matter of history, which has been duly recorded from time to time in the pages of this *Journal* for the benefit of the rising generation of the Indian Veterinarians. Our Silver Jubilee Number (July 1949) gives an exhaustive account of the trials and tribulations, the *Journal* had to go through in the early years of its existence. A few copies of that number are still available with us for sale at Rs. 5/- a copy. The new entrants to our profession after 1949 may do well to get a copy each for his/her private library.

The *Indian Veterinary Journal* is a monumental edifice, which will stand to the credit of the All-India Veterinary Association through ages to come. Perhaps we are too near the events of history to get a proper perspective and appreciate them. But the impartial historian of the future will not fail to appreciate the great part played by the All-India Veterinary Association in the development of Veterinary Science in this land.

This *Journal* was practically started as a labour of love and continues to the present day more or less on the same lines. It is just as well it was so and continues to be so. If it was started as a business proposition, its history might have been different. But events are marching too fast now a days and the

Indian Veterinary Journal has to assume greater responsibilities on behalf of the profession. This has been exercising the minds of all those who are actively connected with the publication of this *Journal* and several schemes are under consideration. Time may not be far off when the All-India Veterinary Association will have to decide definitely the future set-up of this *Journal*. Be it remembered that it is the sweat of the honorary workers and the unstinted support of the profession that kept this *Journal* alive all these years. Silver and Gold, it had none; but it had what is far more precious, the love of the entire profession which made it possible for such dedicated service on the part of all concerned.

Of late, there has been a growing demand to convert this *Journal* into a monthly. Its popularity amongst the ever increasing circle of scientific workers, is also on the increase. Judging from the rush of articles received now a days, we feel confident we can take the next step of converting this into a monthly. In fact there should be a section in our *Journal* for extracts and abstracts, which we are not able to do because of the limited conditions under which we are working now. However we are taking all steps possible, to achieve this object in the near future and we look up to the profession to help us in the matter. They can do this in two ways. First, they can help us to enlist more number of subscribers, through their personal efforts and influence. Each one could try and add one more *at least* to our list. If this is done we would have doubled our circulation. Is it too much to expect this of our profession? We hope not. Secondly they can help by clearing up their own arrears of dues immediately. On this question of arrears, we are experiencing insurmountable difficulties. Perhaps it is our own fault to some extent. We have not been very prompt in sending our bills and that is due to an under-staffed office. Even so, the members of the profession could help us a lot by sending in their subscriptions without waiting for our bills and reminders.

Again they can help us by honouring the V. P. P., when sent at the beginning of each volume. It has been our bitter experience year after year, to get back a large proportion of such

V. P. P's returned as 'refused', thus causing us great financial loss. So we propose stopping this V. P. P. system and insisting on pre-payment of subscriptions. We appeal to all our subscribers to help us in the matter.

Next, the Veterinary Assistant Surgeons who get this *Journal* supplied free by the Government have a great moral responsibility in the matter. They have to keep them safe, bring them to account and hand them over to their successors for subsequent stock verification certificate. Any negligence on their part leads to endless trouble when our bill is presented to higher authorities. We are sometimes asked to re-place a number of our back issues on the plea of their not having been "received". This strange request and intimation comes to us after a lapse of nearly one year or more in most of the cases. Our embarrassment can better be imagined than described. We try to oblige as much as possible; but there cannot but be a limit on all such cases of replacement. We wish to assure our subscribers that we are now taking every possible care at our end to look to the safe despatch of our *Journal*, under personal supervision. We appeal to one and all of our subscribers to ensure similar safe receipt at their end.

The *Indian Veterinary Journal* is now being released regularly in the first week of its month of publication and as such it must be possible for our patrons to keep a watch and inform us of all such cases of non-receipt of the *Journal*, before the month is out. Similarly intimation of change of address may be prompt and not delayed. We should not be held responsible for losses in postal transmission and threatened with withholding of payment on that score. Addressess when intimated may be written in block letters to avoid mis-reading of names.

Now we propose to bring about a slight change in the numbering of our volumes. At present our *Journal* year is from July to June. This is inconvenient in more ways than one. We wish to bring our *Journal* in line with other scientific publications of the world by adopting the calendar year. Incidentally it will meet the trade requirements of our Advertisers and the wishes of most of our foreign subscribers. Hence the next number

viz. Vol 33 will begin in July 1956 as usual but end in December 1956 and consist only of 3 numbers. The subscriptions, both received and claimed will be adjusted suitably. The subsequent Volume *viz* No. 34 will begin from January 1957 and follow the calendar year thereafter with each volume. We request our subscribers to note this change in particular.

Next the question of converting this *Journal* into a monthly depends largely on the response we get from the profession to our appeal on the lines indicated above and also on the continuity of volume of articles of quality received for publication. This will be studied carefully for some more time, before a decision is taken. With it is also involved the question of increased rate of subscription and the re-organisation of the Editorial staff and office. All these are receiving the careful consideration of the Council of the All-India Veterinary Association and we assure our readers that nothing will be done in a hurry or in a hap-hazard manner. We only look forward to the continued, or should we say, to the increased support of the profession.

Long live the *Indian Veterinary Journal*!

NOTICE

Please note the proposed change in the 'Volume Year' of the *Indian Veterinary Journal*. Details are given in the Editorial.

Our subscribers are requested to fill in the money order form enclosed and arrange to remit their subscriptions in advance. The V. P. P. system is discontinued. Please see editorial.

A VALUABLE WARNING

It has become quite common these days to speak of Laboratory work and Field work, Fundamental Science and Applied Science, Research work and Field Investigation work, Animal Husbandry and Disease Control etc. as if they are pairs of opposites. Men engaged on such work often give one the impression that they consider their respective field as an exclusive privilege or a sanctum-sanctorum, which should not be allowed to be defiled by inquisitive workers of other fields. How unscientific is such an attitude is clear from a lecture delivered by Mr. J. E. Lancaster of F.A.O. which we publish in this issue. How work in one field is dovetailed with the other; how one is inter-dependent on the other; how one cannot exist without the other and how any form of Animal Husbandry work cannot progress without proper disease control programme, are all well brought out and implied in that article. In an unobtrusive manner, Mr. Lancaster clearly states that "there must be a very close co-ordination between the Laboratory and the field." He then suggests that there should be a diagnostic Laboratory Unit attached to each farm.

Nothing could be more harmful to the advancement of Science than this tendency on the part of scientific workers to assume the role of split personalities and trying to keep themselves in water-tight compartments.

When the country is planning for expansion of Poultry Development on an un-precedented scale, Mr. Lancaster's warning on what he calls 'Laboratory contamination' has not come a day too soon. It is a valuable warning which should set people thinking. It should not be viewed as a "Damper" or the impression of an inconvenient pessimist. It is a caution signal against possible pitfalls, which should be welcomed by our master-planners and their technical staff. With the increasing use of developing chick embryo for preparation of vaccines of several virus diseases of poultry, the chances of contamination at Laboratory level from other egg transmitted poultry

pathogens should always be borne in mind and the needful done. Mr. Lancaster draws pointed attention to Pullorum disease, visceral form of Leukosis, Infectious Bronchitis, etc.

He has touched upon various other useful suggestions. He says "In Thailand we use the combined Newcastle Disease—Fowl-pox Vaccine for growing stock. Recently we have vaccinated chicks taken straight from the incubator, with both Newcastle disease vaccine given intranasally and pigeon virus given by the feather follicle method."

How practical he is, is evident from his statement. "It is one problem to produce the vaccine, it is another problem to organise the maximum use of the vaccine in the rural areas." And he adds "A number of trained inoculators with adequate transport is essential for a large rural vaccination programme."

Finally he warns "that unless careful measures are taken, the large importation of foreign breeds of poultry can increase the overall poultry disease problem in a country for an indeterminate period of time" and thus disappoint and discourage the village poultry raisers. He suggests "Controlled quarantine measures and initial restricted distribution in the country" as possible precautions to be taken.

We commend his article to all our workers in the poultry field.

Original Articles

THE ANATOMY OF A FOETAL INDIAN ELEPHANT

PART IV

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail

BY

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

[Received for Publication on 30-12-55.]

The Muscles of the Hind Limb

The Lateral Muscles of the Hip and Thigh

1. *Tensor vaginae femoris.* (fig. 1.)

The muscle is large and well developed. It is triangular in form, the apex arising from the external angle of ilium and the base reaching the middle of the thigh for insertion to the fascia lata. The anterior and posterior limbs of superficial gluteus are blended with it along its posterior border. In front of the muscle, the *lateral cutaneous nerve of the thigh* emerges from its deep face to supply the skin.

Nerve supply—Anterior gluteal nerve.

2. *Superficial gluteus.* (fig. 1)

The condition of the muscle is identical with that in the ox. It is 'V' shaped consisting of anterior and posterior limbs arising from the external angle of ilium and gluteal fascia respectively. The anterior limb is blended with the posterior border of the preceding muscle. The upper part of the posterior limb is blended with the anterior border of biceps femoris and the lower part unites with the anterior limb to blend with the preceding muscle for insertion to fascia lata.

Nerve supply—Anterior gluteal nerve.

3. *Biceps femoris.* (figs. 1 & 2)

The muscle is long and narrow confined to the posterior part of the thigh and covering middle gluteus partly. It has extensive origin from the sacral angle of ilium, transverse processes of sacral and first 4 or 5 caudal vertebrae, sacrospinous ligament and tuber ischii. The anterior border above is blended with the posterior limb of superficial

gluteus and below is attached to the fascia lata. The lower part of the muscle as in the ox divides into three parts which are succeeded by aponeurotic tendons for insertion. The anterior part is inserted to the lateral condyle of femur and lateral ligament of patella; the middle part to the tibial crest; and the posterior part to the fascia lata and through it to the tuber calcis.

Nerve supply—Sciatic and posterior gluteal nerves.

Blood supply—Deep femoral, posterior gluteal and femoropopliteal arteries.

4. *Middle gluteus.* (figs. 1, 9 & 10)

The muscle is large and well developed being the largest of the gluteals. It arises from the iliac crest, gluteal face of ilium, sacrosciatic ligament and the transverse processes of sacral vertebrae. The upper part of the muscle is exposed between the limbs of superficial gluteus and the lower part is covered by the biceps femoris and it in turn covers the deep gluteus, sciatic and the gluteal nerves. The muscle has three insertions of which one is by a short thick tendon to the summit of the trochanter of femur and the other two are by fleshy tendons to the lateral face of trochanter and trochanteric ridge.

Nerve supply—Anterior gluteal nerve.

Blood supply—Anterior and posterior gluteal arteries.

5. *Deep gluteus.* (figs. 1 & 9)

The muscle is small and completely covered by the preceeding. It arises from the middle of gluteal face of ilium, iliac shaft and lateral face of acetabulum. The muscle is inserted by a thin flat tendon to the summit of trochanter.

Nerve supply—Anterior gluteal nerve.

Blood supply—Anterior gluteal artery.

6. *Semitendinosus.* (figs. 1, 3, 11 & 14)

It is a long rounded muscle lying behind biceps femoris forming the posterior border of thigh. The muscle arises by a small fibrous tendon in common with biceps femoris from first 3 or 4 caudal vertebrae and by large fleshy tendon from the ventral aspect of tuber ischii. Both the tendons unite to form the body of the muscle which runs behind biceps femoris along the posterior border of thigh. It gradually gains the medial aspect of leg and divides below the stifle into anterior and posterior parts.

The Anatomy of a Foetal Indian Elephant

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail

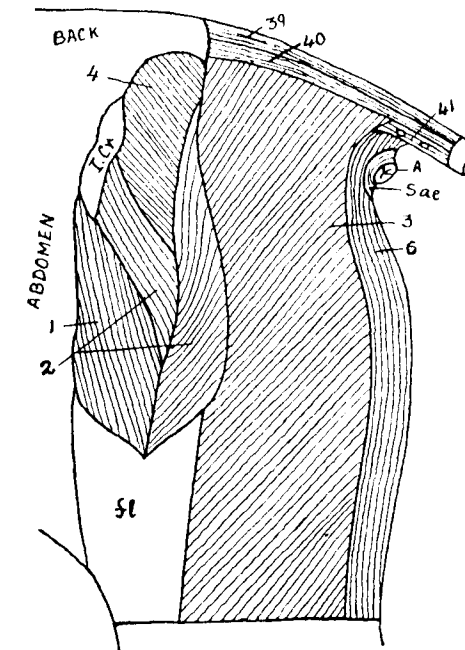


Fig. 1

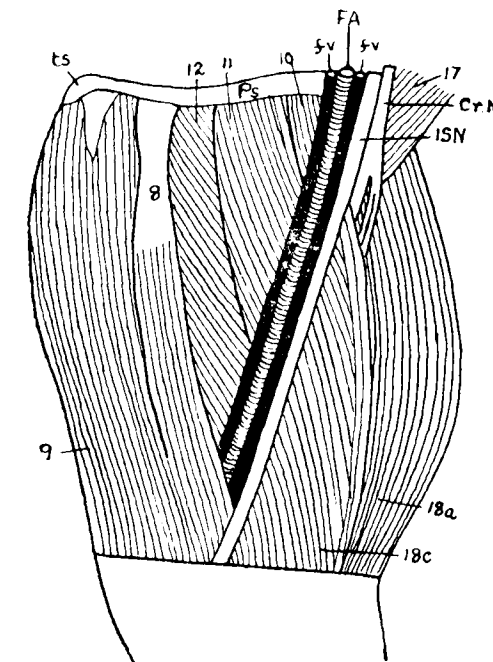


Fig. 2

The Anatomy of a Foetal Indian Elephant

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail

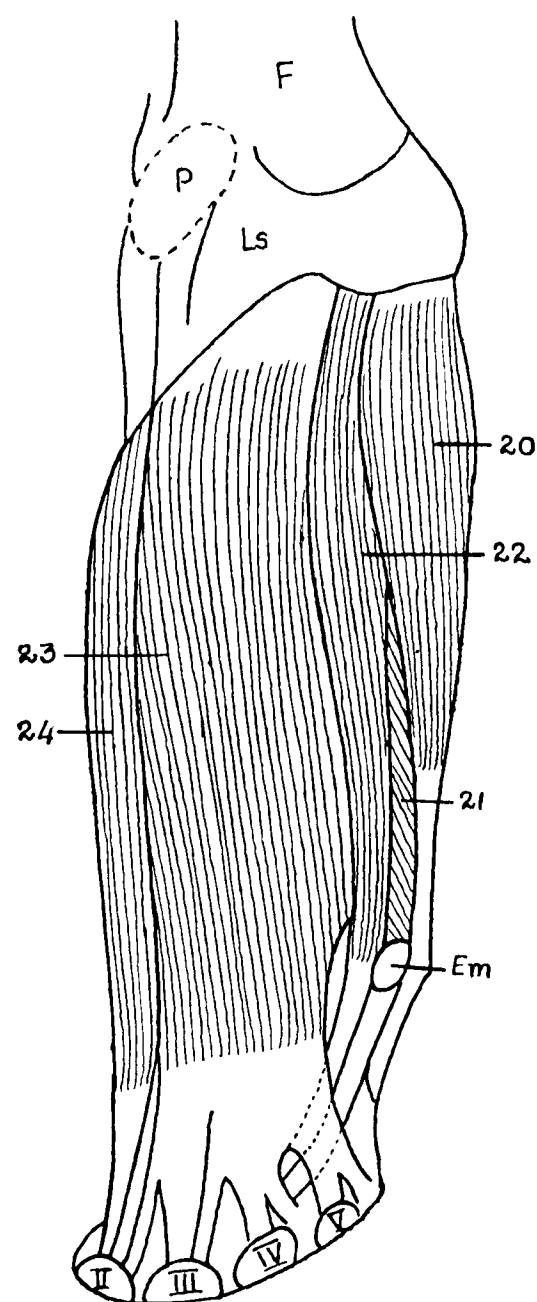


Fig. 4

The posterior part unites with the corresponding part of gracilis to form a round fibrous chord which descends down, expands and is inserted to the I metatarsal. The anterior part of the belly expands which is succeeded by a thick flat tendon that detaches a wide slip for insertion to the medial face of tibia above its middle and descends along the medial border of tibia to its lower end being attached along the border.

Nerve supply—Sciatic nerve.

Blood supply—Posterior gluteal artery.

7. *Gemellus*. (fig. 10)

The muscle is small covering the lateral face of the ischial shaft from which it arises. It is inserted to the upper part of the trochanteric fossa.

Nerve supply—Sciatic nerve.

Blood supply—Posterior gluteal artery.

Medial Aspect of Thigh

FIRST LAYER

8. *Sartorius*. (figs. 2, 3 & 11)

Sartorius and *gracilis* muscles in the elephant are shifted caudalward confined to the posterior part of the thigh exposing the femoral structures (artery, vein and nerve) unlike in the ox and hence there is no femoral canal.

The muscle is thin and flat, arising by an aponeurotic tendon from the posterior part of the pelvic symphysis. The muscle fibres arise from the upper third of the tendon and the belly below becomes wide and flat and blends with the belly of *gracilis* partly covering the *semimembranosus*. The tendon of the muscle separates itself from *gracilis* and is inserted to the upper part of the medial border of tibia.

Nerve supply—Obturator nerve.

Blood supply—Deep femoral and femoropopliteal arteries.

9. *Gracilis*. (figs. 2, 3 & 11)

This is a large flat muscle arising by two muscular heads. The small anterior head arises from the pelvic symphysis behind the preceeding and the posterior large head from the ventral aspect of tuber ischii. Both the heads unite and form a flat belly which blends in front with *sartorius*. The muscle is placed behind *semimembranosus* and medial to *semitendinosus* with which it forms the posterior border

of thigh. Lower down its tendon separates itself from sartorius and divides into anterior and posterior parts. The anterior part is narrow and flat and is inserted to the medial border of tibia below the preceeding. The posterior part is thin and wide which unites with the corresponding part of semitendinosus for insertion to the I metatarsal.

Nerve supply—Sciatic and obturator nerves.

Blood supply—Deep femoral and femoropoplotal arteries.

SECOND LAYER

10. *Pectineus*. (figs. 2 & 10)

It is a small conical muscle arising from below the pubis and inserted to the upper part of medial face of femur. The femoral structures cross over the muscle.

Nerve supply—Obturator nerve.

Blood supply—Deep femoral artery.

11. *Adductor*. (figs. 2 & 10)

This is a large muscle arising from the anterior part of pelvic symphysis behind the preceeding. The lower part of the muscle divides into two parts for insertion to the medial face of femur below and medial to the preceeding. Lower part of the muscle is crossed by the femoral structures.

Nerve supply—Obturator nerve.

Blood supply—Deep femoral artery.

12. *Semimembranosus*. (figs. 2 & 10)

Very large muscle completely covered by sartorius and gracilis. It does not form the posterior border of thigh with semitendinosus as stated by Eales. It arises from the posterior part of the pelvic symphysis and ventral aspect of ischium. The lower part of the muscle is crossed by the femoral structures. The femoral artery pierces the lower part of the muscle to reach the gastrocnemius. The muscle is inserted to the posterior face of femur from below the neck, to medial condyle of femur. *Quadratus femoris* is encircled at the origin of the muscle.

Nerve supply—Sciatic nerve.

Blood supply—Deep femoral and femoropoploteal arteries.

13. *Capsularis*. (fig. 9)

The muscle is well developed and is larger than that of the fore limb being 1.5 cm. wide and 5 cm. long. It is placed between rectus

femoris and iliacus on the anterior aspect of the hip joint. It arises from the anterior border of ilium above the cotyloid rim and is inserted to the capsule of the hip joint and the anterior face of femur medial to that of iliacus.

Nerve supply—Crural nerve (?)

Blood supply—Anterior femoral artery (?)

THIRD LAYER

14. *Quadratus femoris*. (fig. 10)

The muscle is placed below gemellus. It is a large thick band arising from the ventral aspect of ischium being encircled by the origin of semimembranosus. It is inserted to the trochanteric fossa deeper to gemellus.

Nerve supply—Sciatic nerve.

Blood supply—Deep femoral artery.

15. *Obturator externus*. (fig. 10)

This is small placed under the preceeding. It arises from the ventral aspect of pubis and ischium and is inserted to trochanteric fossa by a wide fleshy tendon below the preceeding.

Nerve supply—Obturator nerve.

Blood supply—Deep femoral artery.

16. *Psoas magnus*. (fig. 10)

After the study of abdomen and pelvis, a complete account of the muscle will be given. At present, its tendon uniting with that of iliacus to form iliopsoas is seen. It is inserted by a narrow tendon to a small rough area representing the medial trochanter of femur.

17. *Iliacus*. (figs. 2 & 10)

After the study of pelvis details of its origin and position will be available. At this stage, its wide fleshy tendon is seen uniting with that of preceeding and is inserted to the medial face of femur below the preceeding.

ANTERIOR ASPECT OF THIGH

18. *Quadriceps femoris* (figs. 2, 9 & 10)

This is a large muscle covering the anterior, medial and lateral faces of femur, being identical with that of ox and horse and consists of four heads.

- (a) *Rectus femoris*: This head is large and rounded. It arises from the anterior border of ilium. Its belly is included and covered on the sides by the two vastii. It is inserted to the base of patella by a thick tendon.
- (b) *Vastus externus*: it is large and quadrilateral. It arises from the lateral face of femur from below the trochanter to the lateral condyle. Its tendon blends with that of preceeding and is inserted to the lateral border of patella.
- (c) *Vastus internus*: It is similar but smaller than preceeding. It arises from the medial face of femur from below the neck to the medial condyle. Its tendon blends with that of rectus femoris and is inserted to the medial border of patella.
- (d) *Vastus intermedius*: The muscle covers the anterior face of femur and consists of two parts. The medial part is large arising from the anterior face of femur. The lateral part is small arising from the upper part of the lateral face and partly from the lower part of the anterior face of femur. The tendon is blended with that of rectus femoris and vastus externus and is inserted to the base of patella.

Nerve supply—Great crural nerve.

Blood supply—Anterior femoral artery.

19. *Articularis genu*. (fig. 9)

This is a small thin muscle of two narrow long bands under the lower parts of vastus intermedius. The muscle fibres arise from the lower part of the anterior face of femur and are inserted to the femoropatellar capsule above the base of patella.

Nerve supply—Great crural nerve.

Blood supply—Anterior femoral artery.

The Muscles of the Leg and Foot (Dorsolateral Group)

The muscles are arranged from without inwards.

20. *Peroneus longus*. (figs. 4, 11 & 14)

This is a long conical muscle on the lateral border of the leg. It arises from the lateral tibial condyle. The muscular belly is succeeded by a flat tendon about the middle of leg, passes behind the lateral malleolus in a groove with the tendon of succeeding muscle both being enclosed in a synovial sheath. The tendon turns behind the hock, detaches a slip for insertion to the V metatarsal, runs medialward

under abductor and adductors of the V digit, passes under the plantar ligament, runs across the plantar face of hock and is inserted to the I metatarsal.

Nerve supply—Superficial peroneal nerve.

Blood supply—Anterior tibial artery.

21. *Peroneus brevis*. (figs. 4 & 14)

The muscle is larger than the preceeding, placed under it. The muscle fibres arise from the lateral face of shaft of fibula. The belly of the muscle is succeeded above the lateral malleolus by a tendon which has a narrow fibrous part in front and a fleshy part behind. The tendon passes in a groove behind the lateral malleolus with the tendon of preceeding enclosed in a synovial sheath. Below the malleolus, the tendon is directed forward and passes under tendon of communis digitorum. The fibrous part of the tendon is inserted to the lower part of the IV metatarsal. From the deep face of the tendon, a narrow tendon arises above the malleolus which is inserted to the upper part of the V metatarsal in front of the insertion of the preceeding muscle.

Nerve supply—Superficial peroneal nerve.

Blood supply—Anterior tibial artery.

22. *Peroneus anticus*. (figs. 4, 11, 13 & 14)

This is a narrow fusiform muscle placed between the preceeding and communis digitorum with which it is partly blended. It arises in common with communis digitorum from the lateral tibial condyle, anterior border of fibula and the tibiofibular membrane. Its tendon is fleshy which runs in front of lateral malleolus and the tendon of preceeding muscle, passes under the tendon of communis digitorum and descends on the IV digit and is inserted to the upper parts of IV and V metatarsals.

Nerve supply—Deep peroneal nerve.

Blood supply—Anterior tibial artery.

23. *Extensor communis digitorum*. (figs. 4 & 11)

It is the largest muscle in front of tibia. It arises by a wide tendon from the lateral tibial condyle and lateral face of tibia. Its muscular belly is large, uniformly cylindrical and placed between preceeding and tibialis anticus. About the lateral malleolus the belly divides into two parts—medial and lateral which are succeeded by wide tendons. The medial tendon detaches a narrow tendon to II digit and a wide tendon to III digit. The lateral tendon detaches a fine narrow tendon to III digit, a wide tendon to IV digit and a narrow tendon to

V digit. The tendons of IV and V digits detach slips to II phalanges of the digits. The tendons are inserted to the terminal phalanges of II, III, IV and V digits.

Nerve supply—Deep peroneal nerve.

Blood supply—Anterior tibial artery.

24. *Tibialis anticus.* (figs. 4 & 11)

It is a narrow conical muscle placed medial to the preceeding.

It arises from the lateral face of tibia and at the medial malleolus its belly is succeeded by a thick round tendon which descends over the II digit and is inserted to the II metatarsal and I phalynx of the digit.

Nerve supply—Deep peroneal nerve.

Blood supply—Anterior tibial artery.

25. *Extensor brevis.* (fig. 7 & 14)

The muscle lies under the tendons of communis digitorum and covers the dorsal aspect of tarsus and metatarsus. It has two heads—lateral head small and fusiform arising from the body of os calcis and the medial head large and quadrilateral arising from the anterior face of astragalus. The lateral head is inserted to IV metatarsal and its I phalynx. The medial head is inserted to the III metatarsal and its I phalynx.

Nerve supply—Deep peroneal nerve.

Blood supply—Anterior tibial artery.

(Plantar Group)

26. *Gastrocnemius.* (figs. 5 & 10)

The muscle is ill developed. It has two heads of origin.

- (a) The medial head is large arising from the posterior aspect of medial condyle of femur. The muscular belly is flat and fusiform which is succeeded by a flat tendon about the middle of leg. The tendon is directed to the lateral aspect of tubercalcis.
- (b) The lateral head is very small and vestigeal. It arises by a minute fleshy tendon from the head of fibula and is succeeded by a small fusiform belly which lower down becomes very thin and flat followed by a thin tendon which joins the tendon of lateral head for insertion to lateral aspect of tubercalcis.

The Anatomy of a Foetal Indian Elephant

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail

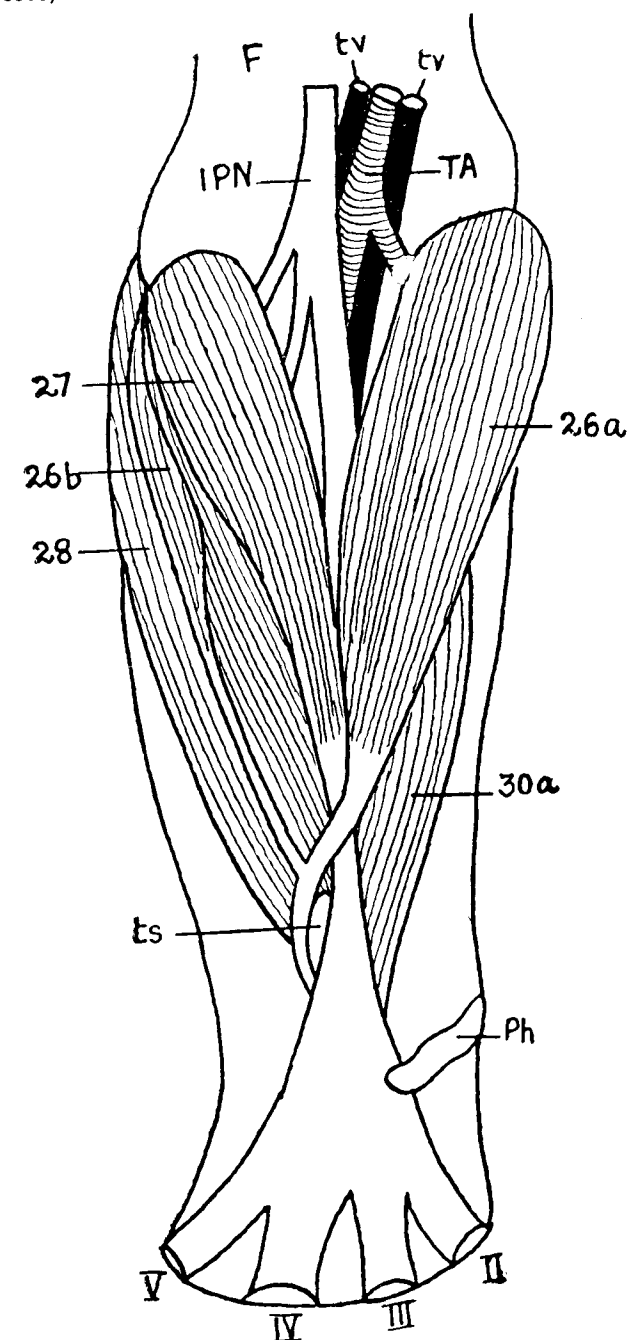


Fig. 5

The Anatomy of a Foetal Indian Elephant

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail

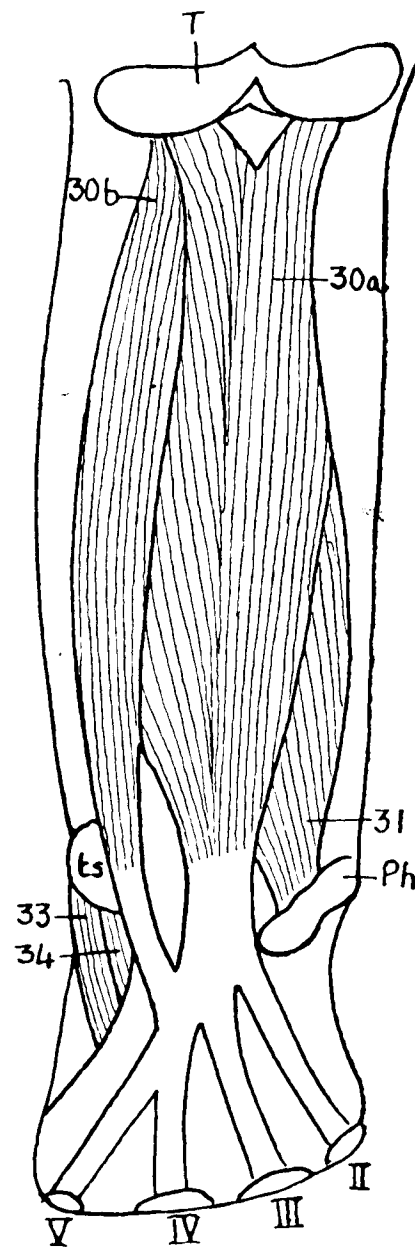


Fig. 6

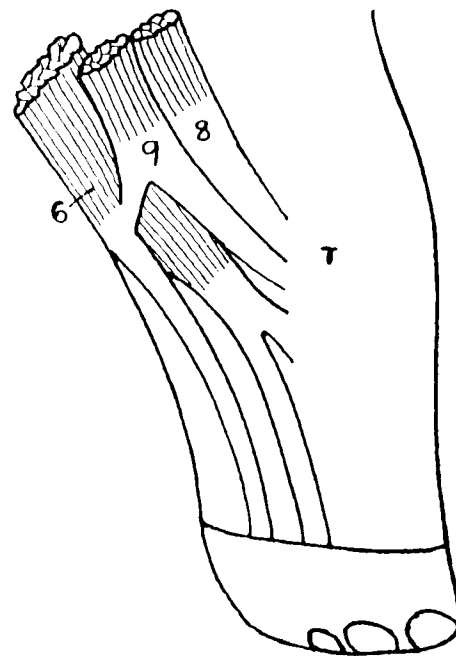


Fig. 3

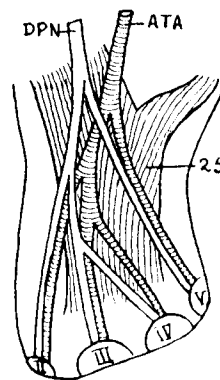


Fig. 7



THE ANATOMY OF A FOETAL INDIAN ELEPHANT

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Nerve supply—Internal popliteal nerve.

Blood supply—Femoropopliteal artery.

27. *Plantaris*. (figs. 5 & 10) (Superficial flexor of the digit).

This is a slender fusiform muscle arising from the posterior aspect of the lateral condyle of femur. Its muscular belly is flat and fusiform which is succeeded by a thin flat tendon about the middle of leg. The tendon is directed medialward under the tendon of preceeding, passes medial to tubercle and expands into a thin membranous web which passes deeper to the digital cushion and detaches thin wide slips to II, III, IV & V digits for insertion to their terminal phalanges.

Nerve supply—Internal popliteal nerve.

Blood supply—Femoropopliteal artery.

28. *Soleus*. (figs. 5 & 13)

The muscle is large and greatly developed unlike in the plantigrades. It is placed deeper to the medial head of gastrocnemius. Its tendon of origin is narrow and aponeurotic arising from the head of fibula. The muscular belly is large, thick and fusiform. It is inserted by a thick wide fleshy tendon to the summit of tubercle.

Nerve supply—Internal popliteal nerve.

Blood supply—Femoropopliteal artery.

29. *Flexor digitorum brevis*.

The muscle is placed under the tendon of plantaris. It arises from the fascia over os calcis. Its fleshy tendons cover the sheaths for the tendons of deep digital flexor, and are inserted to the middle and terminal phalanges of III, IV and V digits.

Nerve supply—Medial plantar nerve.

Blood supply—Medial plantar artery.

30. *Deep flexor of the digit*. (figs. 5, 6 & 12)

The muscle has two parts—medial and lateral.

(a) Medial part is large arising by two heads from the posterior face of tibia and its lateral condyle. The two heads unite and form a large conical belly covering tibialis posticus. The belly becomes narrow above tubercle and is succeeded by a narrow tendon that passes in a groove medial to tubercle in a synovial sheath.

(b) The lateral part is small arising from the head and posterior face of shaft of fibula. Its muscular belly is long,

narrow and three sided which is succeeded by large tendon medial to tubercle. It passes through a groove in a synovial sheath. This tendon passes deeper to the other tendon and fuses with it about the prehallux and expands below the metatarsals and divides into four flat tendons that pass through fibrous sheaths and are inserted to the terminal phalanges of II, III, IV & V. digits.

Nerve supply—Internal popliteal nerve.

Blood supply—Tibial artery.

31. *Tibialis posticus*. (figs. 6, 12 & 13)

It lies deeper to preceding. The muscle arises from the upper part of posterior border of fibula and lower part of posterior face of tibia. The muscular belly is large, rounded and directed medially. Above the hock it becomes narrow and is succeeded by a tendon that passes deeper to that of semitendinosus, passes in a groove obliquely behind medial malleolus and under the medial ligament of hock in a synovial sheath and inclines forwards over the dorsal aspect of hock, passes under the tendon of tibialis anticus and expands for insertion to the upper part of III metatarsal.

Nerve supply—Internal popliteal nerve.

Blood supply—Tibial and femoropopliteal arteries.

32. *Popliteus*. (fig. 12)

The muscle is long and foliate covering upper half of posterior face of tibia to which it is inserted. The muscle fibres are directed obliquely from without inwards. Its narrow tendon of origin is intra-capsular and passes in a cartilagenous groove over the head of fibula deeper to lateral ligament of stifle and is attached to a depression on the lateral condyle of femur.

Nerve supply—Internal popliteal nerve.

Blood supply -- Tibial artery.

33. *Abductor digiti quinti.* (fig. 6)

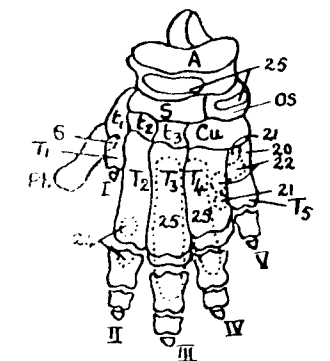
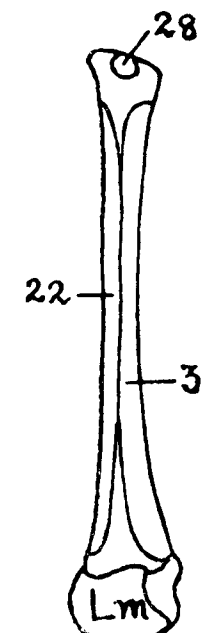
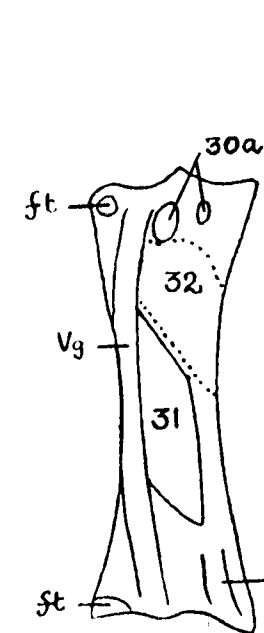
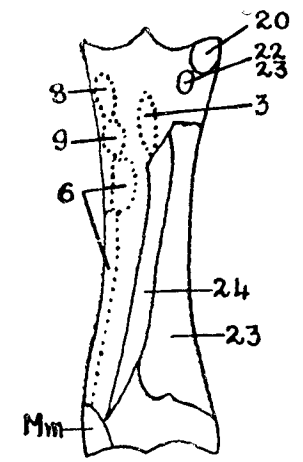
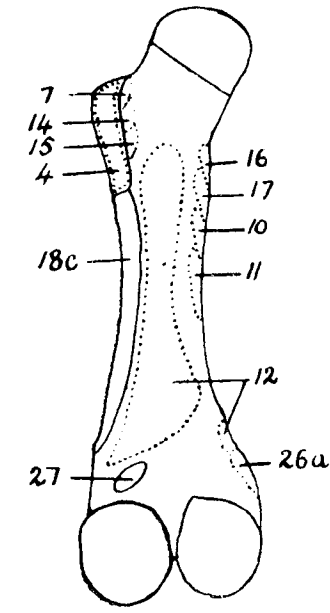
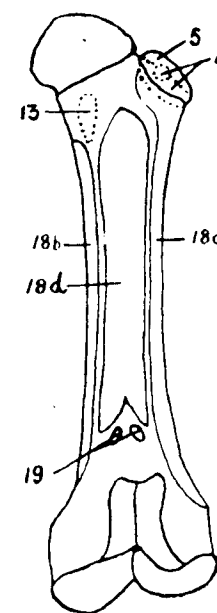
The muscle is placed on the posterolateral aspect of tubercalcis. It consists of a large thick belly arising from tubercalcis and inserted to the lateral sesamoid of the V digit.

Nerve supply—Lateral plantar nerve.

Blood supply—Medial plantar artery.

The Anatomy of a Foetal Indian Elephant

The Muscles, Nerves and Blood Vessels of the Hind Limb and Tail



THE INDIAN VETERINARY RESEARCH INSTITUTE
IZATNAGAR



Farewell party given to Sri P. R. Krishna Iyer, G.M.V.C.,
Research Officer, Indian Veterinary Research Institute, Izatnagar, on the eve of his retirement from service.

THE ANATOMY OF A FOETAL INDIAN ELEPHANT

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34. *Adductor digiti quinti.* (fig. 6)

It is placed deeper and posteromedial to the preceeding. It is a short thick bundle arising from tubercalcis and inserted to the V metatarsal.

Nerve supply—Lateral plantar nerve.

Blood supply—Medial plantar artery.

35. *Abductor ossis metatarsi digiti quinti.*

A small triangular muscle wide above at its origin from the lateral aspect of tubercalcis in front of abductor digiti quinti. Below it narrows down to an apex for insertion to the V metatarsal.

Nerve supply—Deep peroneal nerve.

36. *Flexor hallucis brevis.*

A small triangular muscle placed above prehallux. It arises by a narrow fleshy tendon from the fascia below the tendon of semi-tendinosus. It widens below for insertion to I metatarsal and prehallux.

37. *Lumbricales.*

They are four small bundles arising from the medial borders of the tendons of deep digital flexor and inserted to the medial borders of II, III, IV & V digits.

Nerve supply—Medial plantar nerve to bundles for II, III & IV digits and lateral plantar nerve to that of V digit.

38. *Pantar interossei.*

They cover plantar faces of II, III & IV metatarsals to which they are attached. That covering the II metatarsal is a short thick bundle and those covering the III and IV metatarsals are fused to form a large quadrilateral mass.

Nerve supply—Medial plantar nerve.

THE NERVES OF THE HIND-LIMB.

Details of the formation of the *lumbosacral plexus* will be available after completing the study of pelvis. At present only the nerve trunks as they appear on the lateral and medial aspects of the limb are followed to their termination. On the medial aspect of the limb, great crural nerve, internal saphena nerve and obturator nerves are seen. On the lateral aspect of the limb, sciatic nerve, anterior and posterior gluteal nerves are seen emerging from the greater sciatic foramen.

OBTURATOR NERVE

The nerve after its emergence from the pelvis by the obturator foramen gives off muscular branches to supply pectineus, gracilis, adductor, obturator externus and sartorius.

GREAT CRURAL NERVE (Fig. 2)

The great crural nerve with the internal saphena nerve runs down the medial aspect of thigh placed in front of femoral vessels. The nerve passes over iliopsoas and enters quadriceps between vastus internus and rectus femoris and divides into a number of branches to supply all the four heads of quadriceps, articularis genu and the femoropatellar capsule.

INTERNAL SAPHENA NERVE (fig. 2)

The nerve passes obliquely on the medial aspect of thigh with the crural nerve in front and femoral vessels behind. It passes over iliopsoas, pectineus and vastus internus and reaches the medial aspect of stifle where it passes in front of tendon of semimembranosus and over the common tendon of sartorius and gracilis and runs down the medial aspect of the leg. The nerve is very large and supplies cutaneous branches to the skin on the medial aspects of thigh and leg. Over the metatarsus it breaks off into numerous terminal branches that pass backward to supply skin on the medial aspect of metatarsus but one of them which is large descends over the I digit.

ANTERIOR GLUTEAL NERVE

The nerve is large emerging from the greater sciatic foramen in front of the sciatic nerve. It passes forward between deep and middle gluteus supplying branches to them and one of its long branches passes under middle gluteus and reaches the deep face of tensor vaginae femoris and superficial gluteus to supply them.

POSTERIOR GLUTEAL NERVE.

The nerve leaves the greater sciatic foramen behind the sciatic nerve and runs backward under the middle gluteus and terminates in the deep face of upper part of biceps femoris.

SCIATIC NERVE

The nerve is large emerging from the greater sciatic foramen between the gluteal nerves, runs obliquely downward and backward over the sacrosiatic ligament along the posterior border of deep gluteus being covered by middle gluteus, passes over gemellus behind the trochanter, descends down the posterior border of thigh between

biceps femoris and gracilis and reaches the posterior aspect of stifle, below which it is continued as the internal popliteal nerve.

In its course it detaches a number of collateral branches:—

1. A branch to supply semitendinosus and semimembranosus.
2. A branch to supply lower part to biceps femoris.
3. A large branch to supply gemellus and quadratus femoris.

4. *External saphena* nerve arises from its posterior border about the middle of thigh, passes down between biceps femoris and semitendinosus, pierces the posterior aponeurotic tendon of biceps and breaks off into a number of cutaneous branches to supply skin on the lateral aspect of leg. One of the long branches passes down to reach the sole to supply the digital cushion.

5. *Peroneal cutaneous* nerves are detached about the middle of thigh, which pierce the lower part of biceps to supply the skin on the lateral aspect of thigh.

6. *External popliteal* nerve arises about the middle of thigh, passes outward over the head of gastrocnemius under biceps, passes under peroneus longus and divides into two terminal branches—superficial and deep peroneal nerves.

SUPERFICIAL PERONEAL NERVE (fig. 8)

The nerve passes under peroneus longus supplying branches to it and peroneus brevis, emerges between peroneus longus and peroneus anticus to become subcutaneous above the middle of leg, runs forward and downward to reach the anterior aspect of metatarsus. It gives number of cutaneous branches to the skin in front of the leg. The terminal branches of the nerve are in two sets over the metatarsus. The anterior set of three nerves supplies the skin over II, III & IV digits. The posterior set of two nerves supplies the skin over IV & V digits.

DEEP PERONEAL NERVE (fig. 7)

The nerve passes forward under peroneus longus, pierces peroneus anticus and passes under communis digitorum, supplies branches to peroneus anticus, communis digitorum and tibialis anticus, gains company of anterior tibial artery and descends between the heads of extensor brevis supplying it and divides into four terminal branches which accompany the corresponding arteries as the II, III, IV & V dorsal digital nerves.

INTERNAL POPLITEAL NERVE (fig. 5)

It is the continuation of the sciatic nerve below and behind the stifle. It passes down between plantaris and medial head of gastrocnemius

placing itself on the deep flexor. The nerve passes under tendon of gastrocnemius about the middle of leg, runs between the two parts of deep flexor, becomes superficial medial to the calcaneum and divides over the tubercalcis into medial and lateral plantar nerves. The nerve in its course supplies gastrocnemius, plantaris, soleus, deep flexor, tibialis posticus and popliteus.

Lateral plantar nerve

It passes along the calcaneum and supplies abductor and adductor digiti quinti and continues along the medial border of V digit as the *V plantar digital nerve*.

Medial plantar nerve

The nerve supplies flexor digitorum brevis, lumbricales and plantar interossei and divides into three terminal branches which continue as II, III & IV *plantar digital nerves*.

BLOOD VESSELS OF THE FORE-LIMB. ARTERIES.

As the dissection of the limb is carried out with the pelvis and abdomen left in tact for study, only gluteal arteries and the femoral artery are examined.

ANTERIOR GLUTEAL ARTERY.

It is a collateral branch of internal iliac artery. It emerges from the greater sciatic foramen with the anterior gluteal nerve and supplies middle and deep gluteus muscles.

POSTERIOR GLUTEAL ARTERY.

It arises from the internal iliac artery and emerges from the lesser sciatic foramen. The artery is very large to supply biceps femoris, semitendinosus and gemellus.

FEMORAL ARTERY. (fig. 2)

Femoral artery is the continuation of the external iliac artery below the pubis. It passes down the medial face of thigh between the two satellite veins with the internal saphena nerve and crural nerve in front. It passes down over pectineus, adductor, vastus internus and semimembranosus being placed subcutaneously, (as there is no femoral canal) pierces the semi-membranosus at the lower third of thigh and passes down behind the stifle joint to be continued as the tibial artery.

In its course, it detaches a number of collateral branches—

1. *Deep femoral artery* arises from the femoral below the pubis, passes backward under the pelvic symphysis and supplies

branches to pectineus, adductor, semimembranosus, biceps femoris, sartorius, gracilis, quadratus femoris and obturator externus.

2. *Anterior femoral artery* arises from the femoral a little below the preceeding and accompanies the crural nerve between rectus femoris and vastus internus to supply all the four heads of quadriceps and articularis genu.

3. Branches to supply lower part of adductor and semimembranosus.

4. *Femoropopliteal artery* arises from femoral after it pierces the lower part of semimembranosus. It divides into dorsal and ventral branches. The dorsal branch passes up and supplies biceps femoris, gracilis, sartorius and semimembranosus. The ventral branch supplies gastrocnemius, plantaris and soleus.

5. *Saphena artery* arises from the femoral artery behind the medial condyle of femur, runs obliquely under medial head of gastrocnemius, and divides into dorsal and ventral branches. The dorsal branch is larger which pierces the common tendon of Sartorius and gracilis and passes upward subcutaneously on the medial face of thigh. The ventral branch is small which passes over the tibial attachment of semitendinosus and runs down the medial face of leg.

TIBIAL ARTERY (fig. 5)

It is the continuation of the femoral below the stifle. It is covered by a large venous plexus behind the stifle placed between the plantaris and medial head of gastrocnemius. It passes down between tibia and fibula placed in the vertical vascular groove of tibia under cover of popliteus and deep flexor. At the lower third of leg it detaches the anterior tibial artery and passes down to the tubercalcis above which it terminates by dividing into two plantar arteries—medial and lateral.

The tibial artery supplies muscular branches to popliteus, deep flexor soleus and tibialis posticus.

Anterior tibial artery (fig. 7) It pierces the tibiofibular membrane and gains the anterior aspect of the lower third of leg. It passes obliquely under peroneus anticus and communis digitorum and gains the median line to gain the company of deep peroneal nerve. It supplies branches to all the muscles in front of leg viz. peroneus longus, peroneus anticus, peroneus brevis, communis digitorum, tibialis anticus and extensor brevis. In company with the deep peroneal nerve it runs between the two heads of extensor brevis and divides into four terminal branches which continue as II, III, IV & V dorsal digital arteries with the corresponding nerves.

Lateral plantar artery reaches the lateral aspect of calcaneum and runs along its lateral border reaches the heel and terminates in the digital cushion.

Medial plantar artery passes along the medial border of tubercalcis in company with the medial plantar nerve and terminates in the digital cushion.

PLANTAR CUSHION

It is elongated and oval in shape being similar in structure to that of the forelimb.

Veins

Internal saphena vein is large and external saphena vein is absent.

Popliteal artery is covered by a large plexus of veins.

Muscles, Nerves and Blood Vessels of the tail

39. *Sacro-coccygeus dorsalis*. (fig. 1).

The muscle arises from the neural spines of sacral and caudal vertebrae and is inserted to the lateral faces of the neural spines. The muscle consists of numerous bundles, each bundle after its origin, passes over two or three vertebrae and is inserted to the vertebra lower down.

40. *Sacro-coccygeus lateralis*. (fig. 1).

The muscle is larger than the preceeding with which it is blended. It arises from the sacral angle of ilium and the dorsal faces of the transverse processes of sacral and caudal vertebrae and consists of numerous bundles. From its dorso-medial border, it detaches numerous round tendons which are inserted to the summits of the neural spines. Each tendon of a bundle passes back over two or three vertebrae for its insertion.

41. *Intertransversales coccygeus*. (fig. 1).

The muscle consists of thick bundles filling up the intertransverse spaces. Each bundle arises from the posterior border of the transverse process, and is inserted to the anterior border of the transverse process of a vertebra behind. The first bundle arises from the posterior border of the wing of sacrum. Between the dorsal face of the muscle and the preceeding, the lateral coccygeal nerve passes.

42. *Sacro-coccygeus ventralis*.

The muscle consists of two parts-lateral and medial. The lateral part is large and thick covering the ventro-lateral aspects of the

vertebral bodies. Deeper to this part is the lateral coccygeal artery and vein. The medial part is a small narrow bundle covering the ventro-medial aspects of the vertebral bodies. Deeper to this part is the middle coccygeal artery and vein. The muscular bundles of each part arise from the ventral aspect of the last sacral and caudal vertebrae. Each bundle passes over two or three bodies and is inserted to the body behind.

43. *Recto-coccygeus*.

Each muscle is a flat triangular band of plain muscle covering two vertebral bodies above the anus.

LATERAL COCCYGEAL NERVE

The nerve appears to be formed by the union of I and II coccygeal spinal nerves and passes back between sacro-coccygeus lateralis and intertransversales coccygeus. It detaches dorsal and ventral branches to supply the muscles placed dorsal and ventral to it.

MIDDLE COCCYGEAL ARTERY

The artery passes on the ventral aspect of the vertebral bodies under the medial parts of sacro-coccygeus ventralis which it supplies. It has two satellite veins, one on each side of the artery.

LATERAL COCCYGEAL ARTERY

The artery is larger than the preceeding and runs with a satellite vein under the lateral part of sacro-coccygeus ventralis. The artery supplies the muscles placed dorsal to it.

Discussion

A review of available literature on the muscles of the hind limb and its comparison with the present study reveals several variations which need explanation. In the foregoing, they are discussed with the object of correct appreciation of their relative position and attachments, bearing in mind the nerve muscle relations that are of great value to establish their homology.

1. *Muscular attachments in general*.

In the present study the attachments of several muscles will be found to vary in some details with those recorded by previous workers as already indicated and reasoned out while dealing with the muscles of the forelimb.

2. *Certain important muscles*.

(i) *Gluteal muscles*.

MIALL & GREENWOOD describe three muscles—gluteus maximus, gluteus medius and gluteus minimus. The relative position

and attachments of the latter two muscles broadly agree with the present study. But the attachments of gluteus maximus to middle fifth of femur, sacrosciatic ligament, sacrum and caudal vertebrae refers to part of biceps femoris taken along with it as admitted by them when they cite CUVIER & LAURILLARD as confirming the same.

WINDLE & PARSONS cite PATERSON & DUN and agree with the femoral attachment of gluteus maximus.

EALES describes five muscles — gluteus maximus, gluteus medius, gluteus accessorius, gluteus profundus and piriformis. Superficial gluteus is described as being deeper to biceps femoris and arising from the fascia and vertebrae in this region. Its insertion is on the postero-medial side of femur and by a small tendon from its deep face to the capsule of the hip close to the great trochanter. Gluteus medius is the largest of the gluteals filling the fossa of the iliac wing. Gluteus accessorius lies deep to medius. Gluteus profundus is smaller and deeper to accessorius. Piriformis is small lying posterior to maximus blending with it and medius.

In the present study only three gluteal muscles are present and their relative position and attachments are similar to the gluteals of larger mammals like ox and horse. *Superficial gluteus* is placed in between tensor vaginae femoris in front and biceps femoris behind forming the superficial layer of muscles in this region but not deeper to biceps as recorded by Eales. The muscle is 'V' shaped, anterior limb blending with tensor vaginae femoris and posterior limb blending with biceps femoris as in ox and not having any femoral attachment as noted by previous workers or any attachment to capsule of hip recorded by Eales. Tensor vaginae femoris detaching a slip postero-dorsally to join biceps femoris as recorded and figured by Eales is evidently the superficial gluteus. Trochanter tertius of femur when present in some animals is for insertion of superficial gluteus. But the elephant has no trochanter tertius on femur and attachment of maximus on femur recorded by others cannot be satisfactorily explained. *Gluteus medius* of ox and horse as stated by Sisson is a combination of three muscles — gluteus medius, gluteus accessorius blended on its deep face and piriformis blended along its posterior border. The muscle in this specimen is identical to that of ox and horse. The specimen dissected by Eales being very small would explain the presence of accessorius and piriformis (not yet blended) being described as separate muscles.

(ii) *Biceps femoris.*

MIALL & GREENWOOD describe biceps as arising by a thin round tendon from tuber ischii only and state its connection with superficial gluteus. Its insertion is on the outer side of femur several

inches above the knee. A separate strap like bundle of posterior fibres proceeds to the fascia of the leg.

EALES notes its origin from posterior three quarters of the crest of ilium, adjacent vertebrae and tuber ischii. Its insertion is both proximally and distally to the knee joint. Proximally to the femur and capsule of the knee joint and distally to the tendinous tissue over the tibia though it does not reach the bone. It gives off a long tendon which passes postero-laterally along the leg to an insertion on the aponeurosis over the os calcis.

In the present specimen, its attachments differ in several points noted by others. It originates from the sacral angle of ilium, transverse processes of sacral and first four or five caudal vertebrae, sacrosciatic ligament and tuber ischii. The lower part of the muscle, as in the ox and horse, divides into three parts which are succeeded by aponeurotic tendons for insertion — anterior part to lateral condyle of femur and lateral ligament of patella; middle part to the tibial crest; and the posterior part to the fascia lata and through it to the tubercle of calcis. Reference by MIALL & GREENWOOD to a strap like bundle of posterior fibres and long tendon passing postero-laterally to os calcis by EALES appears to correspond with the posterior tendon described above.

(iii) *Semitendinosus.*

MIALL & GREENWOOD note its origin by fleshy fibres from ramus of ischium. The muscle ends about the middle of thigh in a thin tendon which is lost in the fascia of the inner and back part of the thigh.

EALES notes its origin by two heads — a slender tendinous one running parallel with sacrosciatic ligament reaching to the vertebrae and a more fleshy head from tuber ischii blending with deep head of biceps femoris. It is inserted to the medial side of tibia by a broad strap, transversely placed. A tendinous strip extends from the tibial attachment along the medial side of the limb towards the heel and is fixed to the fibrous tissue covering astragalus and medial condyle of tibia. Proximal portion of the strip is fastened to tibia but distally it becomes free and passes laterally to a similar tendon from semimembranosus.

In the present study it arises by two heads — a small fibrous head in common with biceps femoris from first three or four caudal vertebrae and by a large fleshy head from tuber ischii. The muscular belly gains the medial face of leg and divides below the stifle into anterior and posterior parts. The posterior part unites with the corresponding part

of gracilis to form a round fibrous cord which descends and reaches the I metatarsal for insertion which is not noted by previous workers. The anterior part expands which is succeeded by a thick flat tendon that detaches a wide slip for insertion to the medial face of tibia above its middle and descends along the medial border of tibia to its lower end being attached all along its border as noted by EALES. A similar condition by way of a tarsal tendon of the muscle is seen in the Horse.

(iv). *Sartorius, gracilis, adductor and semimembranosus.*

The description of these muscles of the medial aspect of thigh in this specimen is made according to the method adopted by Sisson. A comparison of these muscles, their attachments and their relations with those recorded by previous workers raises a great confusion in the mind of the reader and the foregoing is an attempt to clear and reconcile the differences in the present literature.

The muscles on the medial aspect of thigh of animals including the elephant are arranged in three layers. In the first layer (superficial) there are two muscles—sartorius in front and gracilis behind it. In animals where femoral canal (Hunter's canal) is formed for the passage of femoral vessels, sartorius covers the vessels and encloses the canal with gracilis, pectineus, vastus internus and iliopsoas forming other boundaries. This is so in the ox and horse. But in the elephant the femoral canal is open exposing the femoral vessels subcutaneously. This is due to the displacement of sartorius caudal ward and behind the femoral vessels. In ox, horse and elephant only these two muscles of the medial aspect of thigh—sartorius and gracilis have tibial attachment. In the second layer (deeper) there are three muscles from before backwards—pectineus, adductor and semimembranosus, all of them being inserted to femur except the last muscle having a small insertion on the medial condyle of tibia in ox. Adductor and semimembranosus of animals are the homologues of adductor longus and adductor magnus of man respectively. Semimembranosus of man has extensive tibial attachment and its homologue in animals appears to be absent. In the third layer there are other muscles viz. quadratus femoris, obturator externus, etc. With this introduction the observations by previous workers can now be reviewed.

MIALL & GREENWOOD in their description of sartorius and gracilis do not indicate their relative positions. They describe adductor longus, adductor magnus and adductor minimus. By the attachments of these muscles it is evident that adductor longus corresponds to adductor; adductor magnus to semimembranosus (pierced by femoral vessels); and adductor minimus to quadratus

femoris of the present study. Semimembranosus is said to arise by a double tendon and its insertion is to internal face of tibia by the the anterior part of tendon which is broad and flat and the narrow posterior part of tendon is continued to the internal malleolus. This requires an explanation that will be taken up in the concluding paragraph.

WINDLE & PARSONS make a very significant observation that, "Many of the dissectors of ungulates in the past have, we believe, been stimulated by their knowledge of human anatomy to artificially divide up this mass in an unnecessary manner" when they describe adductor mass. They describe semimembranosus having the usual mammalian insertion deep to the internal lateral ligament (tibia) and from this insertion an expansion found running down to the inner side of the ankle.

EALES states that sartorius is a mere vestige in the foetus. On the right side of the specimen it was a slender strip of tendinous tissue, with a few muscle fibres in it, running parallel and anterior to the femoral artery and vein and inserted on the capsule of the kneejoint. On the left side the tendinous strip has no muscle fibres in it. This is at variance with the present study and those of previous workers regarding its attachment. Its relative position with femoral vessels is quite in contrast with the present study. All this could be attributed to the small size of the specimen and the ill defined structures that should have added considerably to difficulty in identification and interpretation. Gracilis and semimembranosus are described and figured as being in the same layer, gracilis in front and semimembranosus behind both placed behind the femoral vessels. Semimembranosus of animals and the elephant is in the deeper layer to gracilis and never in the same layer with it. It appears that sartorius and gracilis have been mistaken for gracilis and semimembranosus judged by their attachments and relations with the present study. Probably the other two authors also have mistaken gracilis for semimembranosus, as otherwise, it is impossible to explain and reconcile the extensive tibial attachment of semimembranosus in the elephant. Adductor has been described as having two parts between which femoral artery passes. The large anterior portion is inserted to the shaft of femur mesially and the small posterior portion to the mesial condyle of femur. It appears that semimembranosus is mistaken for adductor judged by its insertions and its relation to femoral vessels. Pectineus has been figured indicating its large size—larger than semimembranosus. In all animals pectineus is very small being the smallest muscle of that layer, next in size being adductor and the largest being semimembranosus. As pointed out already semimembranosus is mistaken for adductor and pectineus

figured as the largest mass includes adductor which has not been separated. The pubiofemoral ligament is supposed to divide pectineus into two portions which evidently indicates the lower portion as adductor and the upper portion as pectineus.

(v). *Extensors of leg and digits.*

In the present study, attachments of these muscles agree mostly with those of MIALL & GREENWOOD and WINDLE & PARSONS and differ in some respects with those of EALES.

(vi) *Flexors of leg and digits.*

Observations on these muscles mostly agree with those of EALES differing in some respects from those of others. Flexor hallucis brevis is attached to prehallux as noted by BRADELEBEN (1890) cited by EALES. (1928)

3. FASCIA.

Superficial and deep fascia are very thick with numerous elastic fibres and no special bands are formed as in the forelimb. The deep fascia over the tarsus forms the anterior and posterior *annular ligaments* to bind down the extensor and flexor tendons over the joint.

4. NERVES.

Muscular and cutaneous supply is similar to what obtains in larger animals as ox and horse. On the dorsal aspect of the digits, there are two sets of nerves—the superficial set derived from superficial peroneal nerve passing in the superficial fascia as cutaneous nerves of the digits and a deeper set—dorsal digital nerves derived from the deep peroneal nerve that are accompanied by the corresponding digital arteries. The plantar digital nerves are contributed by the plantar nerves and are deeply placed in relation with the tendons of deep flexor.

5. ARTERIES.

Arterial supply to the structures of the limb is similar to the condition in larger animals as ox and horse. There is no vascular arch in the plantar region. There is only one set of dorsal digital arteries derived from the anterior tibial. Branches from these descend to the plantar aspect of the foot to compensate for the absence of plantar digital arteries.

6. VEINS.

Internal saphena vein is large and external saphena vein is absent. Popliteal artery is covered by a large plexus of veins. Other veins that are statelites of arteries are very large.

7. LYMPH GLANDS AND LYMPHATICS.

They are absent.

Summary

1. The musculature of the hind limb is poorly developed as compared to the forelimb.
2. There are three gluteal muscles resembling those of the ox unlike five gluteals recorded by EALES.
3. Biceps femoris is poor in development as compared to that of ox and horse but has similar insertions.
4. Semitendinosus, its relation with gracilis and its extensive attachments by two long tendons besides the usual mammalian attachment to the medial face of tibia, overlooked by others has been noted.
5. Sartorius, gracilis, adductor and semimembranosus have been studied in conformity with the method adopted by veterinary anatomists. The differences in the observations made by previous workers are explained. Semimembranosus of animals and elephant is not the homologue of that of man and has no tibial attachment.
6. Obturator tertius described at length by EALES is blended with obturator externus.
7. Gastrocnemius is poorly developed and soleus is greatly developed unlike in the plantigrades where the conditions are reversed.
8. As in the forelimb, extensors are greatly developed at the expense of flexors.
9. Capsularis is better developed than that of the forelimb.
10. Coccygens recorded by EALES is not present.
11. In the literature available, only muscular supply by nerves is noted. Details of their course, muscular relations, cutaneous nerves, formation of digital nerves and their disposition is recorded.
12. On the arteries very little information is available. Their course, relations, muscular supply and formation of digital arteries are described.
13. Caudal nerves, arteries, their course, disposition and their supply are noted.
14. Lymph glands and lymphatics are absent.

Explanation to Figures

Numbers in figures correspond to those given for muscles in the text.

- Fig. 1. 1, cr, iliac crest; fl, fascia lata; A, annus; Sac, sphincter ani externus.
 Fig. 2. ts, tuber ischii; Ps, pelvic symphysis; fv, femoral vein; FA, femoral artery; CRN, great crural nerve; ISN, internal saphena nerve.

- Fig. 3. T, tibial region.
 Fig. 4. F, femur; P, patella; LS, lateral retinacula; Em, external malleolus. dotted lines indicate structures placed or passing under.
 Fig. 5. F, femur; IPN, internal popliteal nerve; tv, tibial vein; TA, tibial artery; Ph, prehallux; ts, tubercalcis; II, III, IV, V, digits.
 Fig. 6. T, tibia.
 Fig. 7. DPN, deep peroneal nerve; ATA, anterior tibial artery.
 Fig. 8. SPN, superficial peroneal nerve.
 Areas marked by lines indicate muscular origin and areas marked by dotted line indicate insertion.
 Fig. 9. Anterior view of left femur.
 Fig. 10. Posterior view of left femur.
 Fig. 11. Anterior view of left tibia. Mm, medial malleolus.
 Fig. 12. Posterior view of left tibia. Vg, vascular groove; ft, facet; gt, groove for tendon.
 Fig. 13. Lateral view of left fibula. Lm, lateral malleolus.
 Fig. 14. Anterior view of left pes. A, astragalus; os, os calcis; S, scaphoid; cu, cuboid; t₁, t₂, t₃, respective tarsals; T₁, T₂, T₃, T₄, T₅, respective metatarsals;

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SALMONELLOSIS IN RABBITS - A COMPARISON WITH RINDERPEST

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A serious out-break associated with heavy mortality occurred among the healthy rabbits maintained in the Institute for experimental purposes. Chemotherapy, serum and vaccine therapy, failed to control it. We had several occasions to examine post mortem of rabbits infected with the strain of rinderpest virus recently introduced at this Institute for immunisation of cattle against rinderpest. Rabbits infected with lapinised strain of rinderpest reveal certain characteristic lesions which are considered to be pathognomonic of the disease. These

lesions are most obvious in the Peyer's patches which become swollen and can be seen from the serous side as patches of numerous greyish white granules. The intestinal lymph glands also show a similar appearance though less marked. These lesions are in fact the only constant ones in the rinderpest virus producers and are considered to be the specific lesions of rinderpest. But the animals dying in the out-break reported herein also showed constantly in all cases in the Peyer's patches lesions identical to those seen in the rinderpest cases following infection with lapinised strain of rinderpest virus together with other lesions which are not seen in rinderpest cases; hence the following further studies were undertaken.

History

The disease was introduced in rabbits through the purchase of a few animals from Lucknow and the first case noticed was dull, off feed, with a temperature of 104°F, passed soft faeces which were followed by diarrhoea and death intervened within 24 hours. The carcass was sent to us for post mortem examination and the following lesions were recorded:—

Rabbit No. 55—adult, condition fair with signs of diarrhoea. Peritoneal and pleural cavities contained about 20 and 10 c.c. of sero sanguineous fluid respectively.

Heart.—Enlarged with cavities distended with blood and the epicardium showed petechiae.

Lungs.—Showed patchy congestion with a few nodules containing purulent material.

Liver.—Showed a few nodules and acute congestion and slightly round border suggestive of enlargement.

Spleen.—Markedly enlarged about 4 times the normal size and congested. (Figures I and II).

Intestines.—Showed petechiae on the peritoneal and mucous surfaces. Peyer's patches showing small necrosed areas as big as pin heads grouped together to form a round hard body on the serous surface conspicuously visible as soon as the abdominal cavity was exposed. These necrosed areas extended to caecum where grouping was not present, but individual small nodules scattered about giving the appearance of 'Itchy skin'. Mesenteric lymph node enlarged and hard. (Figure 1).

All other organs.—Slightly congested.

Heart blood smears.—Were negative for organisms but there was marked leucocytosis with increased polymorphs. Similar leucocytosis was also seen in the impression smears from liver and spleen which

were otherwise negative for organisms. Twenty four hour old broth culture yielded pure culture of gram negative short rods actively motile and producing uniform turbidity of the media. This organism failed to attack lactose when tested as preliminary measure.

In F. A. O. Agricultural Studies No. 8, 1949. (Rinderpest vaccines), mention is made of experimental rabbits when inoculated with *Salmonella typhimurium* showing identical lesions in the Peyer's patches. Hence a tentative diagnosis of Salmonellosis was made and treatment of all animals with sulpha drugs preferably sulpha-mezathin or Thiozal was recommended to stop further mortality. In the absence of both these drugs, sulpha drug M. B. 693 was administered half a tablet per rabbit as an initial dose and reducing to half again for the following six days. A week's treatment of all the surviving animals put a stop to the outbreak; only animals far advanced in symptoms failed to respond to the treatment and succumbed eventually.

Altogether eleven post-mortem examinations were carried out and all the animals showed identical lesions in the Peyer's patches and the enlargement of spleen. Other lesions such as congestion and the presence of nodules in liver and lungs were not so constant. However, enlargement of spleen may be taken as a specific lesion which was found in almost all cases and which was the only differentiating factor from rinderpest. (Figure II).

Bacteriological Studies

From six carcasses, cultures were attempted from heart blood, spleen and liver and organisms so obtained were subjected to the cultural, staining and biochemical tests with the results given below:—

Broth—growth with uniform turbidity.

Plain agar—round smooth colonies, slightly elevated at the centre.

Blood agar—non-hæmolytic.

Macconsky's media—round colourless colonies.

Motility—actively motile after 24 hour incubation in broth.

Sugars—attacked dextrose, mannite, arabinose, maltose, rhamnose and glucose with production of gas in arabinose, maltose and glucose but not succrose, lactose, salicin, inositol, adonite and dulcitol.

Biochemical.—

- (1) M. R. positive but V. P. negative.
- (2) Produced no change in litmus milk.
- (3) Failed to produce Indol.
- (4) Produced H_2S .

Salmonellosis in Rabbits - A Comparison with Rinderpest

By
P. R. Krishna Iyer and D. R. Uppal



Fig. 1
Viscera showing the enlarged spleen (1) and the lesions in Peyer's patches of small intestines and caecum (2) and (3).

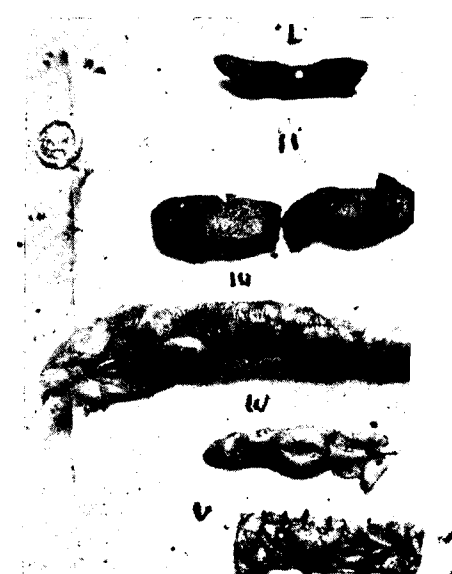


Fig. 2
(I) Normal rabbit spleen; (II) Enlarged spleen from rabbit died of Salmonellosis. The organ got broken in the centre while fixing for photograph; (III) Caecum with pin head lesions; (IV) & (V) Pieces of intestines with Peyer's patches.



Fig. 3
Intestines of a healthy rabbit showing the intact epithelial layer of the mucous membrane and the lymphoid follicles.

[H. P. staining $\times 144$.]

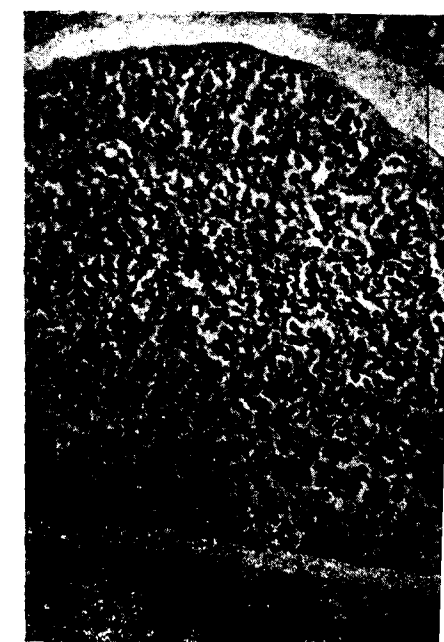


Fig. 4
Lymphoid follicle of the intestines of the healthy rabbit. Note the healthy cells of the lymphoid follicle.

[H. P. staining $\times 288$.]

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Fig. 5

Intestines of a rabbit died of Salmonellosis. The microphotograph shows the desquamation of the columnar epithelium from almost the entire mucous surface. Note the degenerating cells of the lymphoid follicle marked X.

[H. E. staining $\times 120$.]

Fig. 6

Lymphoid follicle of intestine of rabbit (Salmonellosis) showing degenerative changes in the cells.

[H. E. staining $\times 140$.]

Fig. 7

Intestines of rabbit died of rinderpest. Note the intact columnar epithelial lining of the mucous membrane and necrosis of lymphoid follicles.

[H. E. staining $\times 120$.]

Fig. 8

Lymphoid follicle of the intestines of a rabbit died of rinderpest showing marked necrosis.

[H. E. staining $\times 140$.]

SALMONELLOSIS IN RABBITS—A COMPARISON WITH RINDERPEST 433

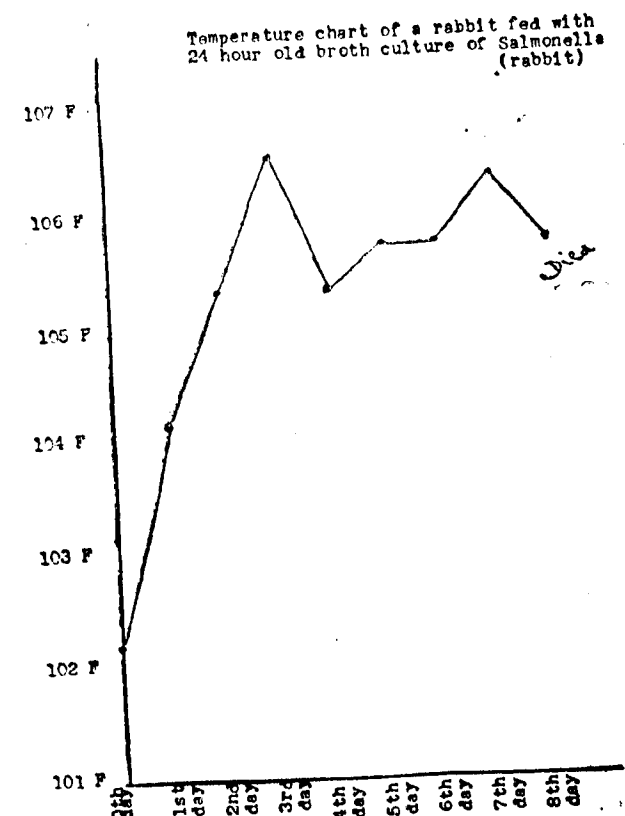
- (5) Positive to catalase test.
- (6) Positive to Sodium Tartarate.
- (7) Nitrates were not reduced.

Serological.—Plate agglutination test was positive with the serum of *Salmonella abortus equi*.

From the biochemical reactions recorded, the organism, beyond doubt, appears to be a *Salmonella*. Since it failed to attack inositol, *Salmonella Typhimurium* was ruled out. From the reaction produced on maltose, arabinose, rhamnose and as it produced H_2S , it was concluded that it belonged to the group Enteritidis. For confirmation a series of biochemical tests were carried out in poultry pathological laboratory concurrently and the results obtained there were identical with what we recorded in our cultures.

Pathogenicity tests

Rabbits.—A 24 hour old broth culture 0.5 c.c. was inoculated intravenously in a healthy rabbit. The rabbit showed symptoms of Salmonellosis in the acute form and died after 10 hours of the inoculation and the organism was recovered from its heart blood, liver and



spleen. The post mortem lesions in this case were more of septicæmic nature than those observed in cases of natural outbreak and lesions in Peyer's patches were not marked. The transmission experiment was repeated by feeding a rabbit with a 24 hour old broth culture mixed in feed consecutively for two days. The disease was again successfully produced and the animal died after 8 days, showing the typical lesions in Peyer's patches and spleen. The course of the disease in the experimental animal is shown in the chart.

Hill Bulls.—One hill bull was inoculated subcutaneously with 3 c.c. of 24 hour old broth culture. Second bull was drenched with 10 c.c. of 24 hour old broth culture mixed with 6 oz of water and the third bull was inoculated intravenously with 2 c.c. of 24 hour old broth culture. No reaction ensued in any of these bulls. The animals were kept for two weeks under observation and then discontinued.

Goats.—One goat was inoculated subcutaneously with 3 c.c. of 24 hour old broth culture. Second goat was inoculated with 1 c.c. of 24 hour old broth culture intravenously and the third goat was drenched with 5 c.c. of 24 hour old broth culture mixed with 3 oz of water. The goat which was drenched with cultures did not show any reaction. The goat which received subcutaneous inoculation showed a rise of temperature upto 105.4°F on the second day of inoculation which persisted for three days and then came to normal. While the goat which received intravenous injection of salmonella cultures showed decided thermal reaction and the temperature in this case shot upto 105.8 F on the second day of inoculation and 107.0 F on the third day. This high thermal reaction remained steady for nine days, after which the temperature gradually came to normal after twelve days of inoculation. The animal during the febrile condition was dull, fed fairly and passed soft faeces.

Blood picture

Blood smears from rabbits suffering from salmonellosis proved negative for organisms. But the cytoplasm of almost all polymorph nuclear cells contained a few or more bacteria. A series of differential leucocyte counts was made from sick animals which proved to be suffering from salmonellosis after death and antimortem with healthy control smears. The following table gives a comparative statement of both the counts.

	Healthy	Salmonellosis
Polymorphs	41	54
Large Lymphocytes	34	13
Small Lymphocytes	12	19
Monocytes	6	11
Eosinophiles	2	—
Basophiles	5	3

From the above averages, leucocytosis of the neutrophilic type is distinctly evident and in some individual cases the count of polymorphs reached even 80%. Unfortunately we had no opportunity to make similar studies on lapinised virus producers, only two animals being examined both of which gave higher polymorph count and both of them showed intercurrent infections (Pasteurellosis in one case.)

Study of Lesions in rabbits hyperimmunised with salmonella and subsequently inoculated with rinderpest virus

Three rabbits were immunised by giving gradually increasing doses of killed cultures of *Salmonella* followed by gradually increasing doses of live cultures at different intervals. One of these immunised rabbits was destroyed. Nothing unusual was noticed in any of the organs on autopsy. The remaining two rabbits were inoculated intravenously each with 1 c.c. of lapinised virus (1% saline emulsion of spleen and lymph node). Both these rabbits developed typical thermal reaction and died after six days of the inoculation. On post mortem examination enlargement of Peyer's patches and lymph nodes which are characteristic of rinderpest were seen.

Histopathology

The histo-pathological study was restricted to intestines as the identical lesions in Rinderpest as well as in Salmonellosis are found in this organ only.

Intestines (Salmonellosis).—The columnar epithelium was desquamated from almost the entire mucous surface. The lamina propria showed marked lymphocytic and neutrophilic infiltration. The epithelial lining of crypts of Lieberkuhn showed degeneration characterised by pyknosis and karyorrhexis and in some cases there was present degenerative material in these glands. Some of the apices of lymphoid follicles pointing to the lumen of intestines showed infiltration with deeply stained young lymphocytes as compared with the feebly stained nuclei of the lymphocytes of the normal follicle. The Peyer's patches showed lesions indistinguishable from those of caseation characterised by homogenously stained foci and did not show any nuclear material. The sub-mucous layer showed fibrin deposition with focal leucocytic infiltration. The serous layer showed capillary congestion and oedema (Figures V and VII).

Intestines (Rinderpest).—The columnar epithelial lining of the mucous membrane was intact in most of the part and there was no evidence of catarrhal changes. The lymphoid follicles showed indications of hypertrophy accompanied by focal necrosis which in some

instances had undergone changes similar to those of caseation. Majority of lymphocytes comprising the Peyer's patches showed distinct karyorrhexis. In lamina propria there was diffused infiltration of lymphocytes. The crypts of Lieberkuhn were devoid of any inflammatory exudate. The sub-mucous and serous layers did not show any marked histo-pathological change (Figures VII and VIII).

For comparison of the above mentioned histo-pathological changes with the histology of the normal intestines (rabbits), reference may be made to (Figures III and IV).

Discussion

Investigation so far carried out gave us conclusive results that both rinderpest lapinised virus and salmonellosis produce exactly identical lesions in Peyer's patches so indistinguishable from each other that the worker in the field carrying out rinderpest immunisation with wet lapinised virus is at a disadvantage to confirm that his virus producer has reacted specifically to rinderpest and not to any other infection. Datta *et al* (1951) in their report on lapinised virus of rinderpest describe the clinical symptoms of a rabbit after experimental inoculation and the symptoms are in no way different from what were observed by us in natural as well as experimental cases of salmonellosis.

Blood smear examination in both the cases were negative, but heart blood when inoculated in a suitable media and incubated produced pure cultures of salmonella in cases of salmonellosis, but rinderpest produces no change in the media. This is the most important and sure differential diagnosis between rinderpest and salmonellosis, yet it is of little practical value in the field due to the absence of facilities for cultural experiments. Further it takes at least 24 hours to differentiate one from the other and the lapinised virus may not remain viable for 24 hours unless kept under proper refrigeration.

Organ smears or heart blood smears are negative for organisms in both the cases but in all cases heart blood from salmonellosis yields pure cultures of salmonella on cultural examination. Smears although negative, reveal leucocytosis with increased polymorph nuclear cells, the cytoplasm of each occupied by bacteria-like bodies which do not take gram's stain. In the blood, perhaps, the organisms occur in the intraleucocytic situations only and the bodies referred to as occurring in the cytoplasm of the polymorphs are nothing but the specific organisms i.e. *Salmonella*. In many cases the cell structure of the leucocyte is found destroyed with the result that group of such bodies are left free. There is no other source visible under microscope for the organisms appearing in the media than from such groups; hence it is reasonable to

infer that the bodies in the leucocytes are only phagocytosed organisms which when they destroy the cell structure exist free in the blood in small numbers to multiply in the media, but are too few to be seen in the blood smears in a free state. Impression smears taken from spleen, liver and glands also show numerous such phagocytosed organisms and pure cultures of *Salmonella* were also obtained from such organs. Rinderpest blood does not show such phagocytosed bodies.

The pathogenicity tests carried out show that the disease can easily be transmitted to rabbits by intravenous route by feeding culture. Whereas *Salmonella* isolated from rabbits is non-pathogenic to hill bulls but goats when inoculated intravenously show decided thermal reaction which might complicate reactions in goats receiving lapinised virus for the production of goat reactor vaccine when required to be used for immunisation of cattle against rinderpest.

From the biochemical reactions carried out, it may be concluded that the *Salmonella* isolated from the outbreak investigated, belongs to the group Enteritidis (Manual of Determinative Bacteriology—Burgy).

Splenic enlargement which we have observed in natural cases of salmonellosis is almost a constant factor except in a single case of experimental rabbit where the disease was produced by intravenous inoculation and where the disease was acute. This splenic enlargement was never noticed by us in lapinised virus producers nor is this lesion reported either by Datta *et al* (1951) or F. A. O. in Agricultural studies No. 8, 1949—Rinderpest vaccines. So this can be taken as the differentiating factor and it would be easy enough for the field worker who uses lapinised virus to distinguish an enlarged spleen from a normal spleen according to the size of animal. Nos. 1 and 2 of Figure II illustrate the comparative sizes of healthy spleen and spleen from salmonellosis of adult rabbit of almost of the same size and age.

From the comparative histo-pathological study of intestinal lesions of rinderpest and salmonellosis in rabbits we may conclude that

- (1) The columnar epithelial lining of the intestines in rinderpest was intact for most of the part while it was desquamated in the intestinal lesions of salmonellosis.
- (2) The changes seen in the Peyer's patches in both the diseases were almost similar.
- (3) The submucous layer of intestines in salmonellosis showed fibrin deposition with focal leucocytic infiltration and serous layer

showed oedema and capillary congestion which could not be detected in sections of intestines of rabbits which died of rinderpest.

Before concluding it may be mentioned that salmonellosis is common in rabbits but the importance of this investigation lies not in the outbreak of salmonellosis but in the similarity of lesions produced to those of rinderpest in rabbit and their macroscopic and microscopic studies to arrive at the differential diagnosis. In the immunisation of livestock against rinderpest when carried out in the field using lapinised virus, salmonellosis should not be lost sight of as it is likely to complicate the reaction.

Summary

- (1) An outbreak of salmonellosis in rabbits is recorded.
- (2) Blood smears from rabbits suffering from salmonellosis are negative for organisms. But there is increase of polymorph nuclear cells and the cytoplasm of almost all polymorph nuclear cells contained bacteria-like bodies which do not take gram's stain. It is presumed that these bodies are only phagocytosed organisms of salmonella. Rinderpest blood does not show such phagocytosed bodies.
- (3) Blood smear examination of rinderpest and salmonellosis are negative but heart blood when inoculated in a suitable media and incubated, pure cultures of salmonella are produced in cases of salmonellosis, but rinderpest produces no change in media.
- (4) Salmonella (Enteritidis) is non-pathogenic to hill bulls but goats inoculated intravenously show decided thermal reaction.
- (5) Both rinderpest and salmonellosis in rabbits produce exactly identical lesions in Peyer's patches.
- (6) The comparative histo-pathological study of intestinal lesions of rinderpest and salmonellosis is described.
- (7) Splenic enlargement is almost a constant factor in natural cases of salmonellosis in rabbits but this is not noticed in lapinised virus producers.

Acknowledgment

The lapinised virus producers which we used for comparative study were all supplied by Shri M. R. Dhanda, Head of the Division of Pathology and Bacteriology, Indian Veterinary Research Institute, Mukteswar, for which we are thankful to him.

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DETERMINATION OF THE NATURE OF OESTROGENS IN THE GEL, SPERM PACK, AND SPERM FLUID FRACTIONS OF BOAR SEMEN

By

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Several workers have found that human semen or its extract when injected into spayed rodents produces the characteristic cornification of the vaginal epithelium (Green-Armytage *et al*, 1947; Riisfeldt 1948; McCullagh and Schaffenburg 1951.) They, however, did not separate the spermatozoa from the sperm fluid and so it is not known whether oestrogens were present in the spermatozoa or in male sex-accessory fluids. Mukherjee, Johari and Bhattacharya (1951; 1953) found that the gel portion of rabbit semen produces a similar effect when injected to ovariectomised rats and mice. Diczfalusy (1954) found by chemical determination that a litre of human semen contains approximately 60 μ g oestrone, 30 μ g oestriol and 10 μ g of oestradiol-17 β in free, non-conjugated form. The present studies were undertaken with the object of finding out whether the oestrogens are present in the spermatozoa themselves or in the accessory fluids and to characterise oestrogens with special reference to the semen of the boar.

The human semen is very much similar to boar semen as both contain a large quantity of seminal fluid and so the studies in the boar may throw some light on similar processes of reproduction in human beings. The result of this chemical determination has proved negative but keeping in view the importance of this subject, it is considered necessary to record here and to discuss the results of this study.

Material and Methods

Semen specimens were obtained from a boar of Yorkshire breed, aged 18 months, body weight 180 Kg when the experiment was started and subsequently, increased to 230 Kg. The boar was housed in a sanitary stall of the Department of Obstetrics and Gynaecology, Royal Veterinary College, under optimum conditions of food and management.

[The work was done during the author's stay in Sweden at the F. A. O. International Training Centre.]

The semen was collected by an artificial vagina over a dummy sow and the two collections, made on two different dates with a gap of three days, were mixed after precipitating them immediately with ethanol. The boar had a good serving behaviour and the semen quality as judged by standard methods, was as follows :—

First collection :—Volume, 150 ml. excluding the gelatinous portion which weighed approximately 42 g., Colour and Consistency: greyish white, thin milky, Mass activity + + + (+), Sperm concentration 388 thousand/cmm³, with 80% motile sperms, pH 7.4, the total number of sperms in the whole ejaculate was 58.2×10^9 ..

Second collection :—Volume 165 ml., excluding the gelatinous portion which weighed approximately 65 g., Colour and consistency: greyish white, thin milky., Mass activity + + +, Sperm concentration 379 thousand per cubic m.m., with 70-80% motile sperms., pH 7.58., the total number of sperms in the whole ejaculate 62.5×10^9 ..

Precipitation of Semen fractions with ethanol

Although efforts were made to precipitate the semen fractions with ethanol immediately after collection, for technical reasons it took 15-20 minutes before this could be done. However, for physical and microscopical study of semen 5 ml. was taken out separately and the rest of the semen was fractionated into Sperm fluid, Sperm pack, and Gel portions.

The semen sample was filtered through a thin meshed cloth over a wide funnel and the semi-solid gelatinous portion, hereafter, called as Gel was removed. The Gel was washed twice by adding glass-distilled water to remove traces of adhering seminal fluid and spermatozoa. After drying the Gel on a filter paper, it was weighed in a physical balance, thoroughly chopped in an electric auto-mixer (Turmix) before precipitating it with ten times 80-95% ethanol.

The fluid part of semen was centrifuged at 3,000 revolutions per minute for 10-15 minutes and the fluid portion was separated from the white pack left in the bottom of the centrifuge tube. The white pack, containing mostly spermatozoa, was washed twice with distilled water and centrifuged to make it free from the seminal fluid. The Sperm pack was thoroughly disintegrated with quartz sand in a pestle and mortar with an equal quantity of water and then 95% ethanol 10-12 times its volume was added before storing it in deep freeze at -13°C .

The Sperm fluid was similarly treated and precipitated by adding 10 times 80-95% ethanol. All the three fractions were stored at -13°C .

The second semen sample was fractionated into Sperm fluid, Sperm pack, and Gel; similarly treated with ethanol and stored in the deep freeze at -13°C for 24 hours. The First and Second set of samples were mixed and treated as one, in further extractions. The total amount of seminal components in each one of them was as follows :—

- (a) Sperm fluid 220 ml.
- (b) Sperm pack, derived from 315 ml. of whole semen, containing approximately 120.7×10^9 spermatozoa.
- (c) Gel 107.9 g.

Extraction and separation of oestrogens

The procedure followed by Diczfalusy (1953) in the extraction and fractionation of placental oestrogens and in the characterisation of oestrogens in human semen (Diczfalusy 1954) was adopted except that instead of fluorimetric method, the Kober colour reaction was carried out in the modification described by Brown (1955). In essence, the method is based on differential solubility of the oestrogens in various organic solvents. The details of the procedure followed in the extraction of oestrogens are given in the Flow sheets (1-3). The various steps are based on the measurement of partition coefficients of the three natural oestrogens (oestrone, Oestradiol-17- β ; Oestriol) in different solvent systems. The partition coefficients for oestrone, oestradiol and oestriol differ but it has been presumed in this case, to be the same, as a practical measure. The method has been discussed in detail by Diczfalusy (1953) in his well documented paper on the estimation of oestrogens in the human placental tissue.

FLOW SHEET I

Separation of the Boar Semen into Sperm fluid, Sperm pack and the Gel portions by filtration and centrifugation.

Sperm pack disintegrated.

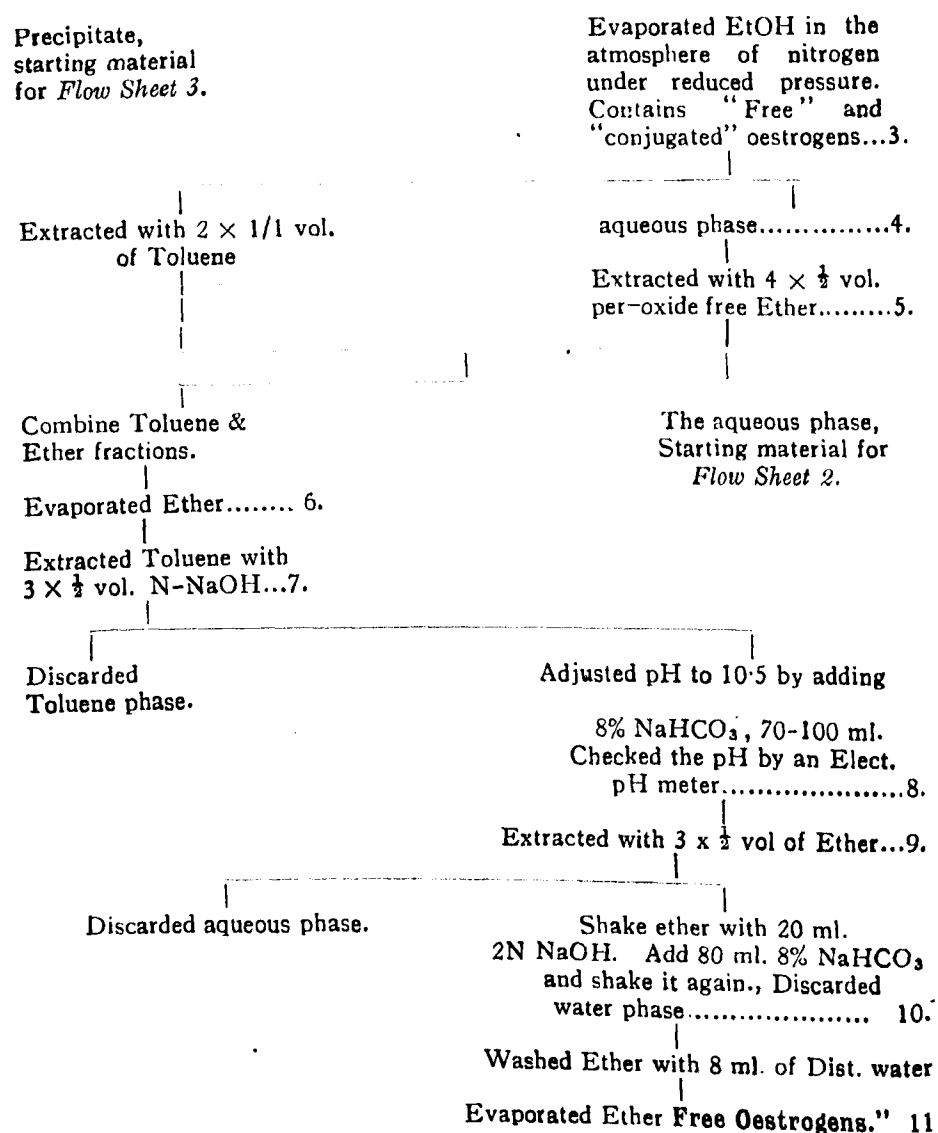
Gel disintegrated.

Proteins precipitated, by adding $\times 10$ vol. of ethanol 80-95% and keeping it over night at -13°C1.

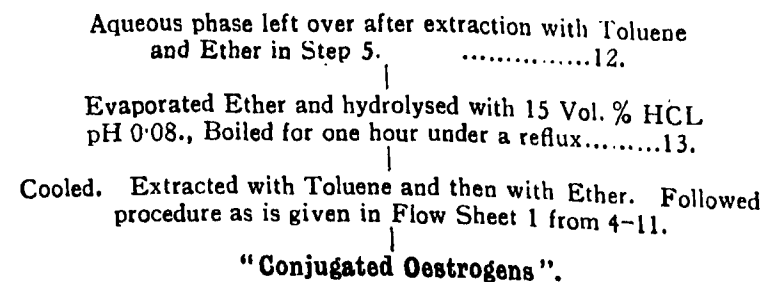
Next day centrifuge at -8°C , Extracted
2 $\times 1/1$ vol. of ethanol2.

(See next page)

Precipitate,
starting material
for Flow Sheet 3.



FLOW SHEET II



FLOW SHEET III

The precipitate, after extraction with Ethanol in step 3 Flow sheet I, was hydrolysed with 1/1 Vol. of 5% NaOH at room temperature for 12 hours.14.

pH adjusted to 10.5, by adding Concentrated HCL.....15.

Extracted with Toluene and then Ether. Followed procedure as is given in Flow Sheet I, from 4-11.

"Protein Bound Oestrogens".

Comments on extraction procedure.

1. Bischoff, Yee, Moran and Katherman (1951); Bischoff, Katherman and Yee (1951), demonstrated that oestrogen can be removed from rabbit or bull sera by the precipitation of proteins at 80-95% ethanol up to the extent of 96-99%. Ethanol under these conditions also removes a considerable portion of water soluble "conjugated" oestrogens. (1). §

2. Some water soluble "conjugated" oestrogens, lying on the surface of the Gel or in the sperm pack would have been removed while fractionating the semen into Gel, sperm pack and making them completely free from adhering sperm fluid.

3. All evaporations and distillations were conducted in an atmosphere of nitrogen and at reduced pressure. Werthessen, Baker and Borci (1948) emphasised the importance of this precaution. The commercial nitrogen available was purified by passing the gas through a column (800 m.m. long, 25 m.m. in diameter) filled with activated copper, heated to 250°C. The active copper was prepared according to the method of Meyer and Ronge (1939). The nitrogen reaches the flasks for ethanol distillation through a small capillary. The whole distillation apparatus was connected to a common vacuum pump. (3).

4. All ether employed was purified by adding silver nitrate solution (Silver nitrate 1.33 g., Distilled water 100 ml), 60 ml. to a litre of ether. The silver nitrate solution was removed in a separating funnel. The ether was again shaken with 100 ml N-NaOH and decanted. The ether now was distilled over NaOH pellets and was in most cases, used immediately. The procedure removes peroxides from the ether. Per-oxides present in the ether, if any, are likely to oxidise the oestrogens.

5. It has been assumed that toluene and ether would only extract "free" oestrogens whereas "conjugated" oestrogens would

§ Figures refer to the stages indicated in the Flow sheets.

remain in the aqueous phase. It is not known if there are conjugated oestrogens in the semen of the boar. The separation of "Free" and "conjugated" oestrogens has been made on their difference in ether solubility.

6. Cohen and Marrian (1935), Pincus (1949) found that alkali removes oestrogens more readily from toluene than from ether (7).

7. Acid hydrolysis was carried out with 15% v/v HCL under reflux. Engle (1950) found no loss of urinary oestrogens under more or less similar conditions. However, there is a possibility that some loss would have taken place (13).

8. Rakoff, Paschkis and Cantarow (1943), Szego and Roberts (1946, 1947) found "Protein-Bound" oestrogens in the blood of pregnant women. Lehninger and Scott (1947); Lieberman, Tagnon & Schulman (1952) found oestrogens becoming protein-bound. Diczfalussy (1953) found indications that boiling crystalline oestrogens in 10% NaOH for 30 minutes does not destroy the crystalline oestrogens to any great extent. The alkaline hydrolysis was carried out by adding 1/1 vol. with 5% NaOH as was done by Diczfalussy (1953) in human placenta.

The difficulties and observations, made in following the extraction procedure, may be interesting as no work of a similar nature has been done in the semen of Farm-animals.

Sperm Fluid Fraction

1. "Free" oestrogens—The sperm fluid of the boar is a straw coloured fluid, of slimy consistency containing a lot of mucus. The ethanol extract was a clear, transparent fluid. On evaporating it to about 1/8 of the volume, the fluid became hazy but subsequently it again became clear when all alcohol was evaporated. This was extracted with Toluene. In ether extraction, the separation would not take place. The "Free" oestrogens were determined only in the Toluene extracted portion.

2. "Conjugated" oestrogens—The aqueous phase for Flow Sheet No. 2 was the residue left in, out of the ethanol extracted portion by toluene. After acid hydrolysis, it was extracted with toluene. Ether extraction was not satisfactory. It had to be done by a large volume of ether. The ether extract was kept in the deep freeze at -13°C for better separation of the fatty material. Next day in the deep freeze, it was filtered on a Buchner's funnel with Munktell's filter paper No. 3. A good quantity of white amorphous substance was left over on the filter paper. However, it was washed twice with ether and then discarded. The ether portion was mixed with toluene extract. After evaporating ether, the N-NaOH extraction from toluene was not possible.

3. "Protein-bound" oestrogens—After alkaline hydrolysis, while making extraction with toluene strong emulsions were formed which had to be broken by centrifugation. Extraction with ether was not possible. The pH was reduced to 9.0 and then ether extraction was tried. Ammonium sulphate crystals were added but with practically no effect. Extraction was carried out by a large volume of ether and the procedure in 9², was followed here too. It appears that a substance, partly soluble in ether interferes with extraction procedure and is present in large quantities in the sperm fluid fraction. However, the nature of this substance was not determined.

Sperm Pack

1. "Free" oestrogens—It has been possible to follow the procedure given in the flow sheet for "Free" oestrogens.

2. "Conjugated" oestrogens—Procedure given in the Flow sheet No. 2 was followed.

3. "Protein-bound" oestrogens—There was difficulty in extraction with ether at pH 10.5 and so the pH was reduced to 9.0 and the procedure followed.

Gel

1. "Free" oestrogens—The procedure in Flow sheet No. I was followed.

2. "Conjugated" oestrogens—The aqueous portion, after acid hydrolysis with concentrated HCL became chocolate coloured.

3. "Protein-bound" oestrogens—After alkaline hydrolysis (Flow sheet 3), the pH was adjusted to 10.5. With toluene, strong emulsions would form which would not break on centrifugation and, therefore, the method given in the Flow sheets could not be followed. However, other alternative methods were not tried.

Isolation and Determination of Natural oestrogens

The dry residue was dissolved in 1.0 ml. of ethanol and 25 ml. of benzene and 25 ml. petroleum ether was added to each of "Free", "conjugated", and "Protein-bound" oestrogen fractions. Each was extracted twice with 25 ml of distilled water and finally extracted with ether at pH 10.5. The ether which possibly contains Estriol (E3) is evaporated in Kober tubes containing 4 mg of hydroquinone, in nitrogen atmosphere, under reduced pressure.

The organic solvents are likely to contain Estrone (E1) and Estradiol (E2). It was extracted with 0.4N-NaOH and the phenolic hydroxyl group methylated with dimethyl-sulphate at room temperature in alkaline medium. The methylated oestrogens were extracted

with N-Hexane. The E1 and E2 were separated by adsorption chromatography on partially deactivated aluminium oxide (Al_2O_3) columns (See Brown, 1955)

Kober Colour Reaction

The oestrone (E1) oestradiol (E2) oestriol (E3), fractions were evaporated in Kober tubes containing 4 mg of hydroquinone in nitrogen atmosphere, under reduced pressure. Add to E1, E2, E3, 3 ml of 66%, 60% and 76% of Sulphuric acid respectively. The test tubes are heated for 20 minutes in a boiling water bath and immediately cooled. The water was added to E1-0.5, E2-0.2 and E3-1.0 ml. The tubes were again heated for ten minutes and cooled. In a Beckman's Spectrophotometer, readings at wave length 480, 516, 552 $m\mu$ for E1 and E3 and 480, 518 and 556 $m\mu$ for E2 were taken.

Calculation:—The Allen formula (Allen 1950) modified by Brown (1955) has been used. The extinction constant is twice the reading at 516 or 518 minus sum of the readings at the other two wave lengths. If this is less than 0.025, it is not taken into consideration as it may be due to experimental error.

Result

The presence of oestrone, oestradiol 17β and oestriol in "Free", "conjugated" and "Protein-bound" fractions, in 220 ml of sperm fluid, the sperm pack derived from 315 ml. of semen/sperm concentration 120.7×10^9 and 107.9 g. of gel, could not be demonstrated as the amount of oestrogens estimated are within the experimental error. The estimation, of "conjugated" oestrogens after acid hydrolysis from sperm fluid and "Protein-bound" oestrogen in the gel portion, could not be made as strong emulsion would form and it would not be possible to break it and separate the fractions satisfactorily.

Discussion

Fellner (1921) reported an increase in uterine weight of spayed guinea-pigs treated with lipid extract of bull testis. Goldzieher & Roberts (1952) identified oestradiol in the human testicular extracts. However, the negative findings in the above study may lead us to the following conclusions:—

1. There are no oestrogens.
2. If the oestrogens are present, they are in a very low concentration and the method is not sensitive enough to determine them.
3. Errors in processing also may be there.

The limitations of the colourimetric method of determination of oestrogens in semen may be kept in mind. According to Hawk, (1947)

colourimetric methods are unsuitable if the concentration of oestrogens is less than 1.5 mg. per litre approximately. The hazards of processing, the time taken between collection and precipitation with ethanol, loss of oestrogen in acid hydrolysis or evaporating ethanol and the worst of all, the formation of emulsions make the method far from quantitative, specially when it is applied to samples other than urine (Emmens 1950).

It appears that if there is less than a few milligrams of oestrogen in the total extract available, biological assay must, at present, be used. The ideal biological test method under these conditions would be one which does not differentiate between the various oestrogens which may be present and is not affected by the presence of extraneous material. Such an assay would give an estimate of the total weight of oestrogen in the sample irrespective of its nature while Kober reaction may be applied with large chemically assayable amounts. The Gel has given characteristic response for oestrogens when injected in ovariectomised mice (Johari 1955).

Summary

The method followed for the determination of oestrogens by Kober reaction in various semen fractions, consisting of sperm fluid, sperm pack, and gel from two ejaculates of an Yorkshire boar, has been described.

It has not been possible to characterise oestrogens of boar semen. However, the various indications of the negative findings have been discussed.

The limitations of the colourimetric method in determining oestrogens in semen samples have been given. It appears that for some time to come at least, biological test method would be more useful as it would give an estimate of the total weight of the oestrogen in the sample.

Acknowledgment

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General Articles

PREVENTION OF LOSSES IN POULTRY-SOME ASPECTS OF POULTRY DISEASE CONTROL*

By

J. E. LANCASTER

It is impossible to describe or discuss all the aspects of Poultry diseases. This subject covers a very vast field. However, I wish to mention some of the more important items and try as far as possible to relate these items to the poultry problems in this region of the world.

*Summary of a lecture delivered by Mr. J. E. Lancaster, Veterinarian, F.A.O. Mission, Bangkok, Thailand, on the subject of "Prevention of Losses in Poultry" at the time of the F.A.O. Technical Meeting on Poultry Production in Asia and the Far East, held in Poona, Bombay State, from 17th to 27th October 1955.

We can conveniently consider poultry disease control from two different aspects, namely laboratory and field control work. Although these aspects appear to be separate and distinct, yet it is quite obvious that both are equally important and must be closely co-ordinated if maximum progress is to be made in a country.

First, I wish to discuss the laboratory aspect and later I will mention field control work.

Briefly, the laboratory aspect concerns the production and testing of the various poultry vaccines which are now regularly used in the field. In addition, there is also need for a research staff to develop more efficient means for the prevention of poultry losses, and to investigate new problems as they arise. It is very likely that a developing poultry industry will be associated with poultry disease problems which at the present, may not be serious in the country concerned.

The use of the developing chick embryo has greatly facilitated the preparation of vaccines for the control of virus diseases of poultry, for example, Newcastle Disease, Fowl Pox, Infectious Laryngo Tracheitis Infectious Bronchitis. The virus can be readily cultivated in the laboratory and the vaccine prepared under strict conditions. Generally such vaccines are economical to produce. There are, however, several important aspects to consider.

First, the possible contamination of the virus vaccine with other poultry pathogens. This may arise as a result of cross infection or contamination in the laboratory. However, the contamination of living virus vaccines may very easily occur by means of egg transmitted poultry pathogens. That is, the pathogenic agent is already present in the egg used for the preparation of the vaccine. The natural transmission of pullorum disease through the egg of an apparently healthy hen was recognised many years ago. Fortunately, the danger of this infection contaminating a living vaccine can be overcome by blood testing the poultry flock supplying the eggs. This is of great importance because recent experiments have shown that a fowl pox vaccine contaminated with *Salmonella pullorum* can produce an outbreak of pullorum disease in vaccinated chicks. However, the control of pullorum disease presents no real problem. It is the transmission through the egg, of certain other diseases which presents a more serious problem, because unless the vaccine is free from these egg-borne diseases, disastrous results may follow use of such vaccines in the field. Such naturally egg borne diseases include the visceral form of leukosis, infectious bronchitis, and possibly other respiratory diseases.

Of the diseases likely to naturally contaminate a vaccine, Leukosis is perhaps the most dangerous because the vaccination of young chicks occurs at an age when the birds are more susceptible to the leukosis virus. In addition, due to the prolonged and uncertain incubation period of leukosis, this virus cannot be readily detected by the usual routine safety and potency tests, which are applied to each batch of vaccine prior to issue. Infectious bronchitis virus which may also contaminate a poultry vaccine has a much shorter incubation period and therefore can be more readily detected by using carefully selected young fowls or chicks for vaccine safety tests.

In another connection, Dr. S. N. Nandi of India, has shown that an undetected selective increase in pathogenicity of Ranikhet virus can occur unless suitable breeds of chicks are used for the safety test.

These examples therefore serve to emphasise the need for the laboratories to take the greatest care in obtaining eggs from healthy poultry flocks. Flocks maintained under the direct control of the laboratory are to be recommended. By this means, the flock can be kept under constant observation and the health maintained at a high level. Economy can be effected in the field-use of vaccines, but no economy can be made in the careful management of the flock supplying eggs, and chicks to the laboratory.

It follows that there is need for laboratories to adopt adequate safety and potency tests for each vaccine prepared.

Experience has shown that the inactivation of a fully virulent virus in order to prepare a vaccine has disadvantages. Either the vaccine often gives poor immunity or virus, by disassociation, may regain its full virulence. Field results with living artificially attenuated Newcastle or Ranikhet disease vaccine have shown that in general, this type of vaccine cannot be used on young chicks, although, in older birds, the resulting immunity is very good.

To overcome these disadvantages, investigations have been conducted to determine the value of living naturally avirulent, Newcastle and Ranikhet Disease virus vaccines. The great advantage of this type of vaccine is that it can be used for day-old chicks. In certain districts where Ranikhet or Newcastle disease-as it is also called is prevalent, it is necessary to protect fowls at an early age. There are at the present time, two strains of virus generally used for the vaccination of day old chicks, namely, the B-1 strain (of Hitchner) and the F strain (of Asplin).

Strain F Newcastle disease virus is being tried on a large scale in a number of countries since it is thought that this strain may have

better antigenic properties than the B-1 strain. In Thailand, we have carried out a number of observations on the properties of strain F. Newcastle disease virus and, as a result, this virus is now used as a vaccine for routine field work in that country.

Perhaps it may be of interest to briefly summarise the characteristics of this strain F. Virus, as we have observed in Thailand.

We find strain F Ranikhet virus vaccine is equally suitable for the vaccination of either day-old chicks, growing stock or adult birds. Thus only one type of vaccine need to be prepared to meet all demands. In Thailand this is a great saving in production and testing procedures and also eliminates any risk of cross infection between different strains of vaccine viruses.

This strain F virus is exceedingly mild in its reaction and the effects of vaccination are often unnoticed. No paralytic symptoms result and the vaccination of laying birds produces no detectable loss of egg production.

The vaccine is very stable; and in our field work in Thailand we have used fresh (undried) vaccine, carried in vacuum flasks with ice, for periods of three weeks at a time without any deterioration (loss) in the immunising power of the vaccine. Freeze dried vacuum sealed vaccine is, of course, a far more stable and useful product and can be readily transported through the normal postal services. However, in countries or districts where large freeze drying equipment is not available, fresh vaccine can be prepared and with care used satisfactorily in the field.

In Thailand, we have used this strain F vaccine on infected and in-contact birds in actual outbreaks of Ranikhet disease. In controlled experiments, we have shown that the use of this vaccine in an active outbreak does not increase the reaction or mortality. On the other hand, we have not observed the interference phenomenon which has been reported by Dr. I. B. Mirza in India using the Indian strain of vaccine.

I fully agree with the statement made by Dr. Mirza in the *Indian Veterinary Journal*, that inoculation of all fowls, including those in the incubative stage, is the best way of cutting short a field outbreak of Ranikhet disease.

One disadvantage of the strain F virus is that the duration of immunity appears to be less than that which follows the use of the more virulent strains, for example, the Mukteswar virus. We have found in Thailand that the intranasal vaccination of growing or adult stock gives a durable immunity for approximately a year. The length of immunity following vaccination of day old chicks is somewhat less.

Thus, as often occurs when a disease problem requires solution, the advantages and disadvantages of the control measures at present available have to be considered and a compromise made. The final approach to the disease problem being greatly influenced by local conditions.

There are a number of other aspects relating to Newcastle or Ranikhet Disease which I should like to mention.

The combination of Newcastle Disease and Fowl Pox Vaccine into the one inoculum given by the wing web stick method is a great saving in time and labour. However, in some countries, Fowl Pox is a serious problem in the young chickens, older fowls being more resistant. In Thailand we use the combined Newcastle Disease—Fowl Pox vaccine for growing stock. Recently we have vaccinated chicks taken straight from the incubator, with both Newcastle Disease vaccine given intranasally and pigeon virus given by the feather follicle method. It seems that with strong chicks reared under good conditions this double vaccination at day-old against Newcastle disease and Fowl Pox can be carried out satisfactorily.

It appears therefore that strain F-Newcastle Disease vaccine could be used in hatcheries, to vaccinate all chicks at day-old before they leave the hatchery. This procedure would be a practical way of vaccinating large number of chickens, in either the Chinese hatchery or in hatcheries using cabinet incubators.

It is obvious that fowls must be healthy at the time of vaccination. In addition, the chickens must be kept free from disease until immunity develops. In general if chickens are exposed to virulent Newcastle virus soon after vaccination, the vaccine has no time to produce immunity and some deaths will occur.

Of course, the ideal way and the one which gives the best results is to vaccinate the birds before the disease has reached them. This is simply another way of saying "Prevention is better than cure," and this approach to disease must be constantly emphasised to all poultry raisers.

The presence of the mild form of Infectious Laryngotracheitis or of a latent Respiratory Infection in young chicks will sometimes cause a severe reaction to follow intranasal vaccination with Newcastle vaccine. This is of importance should a mortality in chickens follow Newcastle vaccination.

I come now to the second part of my talk, that is, to discuss poultry disease control in the field. Although I make a division between laboratory and field work; as I mentioned earlier, there must

be a very close coordination between the laboratory and the field, if the control of poultry disease is to be efficient.

It is one problem to produce the vaccine, it is another problem to organise the maximum use of the vaccine in the rural areas. The urban areas generally present little difficulty, for obvious reasons. Each country and each district must deal with this problem of field work according to staff facilities and local conditions. A number of trained inoculators with adequate transport is essential for a large rural vaccination programme. To facilitate vaccination, I have mentioned the vaccination of day-old chicks before they leave the hatchery; the combination of two vaccines in the same inoculum or the simultaneous use of two different vaccines.

In Thailand we have operated our initial field control programme through the head man of the district and under him, the head man of each village. Also we have tried to carry out most of the field work when the farmers are not heavily occupied with their crops. In most of the rice growing areas, this is during the early part of the dry season, and this in itself facilitates movement in country areas away from surfaced roads.

Large scale vaccination in rural areas presents a problem—and it is very encouraging to learn of the scale on which Newcastle disease vaccination is being carried out in certain countries in this region. It is only by large scale vaccination combined with better husbandry method that an appreciable and noticable improvement can be obtained in the health of the poultry population of a country.

We have had a most interesting and enlightening discussion on poultry breeding and the meeting has discussed present and future plans for the improvement of the indigenous stock. The meeting has discussed the need to consider the future development of fully equipped multiplication farms and hatcheries. I feel that the meeting must—at the same time—consider what improvements, what developments, are necessary to expand simultaneously the disease control programme. This expansion of disease control must take place both in the laboratory and in the field use of the products of the veterinary Laboratories.

Effective disease control is based fundamentally on prompt and accurate diagnosis. Post mortem examinations conducted by trained technicians either in the Laboratory or in the field, will lead to prompt and sound measures being taken.

We have learnt of the housing and management practices of the village or rural poultry raiser of the different countries in this area. The education of the rural poultry raiser is of paramount importance in

order that all will appreciate that poultry disease control cannot be separated from poultry husbandry. In many instances, it is impossible to control poultry diseases without at the same time making changes in the system of poultry husbandry. Improvement in poultry husbandry will often, in itself, produce an improvement in the health and productivity of the flock. Poultry raisers must not be misled by the idea that vaccines and medicine will cure all and every disease condition. This is a fallacy held by many poultry raisers throughout the world.

Farmers must be taught that the prevention of disease, by better housing and management should be the ultimate aim. Vaccines and medicines are merely aids, although very valuable ones, to assist the farmer in the better management of his poultry.

Perhaps at this stage, I might summarise the points so far made, as they relate to the increasing development of the poultry industry. These are:

First:—Expansion—if necessary—of the laboratory facilities for vaccine production, diagnosis and research.

Second:—Expansion of the field vaccination service.

Third:—The development of better husbandry methods through the activity and guidance of the poultry extension service.

To return to certain disease problems of Poultry:

Large Breeding farms and hatcheries operated either by the Government or private breeders provide a ready means of controlling the health of the chicks or fowls which are to be distributed to the villages.

There are however certain diseases of poultry which must receive particular attention on such farms. These are:—

1. *Leucosis*:—The importance of leucosis to raisers of modern breeds of poultry arises from two main facts; viz., the actual mortality which the leucosis complex can produce in a flock; and secondly the lack of precise reliable control measures to produce satisfactory results on the ordinary poultry farm. In these respects, leucosis presents a serious problem to all concerned with the poultry industry.

Two opinions concerning leucosis, worthy of mention, have been recently expressed. One is that an increase in the incidence of leucosis is often associated with a rapid expansion of the poultry industry within a country and with the use of mass production or intensive methods of husbandry. This is a very significant statement. The second opinion concerns the increasing evidence that the visceral form of leucosis is

transmitted through the egg. The latter fact emphasises again, the danger of contamination of poultry virus vaccines with poultry pathogenic agents.

The present evidence that egg transmission applies only to the visceral form and not to the neural form of the disease supports the need for a clearer definition and classification of the various lesions which have been grouped together under the heading of the leucosis complex.

Until more definite means of control can be finalised, poultry breeders must continue to rely on the main methods now being practised. They are, firstly to breed families which have a genetic resistance to the disease. This in turn requires careful post mortem diagnosis of the causes of all deaths in the flock and detailed recording in the pedigree records; secondly, the rearing of chicks in isolation from adult stock. This means careful planning of the farm layout and management.

Government poultry farms and especially those concerned with the distribution of modern or foreign breeds to the village farmer must consider measures aimed at producing chickens with a resistance to the preventable forms of leucosis.

Respiratory Diseases

Many respiratory diseases are not very spectacular so far as the number of deaths which result over a short period of time is concerned. The poultry raiser who, for example, compares the apparent relative importance of Newcastle disease and respiratory disease, is often led into a false sense of economic loss. The seriousness and chronic nature of many of the respiratory diseases, together with the resulting lack of growth and egg production, is often overlooked by farmers.

Many respiratory diseases are specific and respond to specific control measures (e.g. lack of vitamin A — avitaminosis A. and laryngotracheitis.) Other respiratory diseases can be controlled only by careful poultry husbandry and the development and maintenance of healthy flocks. (e.g. chronic respiratory disease and infectious coryza.) Recent work on some forms of respiratory disease suggests that the addition of certain antibiotics to the feed is a useful means of reducing the mortality and maintaining growing rate.

Pullorum Disease

Pullorum disease is an example of a poultry disease which often becomes of increasing importance following the introduction of foreign breeds into a country. Not only are modern breeds of chickens susceptible to this disease, but cross bred birds between the imported and

indigenous breeds may show increased susceptibility over the pure indigenous stock. For this and other reasons, the control of pullorum disease should not be deferred until the more spectacular diseases are under control, for by this time, pullorum disease may have become widespread.

Consideration might be given to experiments and field trials on the control of pullorum disease by medical treatment through the food. The results may lead to a pullorum disease control programme obviating the slaughter of reacting fowls.

With reference to the use of optical chick sexing instruments, experiments which we carried out in England showed that this method of sexing chicks can cause the spread of pullorum disease with deaths of infected chicks. We found the use of para formaldehyde tablets to be a satisfactory means of sterilising the small optical tubes.

Time does not allow discussion of the numerous other diseases and parasites which affect poultry. There is however one aspect which arises from the problem of poultry disease. It is that large breeding and multiplication farms should be located near to a poultry disease laboratory in order that all disease matters may receive prompt attention. To overcome communication difficulties, certain farms may establish their own small poultry diagnostic unit. There is no need for this diagnostic unit to be either large or elaborately equipped. A simple unit can be of considerable value.

Finally, I wish to say a few words on *the introduction of foreign breeds of poultry into a country with an indigenous poultry population*:

The introduction of foreign breeds of poultry not only brings problems of acclimatisation and the need to avoid eventual deterioration of the stock, but in addition, such importations are often associated with new problems of disease control. It is found that imported breeds are generally susceptible to those diseases which only rarely cause serious losses in the local or indigenous fowl. In addition, unless the importations of chickens are subjected to careful and strict quarantine measures, poultry diseases, foreign to the importing country may be introduced.

Experience in several countries shows that the importation of foreign breeds of poultry is often associated with an increased incidence of the different types of avian respiratory diseases. In some instances, these diseases appear to remain confined to the pure-bred imported stock; but there is also evidence, however, that respiratory diseases have become increasingly prevalent in the cross-bred chickens bred from the imported and indigenous breeds.

Thus, unless careful measure are taken, the large importation of foreign breeds of poultry can increase the overall poultry disease problem in a country for an indeterminate period of time. The object of poultry breeding policies of a country must be to provide the village poultry raiser with the advantages of improved breeds without the handicaps of disease susceptibility which is often associated with the raising of newly introduced foreign breeds.

It seems to me from the experience of a number of countries in different parts of the world, that unless carefully controlled quarantine measures followed by an initial restricted distribution in the country, are adopted, the importation of livestock can very often increase the overall disease problem in a country.

I think that in the case of poultry, the safest method to adopt is to keep the newly imported chickens on Government farms for at least one generation. This will allow any new disease or acclimatisation problem which may develop, to be controlled by the Veterinary and Animal Husbandry staff. Thereafter the fowls can be gradually introduced to the village environment. In this way any new disease problem possibly introduced by the importation, will be confined and prevented from reaching large rural areas where disease control measures are far more costly and difficult to undertake.

Unless the procedure of quarantine and an initial limited distribution, is adopted, village poultry raisers may suffer losses in their new stock and be disappointed and perhaps discouraged. These remarks apply in particular to newly imported chickens. They do not, of course, apply to foreign breeds of chickens which have been bred for a number of generations in a country prior to distribution to the rural areas.

NUTRITIVE VALUE OF GREEN MANURE CROPS

II. *Gliricidia maculata*.

By

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Gliricidia maculata (= *G. sepium*) has all the three major characteristics of an ideal green manure crop, viz., (1) rapid growth, (2) abundant and succulent tops, and (3) ability to grow well on poor soils. It has become recently a popular green manure plant in Madras state by growing on the bigger bunds of the paddy fields. It is a medium sized quick growing tree, but there is no adverse shade or root

effect on the paddy plants. It stands repeated lopping and supplies about 20 pounds of leaves per plant within 18 months. Experiments have shown that about 4000 pounds of green leaves applied per acre at the time of puddling, improve the yield up to 40 percent in the first year.

At the suggestion of the Director of Agriculture, Madras state, for determining its forage value, a preliminary study of its composition, palatability and nutritive value was undertaken and the results obtained are presented in this paper.

The leaves and shoots of *Gliricidia maculata* trees 18 months old, obtained from the Rice Research Station, Tirur, Chingelput district, were analysed for their chemical composition, [1].

1. Nutrients Composition

The percentage composition of nutrients in the *Gliricidia maculata* leaves and stalks, dried at 105° C, is given on dry matter basis with the calculated digestible nutrients and starch equivalents in Tables I and II.

TABLE I
Percentage Nutrients Composition of *G. maculata* Leaves and Stalks.
(on dry matter basis.) Age of growth 18 months.

Part of the plant %	Crude Protein (Nx 6.25) %	Ether Extractives. %	Crude Fibre. %	Nitrogen Free Extractives %	Total Ash. %	Insoluble Silica. %	Calcium. %	Phosphorus. %
Leaves.	18.81	5.23	11.87	49.85	14.24	1.75	2.16	0.35
Stalks.	9.67	4.41	31.30	41.23	13.39	0.34	1.29	0.30

TABLE II
Calculated Digestible Nutrients and Nutritive Values of
G. maculata Leaves and Stalks on dry matter basis. [2].

Part of the plant.	Digestible Nutrients.				Starch Equivalent.	Nutritive Ratio
	Protein. %	Ether Extractives. %	Crude Fibre. %	N. F. E. %		
Leaves.	10.70	1.05	2.54	23.44	39.10	2.7
Stalks	5.50	0.88	6.70	19.37	33.59	5.1

Discussion

The fairly high protein with low fibre and a fair amount of crude fat in the leaves make them a useful fodder like any other legume forage. The large amount of ash with only 1.75 percent silica and a high percentage of calcium in the leaves increase their forage value.

The stalks too have about half the protein and calcium contents of leaves, a fair amount of crude fat and considerably lower amount of silica, which make them valuable as fodder. The phosphorus contents of leaves and stalks remain almost the same and are too low when compared with calcium present. The leaves and stalks to be useful as a balanced feed should be supplemented with phosphorus rich feed to correct the abnormal calcium phosphorus ratio.

The composition and nutritive value of young twigs and tender leaves of *G. maculata* on dry matter basis reported from Malaya are, Crude Protein 18.82 %, Digestible Protein 10.7 %, Ether extractives or Crude fat 3.61 %, Digestible Crude fat 0.72 %, Crude Fibre 15.46 %, Digestible Crude fibre 3.32 %, N. F. E. 55.72 %, Digestible N. F. E. 26.2 %, Total ash 6.27 %, S.E. 41.88 and N.R. 2.9. [2, 3].

The crude protein content of young twigs is the same as that of the leaves from 18 months old trees. As the leaves grow fully mature the crude fat content increases as well as crude fibre. The mineral ash too becomes twice as great as that of young twigs. Though the starch equivalent does not differ much in the young twigs and matured leaves, the latter is slightly less than the former. The nutritive ratio is narrow in young twigs, mature leaves and stalks like that of a concentrate mixture, but the starch equivalent is only 33 to 40, which compares low to that of a concentrate feed.

2. Palatability

Breeding bulls, bullocks, cows and calves in the College, were offered specimens of green *G. maculata* leaves and stalks several times for judging its palatability. They smelt, but did not eat the leaves and stalks. Even soaking the leaves and stems in sugar solution did not tempt these animals to taste them. The leaves when offered to guinea-pigs, were not eaten by them. When mixed with cabbage leaves and given to guineapigs, they ate the cabbage leaves and totally rejected *G. maculata* leaves.

This doubtful palatability though observed with the few available animals in the College does not agree with the observations reported in other countries. The foliage has been reported to have good feeding value and is palatable to cattle and other livestock in the British West Indies, Malaya and Ceylon. The leaves are fed either fresh or dried and ground to a meal. The latter contains about 22 percent protein [2].

The leaves and twigs tasted bitter and the bitter principle appeared to be a phenolic compound present in the leaves and extracted in the crude fat fraction. The leaves and twigs, when they are young and tender, did not seem to elaborate this bitter principle to such an

extent to make them unpalatable. The increase of crude fat and also total ash in the 18 months old leaves as compared to that in young twigs reported in Malaya may possibly explain the unpalatable nature of this specimen due to the elaboration of the bitter principle in increasing quantity with growth and age.

3. Feed Value of *G. maculata* Leaves to Guinea-pigs

In order to see the effect of continued feeding of the mature leaves on the health of laboratory animals as a green supplement, groups of 4 guinea-pigs were fed with these leaves in the place of their usual green feed, leaves of cabbage and beet root, with the same basal ration, Bengal gram (*Cicer arietinum*) soaked in water. The weights of animals and their daily feed consumption were recorded with a group of similar control animals for a period of seven days, after a preliminary trial of accustoming the experimental animals for four days with the mixture of new feed added to the usual one by gradual increase. The results are given in the Tables III to V.

TABLE III

Gliricidia maculata Leaves Fed Group. (Feeding period 7 days.)

No.	Weight at first. Grams.	Weight at end. Grams.	Av. basal ration B. Gram. per animal. Grams.	Leaves consumed per day per animal. Grams. Av.	Change of Wt. Grams.	Av. Wt. at first Grams.	Av. change of Wt. Grams.	% change of Wt.
1	180	167	30	3	-13	148.5	-9.5	-6.4
2	164	150	30	3	-14			
3	144	132	30	3	-12			
4	144	145	30	3	+1			

TABLE IV

Cabbage and Beet Root Leaves Fed Group. (Feeding period 7 days.)
(CONTROL)

No.	Wt. at first. Grams.	Wt. at end. Grams.	Av. basal ration B. Gram. per animal. Grams.	Leaves consumed per animal per day. Av. Grams.	Change of Wt. Grams.	Av. Wt. at first Grams.	Av. change of Wt. Grams.	% change of Wt.
1	190	205	30	12	+15	228	+38	+16.7
2	193	222	30	12	+29			
3	265	320	30	12	+55			
4	265	310	30	12	+45			

TABLE V

G. maculata Leaves Fed Group Changed Over to Control Ration.
(Feeding period 7 days with cabbage and beet root leaves.)

No.	Wt. at first. Grams.	Wt. at end. Grams.	Av. basal ration B. Gram. per animal. Grams.	Leaves consumed per day per animal Av. Grams.	Change of wt. Grams.	Av. Wt. at first. Grams.	Av. change of Wt. Grams.	% change of Wt.
1	167	208	30	13	+41	148.5	+32.75	+22
2	150	169	30	13	+19			
3	132	168	30	13	+36			
4	145	180	30	13	+35			

The weights of fresh leaves consumed by each animal are given as an average per day for the whole week.

During the preliminary adaptation period, when the guinea pigs were given the mixture of *G. maculata* leaves and cabbage and beet root leaves, they were observed to consume only the beet root and cabbage leaves, leaving behind those of *G. maculata*. When the *G. maculata* leaves were offered in the chopped condition as the only green feed, they ate them though only in smaller amounts.

The experimental animals after the observation for a week are given again their usual greens and the same basal ration for a week. Their growths are recorded in Table V, for comparison.

Discussion

Each of the experimental animal on *G. maculata* leaves consumed only one-fourth the weight of normal greens and lost weight daily, which amounted on an average to 6.4 % in 7 days. The animals were in negative nitrogen balance by the influence of *G. maculata* leaves, in the diet. The animals in the control group not only ate four times as much as experimental animals the green leaves of cabbage and beet root, but they were also growing steadily. Their increase in weight was on an average about 16.7 % in the same 7 days, showing that they were in positive nitrogen balance. The experimental animals, when changed over to their normal diet, they immediately began to increase in weights and in an equal period of 7 days not only ate more greens but also increased their weights by 22%.

Though the experimental period was only 7 days in each group, the results observed with guinea-pigs show clearly the unsuitable nature of *G. maculata* leaves for them under the conditions adopted and also their poor palatability for these laboratory animals as well. The results of change-over experiment indicate how the ill effects caused by feeding these leaves to guinea pigs are corrected quickly by the leaves of cabbage and beet roots as their normal green feed.

Summary

1. The nutrients composition and nutritive value of *Gliricidia maculata* leaves and stalks from mature trees 18 months after planting are determined and compared with those reported for young twigs and leaves of the same species in Malaya. They have high crude protein, low fibre, high calcium and poor phosphorus. But their digestible protein is only about 11 percent and the starch equivalent is about 39 for the leaves.

2. Cattle and small animals like guineapigs do not relish the leaves and stalks of the grown up trees 18 months old, even though the young twigs and tender leaves of young trees in other countries are reported palatable and relished by livestock.

3. The reduced palatability in the mature leaves used for green manure and their bitter taste are probably due to the increase of phenol like compounds found in ether extractives.

4. The effects of feeding the mature leaves to guineapigs in the place of cabbage and beet root leaves with soaked Bengal Gram as basal diet, are lower intake, and reduced growth or loss of weight as compared with the control animals.

5. The experimental animals when changed over to the normal green supplement, they grew well and increased their weights greater than the control animals, quickly overcoming the ill effect caused by feeding *G. maculata* mature leaves.

6. *G. maculata* leaves used as green manure are found unpalatable in the full grown state to livestock and laboratory animals even though the young and tender twigs are reported in other countries as relished by livestock.

Acknowledgment

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NUTRITIVE VALUE OF GREEN MANURE CROPS

III. *Phaseolus aconitifolius* or *Phillipesara*

By

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Phaseolus aconitifolius (= *Ph. trilobus*), or *Phillipesara* or moth or mat bean, a herbaceous creeping annual, native to India, has almost all the requirements of a soil improving crop such as alternate food or fodder value, easy cultivation in fallow land, easy seed germination and harvesting, rapid growth, low-growing to be turned easily into the soil, nitrogen fixing, acid tolerance and freedom from disease and pests. [4]. It is grown in many countries yielding palatable and nutritious pasturage and hay. In Madras state, it is used as a popular fodder and as the most suitable green manure crop to precede in cotton rotation or to succeed paddy as pure or mixed crop with fodder sorghum in wet or dry lands. It is drought resistant, but not damaged by excessive irrigation. It is less susceptible to insect pests than Sunnhemp [3]. There are about 20,000 seeds per pound and 30 to 40 pounds are sown broadcast or 5 to 6 pounds are planted 30 x 3 inches apart per acre.

It has been grown in all Government livestock and agricultural farms in the state for more than 30 years and its yield has been reported as much as 18,500 pounds under irrigated condition at Koilpatti and 6800 pounds as rain fed crop at Hosur in two or three cuttings for fodder and finally gives a fair amount of seed or green manure [3].

The *Phaseolus trilobus* grown in the College garden is analysed for its nutrients composition in three successive cuttings at monthly intervals from the date of sowing. [1] The results with the calculated digestible nutrients and nutritive ratio are given in Table I. [2] The composition of *Phillipesara* hay reported in the literature has been included in the table for comparison [3].

Discussion

The values for crude protein, crude fibre and calcium increase in successive cuttings with corresponding small decrease in ether extractives or crude fat, nitrogen free extractives, total ash and phosphorous contents. The high protein, low fibre, high N. F. E. and a good amount of calcium make it a fodder of high nutritive value with a very narrow nutritive ratio in monthly growth cuttings, like a protein rich concentrate feed for production. The total digestible nutrients come to about 60, which make it a highly useful forage crop for dairy cows like alfalfa meal. The Calcium Phosphorous ratio, 1:0.33 is unbalanced as

that in any other legume crop and therefore this forage requires Phosphorous rich supplemental feed as bran to make it balanced in mineral requirements also. As it is used as pasture, soiling crop, silage or hay, it is versatile in its fodder value rich in protein requiring no supplementary concentrate feed. Mixed with sorghum fodder or paddy straw it becomes a balanced feed for maintenance and production in dairy cattle.

TABLE I

*The Nutrients Composition of Phaseolus trilobus (Phillipesara)
(at monthly growths for 3 successive cuttings from the
date of sowing, on Dry Matter basis.)*

Nutrients.	1st cut. %.	2nd cut. %.	3rd cut. %.	Av. for 3 cuts. %.	Dig. nutr. %.	N.R.	Hay. %.
Moisture (Fresh) (at 100°C). ...	78.44	74.56	83.26	78.9			10.77
Cr. Protein (N x 6.25) ...	21.44	23.60	26.69	23.91	17.26		11.42
Ether Extractive. ...	3.37	2.83	2.07	2.76	1.84		1.26
Cr. Fibre. ...	13.81	17.52	18.36	16.57	8.29		22.06
N.F.E. ...	47.65	42.40	40.64	43.56	29.10		41.43
T. Ash. ...	14.17	12.65	12.24	13.02			13.40
Ca. ...	1.50	1.60	1.61	1.57			
P. ...	0.56	0.49	0.45	0.50			
Total					58.8	2.4	

Phillipesara hay has only half the amount of protein and fat as the month old green pasture. The crude fibre in hay is higher than in the monthly cutting on dry basis. The N. R. of hay is about 3.9. The hay is also as nutritive as alfalfa hay or cowpea hay. The monthly cut green fodder of phillipesara is thus far superior in nutritive value both in quality and quantity to the hay cut at full mature growth.

As its final stand after 2 or 3 cuttings can be turned into soil as green manure, it acts as a good fertiliser for the next crop in the already nitrogen enriched soil. Just before harvesting paddy it is sown to produce a stand after the paddy harvest either pure or mixed with fodder sorghum in the rice fields from January to June when there is no paddy crop and also as a preceding crop for cotton cultivation in Madras state. [5] Its easy cultivation both in dry and wet lands in all seasons as supplementary crop enhances its usefulness as green manure, fodder, food and soil cover. The Rice Research Workers' conference held at Coimbatore in August, 1951, has rightly emphasised the importance of Phaseolus trilobus whose merits along with other

legumes should be fully tested at various centres in irrigated and non irrigated areas for it appears to be an ideal green manure-cum-forage crop well suited to the varying conditions of agricultural practice in the state.

Summary

1. Phaseolus trilobus or Phillipesara in the three successive monthly cuttings after sowing has the following percentage nutrients composition on dry matter basis respectively for the first, second and third:—Moisture in the fresh samples, 78.44, 74.56, 83.26, Av. 78.9; Crude Protein, 21.44, 23.6, 26.69 Av. 23.91; Ether extractives, 3.37, 2.83, 2.07, Av. 2.76; Crude Fibre, 13.81, 17.52, 18.36, Av. 16.57; N. F. E., 47.65, 42.4, 40.64, Av. 43.56; Total ash, 14.17, 12.65, 12.24, Av. 13.02; Calcium, 1.5, 1.6, 1.61, Av. 1.57 and Phosphorus 0.56, 0.49, 0.45 Av. 0.50.

2. The total digestible nutrients are 58.8 by calculation and the nutritive ratio is 2.4.

3. The nutritive value of green phillipesara at 30 days growth is compared with that of its hay made at maturity or full growth. Its high protein content and nutrients make it as valuable as alfalfa leaf meal for livestock.

4. Its value as an ideal green manure-cum-forage crop in the agricultural practices of Madras state is discussed.

Acknowledgment

Grateful acknowledgment is recorded to Sri K. Satyanarayana Rao for technical assistance rendered.

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ETIOLOGY OF CLINICAL FORMS OF MASTITIS AMONG COWS AND BUFFALOES IN WEST BENGAL

BY

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Introduction

Reports available from various centres in India where mastitis investigations are in progress reveal that the incidence of mastitis is definitely on the increase. This increase is more marked in the big cities and industrial towns where the density of human population is high. According to the latest cattle census report, there are altogether 60,000 cattle in Calcutta, out of which 14,000 are owned by the private owners and the remaining 46,000 belong to 'Khatahs'. These animals live under most unhealthy conditions and their management is left mostly in the hands of untrained persons whose main interest is commercial. It is an admitted fact that mastitis is essentially a disease of bad hygiene, and therefore, the prevailing unhygienic conditions in which the cattle are kept in Calcutta and the industrial belt around it are conducive to the rapid spread of this disease. In the past, the Khatal owners used to sell the cattle suffering from incurable forms of mastitis to the butchers, thus reducing the number of carriers to a great extent, but due to the promulgation of the Slaughter Control Act of West Bengal, there are restrictions in the indiscriminate slaughter of cattle and this has helped, to a certain extent, in swelling up the number of infected cattle. The total economic loss due to this alarmingly high rate of mastitis must be very heavy, but the data are not available to assess the extent of this loss. This problem is, again, directly linked up with the growth of our Dairy industries in future.

With a view to evolve suitable method for treatment and control of mastitis, it is necessary to determine the type of organisms responsible for the disease. The commonest type of organisms associated with clinical bovine mastitis in West Bengal has not so far been worked out. It was, therefore, decided to examine the clinical cases coming for treatment to the hospitals.

Materials and Methods

Milk samples from mastitis cases were received from Bengal Veterinary College hospital and from Government Veterinary Hospitals

at Howrah, Behala, Ballygunge, Alipure and Burdwan. Altogether 170 samples from clinically affected quarters (120 from cows and 50 from buffaloes) were examined during the period from May to October, 1955, the highest number of samples received for examination was in the months of July and August. All the buffaloes were of Murrah breed. Among the cows, the majority were of Haryana breed; the other breeds were Nagori, Multani, European and Bengal. Printed proforma for recording history and other details of mastitis cases were supplied to the Veterinary Officers in charge of those hospitals with a view to ascertain correlation, if any, among the various factors.

For bacteriological examination of milk samples, the following procedure was adopted in all cases. A part of the milk samples was centrifuged at 2000 r.p.m. for 10 minutes. Samples of thicker consistency considered unsuitable for centrifugation were diluted with sterile distilled water. Smears prepared from the sediment were stained with Gram's stain and Ziehl-Neelsen stain using both acid and alcohol as decolourisers. Blood-agar plates were streak cultured with the sediment. Samples negative to microscopical examinations were incubated overnight and poured blood-agar plates were made. Edward's mastitis medium was used according to requirement. 24 hours' growths were examined. Typing of *Streptococci* was based on standard biochemical reactions. Typing of other organisms associated with mastitis was done according to the commonly accepted bacteriological technique. Milk samples proving negative to microscopical and cultural examinations were re-tested. The results of the investigation are shown in Table I.

Discussion

Work on mastitis is being carried out in different parts of India at the various mastitis centres started with financial help from the I. C. A. R. The results of the work, so far available indicate that the commonest cause of mastitis in most herds is *Staphylococcus aureus*; *Streptococcus* coming next. In the present investigation in West Bengal, it was found that among cows and buffaloes *Streptococcus* is the commonest organism causing mastitis and *Staphylococcus* coming next. In this respect, the results compare favourably with those obtained in the European countries. Table II shows the number of infected quarter samples examined from cows of each breed and the percentages of two most common types of mastitis organisms recovered from them. It was interesting to note that although all the hospitals from which samples were received are situated in the mixed rural and urban areas, Bengal breed cattle suffering from mastitis which came for treatment were the least in number. Does this suggest that the Bengal breed cattle are comparatively resistant to mastitis? Further investigation is necessary to answer this question. Correlation among several

TABLE I
Showing types of organisms and their percentages in the milk samples from cows and buffaloes suffering from clinical forms of Mastitis.

Species of Animals.	Total No. of quarter samples examined.	Organisms detected.												Relative percentages of different species of Streptococci.							
		Strept.		Staph.		Corynbact.		Coliform.		Pseudo-monas		Others.*		Sterile.		Strept agalactiae.		Strept dysgalactiae.		Strept uberis.	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cows.	120	38	31.6	30	25.0	13	10.8	16	13.3	2	1.6	8	6.6	13	10.8	27	71.0	8	21.0	3	7.9
Buffaloes	50	20	40.0	10	20.0	2	4.0	6	12.0	3	6.0	5	10.0	4	8.0	15	75.0	4	20.0	1	5.0

* "Others" include milk saprophytes and common laboratory contaminants, as such negative for mastitis organisms.

TABLE II

Showing breedwise the number of infected quarter samples examined from cows and the percentages of two most common types of mastitis organisms recovered from them.

Breed of cows.	No. of quarter samples examined in each breed.	Relative percentages of different species of Streptococcus						Staphylococcus.	
		Strept agalactiae.		Strept dysgalactiae.		Strept uberia.			
		No.	%	No.	%	No.	%	No.	%
Hariana	55	14	82.3	2	11.7	1	5.8	12	21.8
Nagori	42	9	69.2	4	30.7	—	—	8	19.0
Multani	13	2	50.0	1	25.0	1	25.0	5	38.4
European	5	1	50.0	—	—	1	50.0	2	40.0
Bengal	5	1	50.0	1	50.0	—	—	3	60.0
Total	120	27		8		3		30	

factors, viz., breed, age number of lactation, number of quarters affected, etc., which were recorded in the proforma for individual cases, could not be established satisfactorily. It was, however, noticed that Streptococcus was more frequently recovered from mastitis cases, particularly of acute types, in the early lactation period. Clinical manifestations of mastitis were more frequently observed in the hind quarters than the fore.

It was significant that tubercle bacilli were not detected in any of the samples examined.

Staphylococci isolated from milk samples presented varied characters in respect of pigment formation and coagulase reaction. For example, it was found that a number of strains showed characteristic pigmentation of aureus variety, but actually gave negative coagulase test. On the other hand, there were strains resembling albus variety, but actually gave positive coagulase test. Again, some milk samples yielded pure growths of *Staphylococcus albus* in large numbers on repeated examinations. Only a few among them were feebly coagulase positive. The rest were all coagulase negative. Such

Staphylococci were not ignored in the etiological diagnosis and were included in the table. When the coliform organisms were the only type isolated from the milk samples and when found as such on repeated examination, then only they were considered as an etiological factor. *Corynebacteria* recorded in the table were of pyogenes type. Sterile samples recorded in the table were received from chronic mastitis cases not previously treated for mastitis. It was observed that the ratio of percentages of the organisms mainly responsible for mastitis after examining 170 samples was practically similar to that obtained after examining 100 samples, thus maintaining the consistency of frequency. Hence, the investigation was closed at this stage. It may be mentioned here that special care was not taken to detect yeasts, protozoa and viruses in the milk samples during the routine bacteriological examinations.

Summary

(1) Etiology of clinical forms of mastitis among cows and buffaloes in West Bengal was undertaken.

(2) The commonest type of organism causing mastitis among cows and buffaloes was found to be *Streptococcus*. *Staphylococcus* following next.

Acknowledgment

The authors are indebted to Dr. S. Datta, Director of Veterinary Services and Animal Husbandry, West Bengal, and also, to Principal K. C. Mukerjee for their interest. The help of the officers of the various hospitals is gratefully acknowledged.

Clinical Articles

CAESARIAN IN A SHE GOAT UNDER NOVUTOX

By

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On 10 November, 1955, a four year old she goat was admitted to the Bai Sakarbai Dinshaw Petit Hospital for animals, (Bombay Veterinary College, Hospital), with a history, the animal was pregnant, and that the gestation period was overdue, by at least a month or so, and that the animal habitually suffered from eversion of vagina. At the time of admission the animal appeared to be normal. Abdominal palpation revealed an advance stage of pregnancy. It could not however

be ascertained whether the gestation period was overdue. But as the body temperature did not deviate from the normal immediate danger to the life of the animal was ruled out, and the animal was kept under observation. On the morning of the next day, the animal showed eversion of vagina, without any signs of straining. It was reduced and exploration per vagina showed that the os uterus was dilated to an inch. In spite of advance pregnancy and dilatation of os uterus, the animal showed no signs of delivery.

Considering the advanced stage of pregnancy and the complications arising from the eversion of vagina, leading possibly to infection and also to avoid dystokia, it was decided to perform a Caesarian and remove the foetus.

The question now arose as to the choice of anaesthesia; and Nembutal and Novutox were thought of. The latter was however preferred, being local and non-toxic as compared to the general anaesthesia Nembutol and Chloroform which it was feared would prove toxic to the foetus.

20 c. c. of Novutox (para-aminobenzoyldiethylaminoethanol hydrochloride and epinephrine in Ringer's solution with quinotoxine 1 : 80,000) was injected in the prepared seat of the operation, which was the right flank region of the animal. In the course of injection the fluid was infiltrated in a radial fashion, covering about 1000 circular area, on either side of the seat of incision. The deeper strata of muscles were anaesthetised by injecting the fluid at four or five points. The part was anaesthetised within 5 minutes after the Novutox injection.

Vertically straight incision was taken in the centre of the flank so as to cut the skin alone. This was followed by incising the deeper layers of muscles. The three abdominal muscles, viz. Obliques abdominis externus, Oblique abdominis internus, and Transversus abdominis were incised separately and the direction of the incision being vertically straight as originally adopted while incising the skin. The space between the skin and the muscle, and between the muscles, on either side of the incision was separated to a distance of two inches. This was with a view to facilitate suturing layer by layer. Peritoneum was cut along with the transversus abdominis.

The abdomen was opened and the uterus felt and found to contain two living fetuses, presentation being transverse. The uterus was pulled out of the abdominal cavity. It was opened by a straight longitudinal incision on its dorsal surface. Two living kids were removed. Both of them showed signs of gasping and hence oxygen was resorted to. The appearance of the maternal cotyledons and the absence of any signs

of eruption of teeth in the foetal mouth showed that they were premature at least by two weeks.

The uterus was sutured with non-absorbent silk thread. Peritoneum together with transverses abdominis, obliquus abdominis internus, obliquus abdominis externus and the skin were sutured separately. Thus there were four layers of sutures to close the incision. All the sutures were interrupted and the non-absorbent silk thread was used throughout. The wound was closed with Collodium Flexile and adhesive tape.

After the operation the animal was allowed to walk to the stables a distance of about 100 yards—which the animal did cover without any resistance.

After treatment consisted of injecting 200,000,0. units of Procain Penicillin with 1. gm. of Dihydro-Streptomycine.

On the fourth day of operation the wound was examined and found to have healed satisfactorily. All sutures were removed on the fifth day and the raw scar was covered with Collodium Flexile gauze and adhesive tape.

Out of the two newborn kids one died within few hours and the other lived for three days but subsequently succumbed due to want of mother's milk and due to its premature birth could not stand artificial feeding.

The mother she goat was discharged on the 10th day of recovery.

*Conclusion :—*Difficulty is experienced in judging the exact period of gestation in the absence of correct date of covering. Successful use of local anaesthetic proves effective in Laprotomy. Non-absorbent suturing material could be used for internal sutures. Anti-Biotics are indispensable in counteracting post-operation infections.

A RARE CASE OF HYDROCELE IN A BUFFALO-BULL

BY

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Hydrocele is the accumulation of serous fluid in the sac of tunica vaginalis, caused by chronic vaginalitis generally following an injury to the scrotum. It may accompany ascites. Cases are quite common in men, but rare in domestic animals especially in bovines.

An interesting case of hydrocele was detected in a buffalo-bull belonging to Japalpur City Corporation on 17-8-1955 in the local hospital. The animal was 6 years old and the cart driver said that the scrotum started getting large about 7 months back and it was gradually getting larger and larger day by day.

It was seen that the scrotal sac was hanging down to the hock, more than 18 inches in length and about 9 to 10 inches in diameter. The animal was finding discomfort when made to run. The temperature was normal. Palpation revealed a fluctuating swelling and percussion indicated a large quantity of fluid inside. An exploratory puncture was made by which a definite diagnosis was arrived at, as a clear amber coloured serous fluid escaped out of the swelling.

It was decided first to tap the fluid and inject an irritant inside the sac. So on 18-8-1955 both the sacs were tapped, and almost emptied of their contents. Perhaps a couple of ounces of the fluid remained inside and could not be drained out. In all, about a pint of fluid was removed from the right scrotal sac and about 15 ounces from the left scrotal sac. The inner wall of the scrotum on the left side was found to be much thicker which explains why only a smaller quantity of fluid came out from the left side. After tapping, about 3 c.c. of Lugol's solution of Iodine diluted with about 15 c.c. of distilled water was injected into each of the sacs.

The animal was again brought on 22-8-1955 when it was found that the scrotum had again enlarged, almost to the size at the time of admission. As the condition had recurred after tapping, it was decided to perform an operation to remove the affected part of the tunica vaginalis.

On 23rd August 1955 the animal was cast and secured, after administering a dose of chloral hydras. After taking necessary precautions for an operation, the left scrotum was first tapped. Then a bold incision was given on the scrotum parallel to the median raphe up to the tunica vaginalis and the tunica vaginalis was dissected by blunt dissection upto the base of the scrotum. Then the tunica vaginalis with the testicle enclosed in it was removed by limited torsion. As the haemorrhage was profuse it had to be checked by the hot iron. A plug of Tr. Benzoin Co. was left inside the wound.

As the animal had already been in the recumbent position for quite a long time and as the anaesthesia had almost passed away, it was thought proper to take up the operation on the right testicle on 25-8-1955.

On 24-8-1955 the wound was cleaned by Dettol lotion and dressed with antiseptic powder.

On 25—8—1955 the castration of the right testicle was performed as before, taking out as much of the tunica vaginalis as possible. This time the operation was performed with the help of the ecraseur and the castration clamp, as limited torsion was not quite effective in checking haemorrhage. There was no bleeding this time. A plug of Tr. Benzoin Co., was put in the wound.

The wounds were treated from 26—8—1955 as open wounds by usual antiseptics.

Result:—As the scrotal sac was quite large it took quite a long time to heal, and the animal could be discharged as cured only 8—11—1955. The scrotal sac had contracted and looked quite small at the time of discharge.

Complications:—Nil.

A specimen of the right testicle with the tunica vaginalis was sent to the Pathology museum of the M. P. Veterinary College, Jabalpur. The tunica vaginalis was inflamed, thickened and showed small eminences of the size of sago grains all over.

Conclusion:—In this case it was found that the ecraseur is more effective than limited torsion in checking haemorrhage.

We are very thankful to Dr. S. L. Choubey, Veterinary Assistant Surgeon, Jabalpur, for providing facilities for this operation in his dispensary.

OCCURRENCE OF MULTICEPS CYSTS IN THE INTERMUSCULAR CONNECTIVE TISSUE OF A GOAT

By

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On the 15th January 1955 a graded female Beetal goat was brought to the hospital with a complaint of a swelling of about 10 Cms. in diameter located on the right chest wall immediately behind the scapula of the side, close to its posterior border and slightly overlapping it.

On examination it was found to be a cyst and was operated upon. During operation after the overlying tissues were incised, the cyst was found to be lodged in the intermuscular space and came out easily on slight pressure to the surrounding area. Perhaps, the tension of the

cystic fluid inside helped in the process. The wound was attended to and healed up without any complication. The goat was inspected at intervals during the last one year and so far there is absolutely no evidence of recurrence of the cyst.

The cyst removed was of about 7 Cms. in diameter and was without any daughter cyst. The bladderworm presented numerous heads on the inner lining of the cyst wall arranged in groups of several hundreds of scolices. From its morphology it appears to be a *Multiceps* cyst. Its occurrence in the intermuscular connective tissue is suggestive of a bladderworm of *Multiceps Gaigeri* (Hall 1916)—the cystic stage of *Taenia Gaigeri* a very uncommon parasite of the dog.

Sri J. Das, Bacteriologist (Vety.) Orissa, who happened to see this paper informed me that on 18-10-55 while conducting post mortem examination on an experimental goat he recorded a bladder worm of *Multiceps multiceps* attached to the right Brachial nerve and situated in the intermuscular space. But in the present case already described no such neural attachment could be detected. I am very much thankful to Sri J. Das for his suggestions.

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News and Views

Unbelievable! Will our American contemporaries confirm? Here is the news in the *Hindu* dated 28th February 1956:—

A White Leghorn hen has made poultry history in New Jersey, U.S.A., by laying an egg weighing one pound, on the Farm of Mr. Martin Moldovan.

Nothing seems to be uncommon these days!

* * * *

Again, the *Madras Mail* dated 29th February 1956 gives the following news:—

A new world record for milk production by a pedigree dairy Shorthorn cow—4,021 gallons in 555 days—was claimed on Sunday night for one of a head on a farm near here. (Linby-Britain)

She held the previous world record—3,390 gallons in a lactation period of 497 days. She is owned by Mr. David Webton, who said she had, in her milking life, given, 16,000 gallons of milk. She is 11 years

old and her lactation period ended on Sunday because she is due to calve again in May. The cow has been milked three times a day.

Still another record! The *Madras Mail* dated 4th March 1956 says "A new record of 45 lbs. 14 ozs a day in milk yield has been established by a Murrah she-buffalo belonging to the Ambala Military Farm at the All-India Cattle Show here.

This is 1 lb. 6 ozs more than the record set up by a Tharparkar cow in 1955.

Speaking at Bharat Sevak Samaj Conference at Nizamabad recently, Pandit Nehru, said "The country could not prosper by speeches alone but only by doing solid work. The speeches by politicians alone would not build India though they were necessary to educate people. The spirit to work could not be infused by legislation. Gandhiji had done great things in India but the biggest of them all was that he poured life into the dead nation." So it is work that will uplift an individual, that will uplift a profession and benefit the country and the humanity at large. The Veterinary profession should be second to none in this noble task.

Livestock Census for Madras.—The Livestock census for the Madras State is being conducted by the Government of Madras through the Department of Statistics. The census enumeration will be carried out during the period March 15 to April 14, and April 15 will be the date of reference of the census. The primary enumeration will be carried out generally by the Karnams (Village Accountants) in non-municipal areas and towns and by the Municipal staff in municipal areas.

At taluk level, the census will be supervised by Tahsildars who are designated as "Taluk Livestock Census Officers". Officers of other Departments such as Animal Husbandry, Agriculture and National Extension Service will also be associated with the census operations in carrying out a rationalised verification of the census.

Accurate information regarding the population of livestock has been found to be very essential for carrying out various rural development schemes in the Second Five Year Plan. The public are requested to extend their whole-hearted co-operation in obtaining correct statistics of livestock.—*Hindu*, Madras, 7th March 1956.

"Work hard, save more and spend less" is the slogan which Mr. Morarji Desai, Chief Minister of Bombay, gave for the successful

implementation of the Second Five Year Plan and increasing the resources of the country to achieve progress at an accelerated rate. The Veterinary profession has a great responsibility to discharge under the Second Five Year Plan. Let them beware!

India won't be what she is but for her spiritual and cultural heritage. Read what His Holiness Sri Sudhindra Theertha Swamiji, of Puttige Mutt, Udipi, South Kanara District, says as a message for the world, on his 100th Birth Day. "Modern man with his excessive flair for unlimited material advancement has thoroughly neglected the ultimate values of life, with the result, he is losing his spiritual moorings and is heading towards barbarism and destruction. If he is to save himself from this catastrophe, he should realise the true meaning of life and its purpose and his relationship to the world. He has to rediscover his soul and its divinity by developing the inward vision".

What does the phrase "through the proper channel" mean? Here is what Mr. Frank Anthony, M. P., said in Lok Sabha on March 7th, 1956. "It meant only the waste paper basket"! We begin to wonder if that is the reason for our not getting many articles sent for publication "through proper channel"! Well, we live to learn.

Railway men with 20-25 years service had recently been demoted on the ground that they were squint-eyed! Mr. Frank Anthony with characteristic frankness said in Lok Sabha "This order shows a 'mental squint' on the part of the official". This condition seems to be on the increase in the officialdom. Let Veterinarians beware!

We have heard of 'Jaundice' in officialdom but never a 'mental squint'. But both seem to be allied conditions in administration which one has to guard against.

Mr. Sri Prakasa, the popular Governor of Madras, while speaking at a meeting of the Commonwealth Parliamentary Association at Madras on 27-3-56 said "Just as every individual had a definite temperament, so had a race. It was difficult for any race to copy another, except in theory". This basic fact cannot be repeated too often during this transitional stage of our country.

Marketing of Livestock.—A course of training financed by the I.C.A.R. is conducted by the Directorate of Marketing and Inspection,

Union Ministry of Food and Agriculture. The course of training is of six-month duration, during which trainees are taught modern techniques in marketing of livestock and livestock products. The first course ended on February 14 this year, when ten candidates successfully completed their training. A second batch of nine candidates from Bombay, Punjab, Bihar, Rajasthan, T & C., Assam and Andhra is undergoing the training at Delhi.—*Hindu* 29th March 1956.

A battle Royal has been raging over the question of Indigenous Medicines, in several State Councils and in the Parliament of India. The battle has been fiercest both at Delhi and at Madras. The Health Ministers have been accused of lack of sympathy and understanding and even of suffering from a disease called "Westernism". The slogan "Do or Quit" sounded and resounded on the floor of the Lok Sabha at Delhi and of the Assembly Hall at Madras.

As in all battles, the fortunes seem to be fluctuating. It is too early to forecast anything. But we make bold to say that if there is one case of giving a dog a bad name and hanging him, it is this subject of Indigenous Medicine. We only say 'Let there be intensive and co-ordinated research on these indigenous drugs on a country-wide scale, with sufficient funds and facilities and at several State levels. There should be an intelligent, sustained and close direction for a number of years by Experts in the line and the progress should be measured by a suitable yard-stick'. Otherwise all these claims on one side and denials on the other serve no useful purpose. It is immaterial who wins or who loses in this mock fight.

An All-India Farmers' Council was inaugurated at New Delhi on April 3rd 1956. Speaking on the occasion, the Prime Minister, Mr. Nehru, said "This age armed with a whip is compelling us to march ahead. We neither want to stumble down nor be lashed by this whip of time. The only alternative is to continue to march forward and make progress without delay". Will the profession note this thoughtful utterance?

Speaking on the same occasion, President Rajendra Prasad said, "Food grains are, no doubt, the principal item in our diet, but milk, curds and butter are *no less* important. I feel that if only we take up scientific cattle breeding, once again we can have plenty of milk in this country. We shall have to feed the cow properly and take to scientific methods of cattle breeding". Comment is needless.

Dr. Muhammad Shafi Mekhri, the famous Ophthalmic Surgeon of Bangalore, gave expression to some trenchant criticism in his Presidential address at the Third Madras State Ophthalmic Conference held at Salem recently. It is of a standard which we do not ordinarily come across in these days from point of refreshing candour and sincerity of purpose.

Here is what he said :—"That while rapid strides were registered in other branches of Medicine and Surgery, Ophthalmology was perhaps one of the sciences, in which nothing very outstanding was done in recent years. It was even more regrettable, he said, that very little original work was done by Indian Ophthalmologists". A similar charge should not be levelled against Veterinarians in their several fields of work. Let them beware!

Here is what this eminent Doctor thinks on what he calls a "Concentrated and compressed tabloid form" of medical education to evolve a full-fledged Doctor in a *quick time*. "Our new Medical Graduates will be even more ignorant of Ophthalmology than they are today and they will be let loose to practise in a country with numerous blind people".

Even more important than the above statement is the charge that he has levelled against the politicians. "It is unfortunate that the committees that take these decisions consist of members mostly politicians and are not perhaps the best qualified or competent to give an opinion on a subject of such basic importance. These members do not even think of consulting others, who can offer useful suggestions". Herein he has raised a very vital point. It is the professional Councils that should have a final say in all such matters and not others.

XIV INTERNATIONAL DAIRY CONGRESS

An Announcement

The Government of India is participating in the Fourteenth International Dairy Congress, which is scheduled to be held at Rome during the last week of September 1956. This Congress will provide an opportunity for dairy workers and organisations of different countries of the world to meet and discuss problems of common interest. The topics for discussion at the Section Meetings and at the Conference have been selected with a view to focuss attention on the problems of milk production, manufacture of milk products and consumption of dairy products in various parts of the world, and the developmental programmes undertaken for increasing milk consumption, particularly in under developed areas. On this occasion, the Organising Committee of

the Congress will be publishing an International Dairy Index-Book containing particulars about important dairy research and educational centres, official and private dairy organisations, dairy manufacturers and dealers of dairy machinery and equipment in different countries. Other interesting items to be held during the Congress Session, include (i) an international exhibition of posters, leaflets, films and other publicity materials pertaining to the consumption of dairy products, (ii) an international exhibition of dairy bibliography (books, journals, research papers and other published literature) concerning milk and milk products, and (iii) an international contest of advertising posters for promoting the consumption of dairy products.

Dr. K. C. Sen, Director of Dairy Research, Government of India, Ministry of Food & Agriculture, New Delhi, has been appointed as the *liaison* Officer for the International Dairy Congress in India.

THE BLOCK DEVELOPMENT CORNER

STERILITY IN COWS

By

K. S. SHANMUGASUNDRAM, G.M.V.C., B.V.Sc.

The term sterility as applied to cows implies the inability of a cow to give birth to a living calf. Thus not only non-coming into heat, non-holding etc. but also abortions, premature births, dead calves etc., constitute sterility.

The incidence of sterility is more common in cows than in bulls since the cow has greater responsibilities in the matter of reproduction than her counter part. She should in the first instance produce a healthy "Ovum" or egg in her "Ovary" and attract attention of the bull by visible External signs and behaviour called "Heat symptoms" so that she can be served in time. She should afford facilities for the "sperm" introduced in her genital tract, in the form of congenial surroundings, so that they can swiftly move about and reach the ovum. She should liberate the "ovum" in time and under favourable conditions so that the sperms may fuse with the ovum at the right time and at the right place. She should receive the fertilised ovum in her uterus under favourable conditions, nourish and nurture the same in the uterus so that the ovum might develop into a fully grown calf in due course. Finally she should expel the fully developed calf at the right time in a safe manner to the exterior world. Any condition that impairs any one or more of the above functions constitutes "Sterility".

The development of ovum and the appearance of visible signs of Heat are complex physiological processes controlled by a series of secretion of "ductless glands" in the body. These secretions are called "Hormones". It has been established that proper Nutrition to the animal is essential for the satisfactory functioning of these "Hormonal glands". Deficiency in protein, vitamins particularly A and D, deficiencies of minerals and Iodine in the diet of an animal, impair the proper secretion of Hormones resulting in non-appearance of Heat or Temporary sterility. The first fundamental and cardinal principle in overcoming sterility is the proper feeding. Addition of adequate quantities of oil cakes and/or grams, standard mineral supplements, green fodder or at least shark liver oil, when green fodder cannot be obtained, should ordinarily help overcoming the sterility arising from this cause.

The diseased conditions of the genital tract will lead either to the inactivity or the destruction of introduced sperms. Thus a cow will repeatedly come into heat but will not conceive. Due to the same cause, abortions and premature expulsions of the foetus may arise. Ordinarily, the diseased condition arises as a result of neglected wounds to the external genitalia resulting either from the gored wounds, or wounds sustained at the time of delivery. When the delivery is complicated necessitating human intervention and when the after birth is not properly expelled, the uterus may get diseased. Careful attention at the time of pregnancy and application of plenty of Neem Oil on the external genitalia for few days after calving will help in healing the wounds sustained at the time of delivery. Even the slightest wound on the genitalia should receive proper attention as this eventually leads to serious complications. Neem Oil is a very useful agent as it keeps off the flies since flies are enemy number one in complicating these wounds. Any thick whitish discharge with bad smell should be viewed with suspicion and the animal should be taken to a Veterinary Surgeon immediately.

There are other causes like impaired function of ovaries due to the formation of certain bodies called "Persistant Corpus Luteum" "Cysts" etc. on the ovaries. A sound healthy cow should come into heat in about 3 to 6 weeks after calving. A cow which has not come into heat even after 3 months after calving, in spite of judicious feeding, should be taken up for Veterinary Examination. A well fed heifer will come into heat in about 2 years of age and a heifer in good condition which has not come into Heat even after 2½ years requires Veterinary check up. Many of the conditions lead only to Temporary sterility (i.e.) which can be rectified if attended to in time. A neglected temporary condition will lead to permanent sterility and hence a prompt Veterinary check up is necessary in cases of defaults.

FEED ECONOMICS IN EGG PRODUCTION

By

V. MAHADEVAN,

Professor of Animal Nutrition, Madras Veterinary College.

I. HEAVY HENS EAT MORE PER EGG.

This table shows feed eaten per dozen eggs produced by hens of various weights, laying at different rates.

Percent of Lay (100% = 1 Egg per day.)	Lb. Feed Eaten by Hens weighing.			
	4 lb.	5 lb.	6 lb.	7 lb.
30	8	8.8	9.7	10.6
40	6.4	7.1	7.7	8.4
50	5.5	6	6.5	7
60	4.8	5.3	5.7	6.2
70	4.4	4.8	5.1	5.5
80	4.1	4.4	4.7	5

II. THE MORE THEY LAY THE MORE THE PROFIT

Feed cost is roughly half the cost of producing eggs.

This table shows the feed eaten by 100 hens according to their egg production per day.

Eggs per Day for 100 Hens.	Feed per Day in lbs.	Eggs per Day for 100 Hens.	Feed per Day in lbs.
0	18—19	40	22—23
10	19—20	50	23—24
20	20—21	60	24—25
30	21—22	70	25—26

POULTRY FARMING

SOME USEFUL POINTS TO REMEMBER

PART II

By

T. VINAYAKA MUDALIAR,

Retired Livestock Development Officer, Government of Madras.

1. Essentials for good hatching

1. Use eggs from strong and healthy birds.
2. Collect eggs as soon as they are laid and store them in a cool and dark place.
3. Select eggs which are fresh, clean and of normal size and shape.
4. Avoid eggs with ridges, weak or porous shells.
5. Don't wash eggs before placing them for hatching, dry-clean them.
6. Transported eggs should be rested for 24 hours.
7. Use a sitting box and place it in a partially dark and dry place.
8. Don't keep more than 8 to 10 eggs under each broody hen.
9. Choose a good, docile, healthy sitting hen ; feed her regularly.

2. Selection of hen and cock

1. A hen should be of sound constitution with plenty of vitality and vigour. She must be a good feeder inclined to forage long distances.
2. Bright, clear eyes, tight plumage with the body long, broad and deep, wide at the pelvic bones, are indications of a good layer.
3. A healthy vigorous cock of known pedigree should be used ; under-sized and unthrifty males should be avoided.
4. The comb and wattle should be bright red in colour with no marks of any disease.
5. The comb should be uniformly serrated and the toes strong and well webbed.

3. Prevention of external parasites

1. Provide a dust bath with wood ash mixed with loose earth.
2. Examine the birds and give an occasional dusting with any of the following powders in very small quantities.

Gammexane; D. D. T.; Sodium Fluoride; Pulvex Sulphur powder mixed with wood ash; Tobacco powder; Powdered sweet-flag; Fletikoff etc.

4. Prevention of soft shelled egg

Hens lay soft-shelled eggs due to deficiency of lime. Supply mineral mixture, broken limestone; broken egg-shells; Oyster-shell pieces, granulated charcoal, etc. Give Cod-liver-oil in feed — one tea spoonful for about 10 birds.

5. Eggs for the Market

1. Provide a clean nest and collect the eggs frequently.
2. Store the eggs clean and fresh in a cool place with no odourous substance nearby.
3. Grade the eggs as per their weight to get the right value of money.
4. Remove the male birds from the flock if you want to market the eggs; infertile eggs have superior keeping qualities.
5. Pack the eggs in clean and fresh material and in an attractive manner.

I. C. A. R.

Farm News Releases

Urea—A Nitrogenous Fertilizer.—Very shortly a new nitrogenous fertilizer will be manufactured in India. It is called urea.

Urea contains 45 to 46 per cent nitrogen. This means that 100 pounds of urea will give about twice as much nitrogen as the same quantity of ammonium sulphate.

Urea is soluble in water. It can be used wherever nitrogen fertilization is needed. Urea should not be applied when the soil contains free water or is likely to remain wet for three or four days after urea application.

Urea may be applied either at sowing time or as a top-dressing. When applied at sowing time, it should not come in contact with the seed. Because it is highly concentrated, it should be mixed with earth or sand before application.

Urea is suitable for application to all crops and soils.—No. 181.

Correspondence

[The views and opinions expressed in correspondence are those of the writers themselves and are not always endorsed by the Editor. Ed. I.V.J.]

Sir,

Sub: Your editorials in the November issue of the *Indian Veterinary Journal* entitled Re-orientation and Veterinarians and Livestock.

It was a welcome feature to observe the sentiments expressed in your editorial and the strong plea you have made for recognition of the work of the Veterinarians in the livestock field. In fact even to a very casual observer it should be evident that for all livestock work the best fitted is undoubtedly the Veterinary Graduate. A considerable part of the curricula for the B.V.Sc., Degree of the Madras University comprises of advanced training both theoretical and practical, in livestock subjects particularly Dairying. The Government of Madras have recognised this fact and were hitherto recruiting Superintendents of Farms and the Dairy Development Officers from amongst the Graduates of the Madras Veterinary College.

Due to the acute scarcity of Veterinary Graduates in the post-war years, this privilege was widened to include the diploma holders of the Indian Dairy Institute, Bangalore. Many subordinate posts were thrown open to them both in the Animal Husbandry Department and in the Co-operative Department. This class of subordinates have now started pressing their claims to promotions and to higher posts having succeeded in gaining a foothold during an emergency.

It is not necessary here to question the claims of the Indian Dairy Diploma holders to subordinate posts but it is very doubtful if the training they have had will ever suffice, in case they are given any responsible livestock work. The object with which the course of training in Dairying was originally started at the Bangalore Institute was only to provide the necessary human material for manning the lower strata of the services. The Government of India have themselves realised the shortcomings in the training imparted and have now planned to start a Degree course in Dairying at the new Institute at Karnal.

Despite all these facts the Madras State Government have been extending undue advantages to holders of the Indian Dairy Diploma even in preference, in some cases, to their own Veterinary Assistant Surgeons! (Though the Editor is prepared to bury the hatchet, the Government of the State still seem to be far from realising which is 'cheese' and which is 'chalk').

The situation is bound to deteriorate still further with the advent of the new Graduates in Dairying from Karnal. If the livestock work so ably pioneered by Veterinarians in the past is to be continued uninterruptedly it is very necessary to meet this threat and provide for advanced training particularly in Dairying to select Veterinary Graduates, now engaged in this work. It may be mentioned here that while other States have been taking the maximum advantage of the various aid programmes like the T.C.A., Colombo Plan, etc., to train their Veterinarians in various branches of Dairying and Livestock work, this State has not taken full advantage of these facilities.

There is therefore an absolute and immediate need to provide a post graduate degree course in Dairying. Such a course can be easily started with the facilities now available at the Madras Veterinary College. I hope that your esteemed *Journal* will champion this cause and bring it within the realm of immediate practical realisation.

Madras. }
29-2-56. }

Yours sincerely,
'DAIRY VET'

Association News

THE MADHYA PRADESH VETERINARY ASSOCIATION

Proceedings

The combined annual General Body meeting and Conference of the Madhya Pradesh Veterinary Association was held on 29-1-56 in the tastefully decorated hall of Madhya Pradesh Veterinary College, under the Chairmanship of Shri M. Y. Mangrulkar and in the distinguished presence of Octogenarian Major P. V. Beatty, R.A.V.C., (Retired), the chief guest.

The Conference started punctually at 10 A.M. Nearly 90 Members attended.

Shri P. G. Date, Retired Veterinarian from Bombay and Capt. Prasad, I.R.V.F.C., attended the meeting by special invitation. Several senior students of M. P. Veterinary College also watched the proceedings as volunteers and spectators.

After garlanding and introducing the Chief guest in words befitting the occasion, the Chairman in his address of welcome gave a short account of the Association with particular reference to the circumstances which had brought about the revival of the Association early in 1955.

The Chief guest, Major Beatty while inaugurating the function said in very humble terms that he was once a Veterinarian but was out of touch with the profession for quite a long time now. Wishing the Association well, he trusted that it will uphold the honour of the Veterinarian and his profession.

The Secretary, then read out the messages received among which were those from :

1. Sir Thomas Dalling, Veterinary Expert to F.A.O., United Nations, Rome.
2. Shri T. Vinayaka Mudaliar, Secretary, All-India Veterinary Association and the Editor of the *Indian Veterinary Journal*.

After a brief break at this stage, the members reassembled at 11 A.M. The secretary read the minutes of the last General Body Meeting and then the report of the succeeding year with the audited statement of accounts for both the years.

After discussion during which the Secretary clarified certain points and furnished the information, the report was adopted unanimously.

The Members then dispersed at about 12 noon to reassemble again at 2 P.M. for excursion to Bheraghat. The party for the trip started from the place of the Conference in two buses arranged for the purpose. The trip to Bheraghat was an unqualified success. The members, many of them for the first time, witnessed the 'Dhuadhar', the world famous marble rocks and the 'Chousath Yogini temple'. Finally, after tea the Members returned to Jabalpur at 6-30 P.M.

Although a little tired the Members reassembled again at 7-30 P.M. in the Conference hall, for the programme of technical films and scientific papers. The following films received through the kindness of Messrs. May & Baker (India) Ltd., were exhibited :—

- (a) Antihistamines.
- (b) Reduction of surgical haemorrhages.

The meeting lasted till 11 P.M. and as many as five professional papers were read and discussed.

The Conference met again at 10 A.M., the next day and as many as eleven professional papers were read and discussed.

A group photograph was taken in the evening and there was a dinner at night. The chief guest Major P. V. Beatty announced a

donation of Rs. 100/- to the Association which was received with thunderous cheers.

The following resolutions (summary) were passed unanimously:—

1. Requesting the Government of India to hasten the formation of the Statutory Indian Veterinary Council.
2. Requesting the State Government to complete the revision of the C. V. D. Manual at an early date.
3. Requesting the Government of India to put an end to the invidious distinction shown by certain state Governments in the matter of pay and prospects of Veterinary Graduates of comparable qualifications of different States.
4. Requesting the Government of India to include the elected representative of the Association on the Executive Committee of the Interim Council.
5. Requesting the Government to treat the Veterinary Graduates on a par with the Graduates of the allied science of human medicine in the matter of pay, prospects and allowances.

Finally, the following panel of Executive Committee members was duly elected.—

1. Shri J. A. Idnani,
2. „ I. B. Mirza,
3. „ G. K. Rayalkar,
4. „ M. A. Samad,
5. „ R. S. Rangan,
6. „ A. M. Shrivastava,
7. „ D. R. Nawathe.

Thus ended a memorable two-day session of the conference.

Review

Veterinary Bacteriology.—By A. Mukerji, B.Sc., G.V.Sc., Associate I.V.R.I. Assistant Professor of Bacteriology, Bengal Veterinary College. Pp. 226. Scientific Book Agency, Calcutta-1. Price Rs. 12-8-0.

The book on Veterinary Bacteriology by Mr. Mukerji is an ambitious attempt to cover the fields of General Bacteriology, Special Bacteriology and Applied Bacteriology within a short space of 226 pages.

The whole matter is presented in a highly condensed form and the book is more in the nature of notes than an explanatory discourse for beginners. The book contains 8 chapters. The important features of which are—1. General Bacteriology and Immunology, 2. Special Bacteriology of Pathogenic Bacteria, Filterable viruses and Pathogenic fungi, 3. Bacteriological technique, 4. Preparation and Standardisation of Biological Products and 5. Bacteriological examination of milk, water, air and soil.

The bacteria species are described in general under the heads.—Morphology and staining, Cultural characters, Experimental inoculations, Lesions and diagnosis.

Since antigenic structure plays an important part both in the immunity identification of bacteria and development of immunity, it is unfortunate this has not been discussed against each organism.

The description of bacteria is dealt with in some detail with reference to certain species, while in the case of others it is rather scrappy. For instance *Corynebacterium ovis*, *Cornebacterium renali* and *cornebacterium equi* could have been dealt with in some greater detail.

It is not known why *Pneumococcus* has been dealt with between the *Proteus* and *Corynebacterium* groups and not along with *Streptococci*. There is some scope for revision of order of treatment.

Treatment of *Salmonella* does not follow modern trends. Some mention could be made about phase variations and also about patterns of distribution of antigens through the whole genera. The predominant types met with in different species of animals could have been brought out more clearly, e.g. the Doubling variety of enteritis in cattle and Typhimurium in pigeons and rodents, etc. The differentiation of the Welchii group of bacteria is based on the characters of the different types of toxins produced and a short discussion on it would render the account more complete.

In the description of several techniques, certain vital factors have been omitted. In the description of technique for growing organisms under known CO₂ concentration, the method for the introduction of measured quantities of CO₂ could have been usefully indicated. Again, in the enumeration of bacteria that pippette should be changed between dilutions and that several plates should be sown with each dilution for striking out average would have been useful to the beginner.

The author has given prescriptions for the production of various types of biological products; perhaps it would have been sufficient if a book of this kind gave only the principles for the production of potent

vaccines. Because there is no finality in the technique for the production of vaccines, which is being improved upon from day to day. The methods described in this book are perhaps those which were in vogue in a particular Institute some several years ago. As regards production of H. S. Vaccine Serum, the use of avirulent strain should be deprecated for obvious reasons. As regards fowl-pox vaccine, it is understood that mixed fowl-pox and pigeon-pox crust vaccine has been found to be dangerous and given up. In the preparation of B.Q. Vaccine, recent research has shown that there is no use for prolonged incubation of cultures. The medium also has been simplified by the incorporation of reducing substances like Sodium Thioglycolate or Lysteine Hydrochloride to replace the kidney tissue. In the preparation of Anthrax spore vaccine, it is very essential that beginners are told that they should proceed from stock cultures of 'avirulent variants'. The description given in the book may be confusing. The strength of the agar-wash pasteurilla vaccine should have been mentioned.

The figures of bacteria given in the book appear to be diagrammatic sketches without reference to scale. It would add to the value of these figures, if they were actual photographs or were drawn to scale.

There are several misprints which doubtless will be rectified in future edition.

The book is a very useful addition both for students and for junior Bacteriologists. It brings together the several related aspects in one place. The author has taken enormous pains to bring the matter up to date. The usefulness of the volume would have been enhanced if an index was provided. The get-up of the book is excellent.

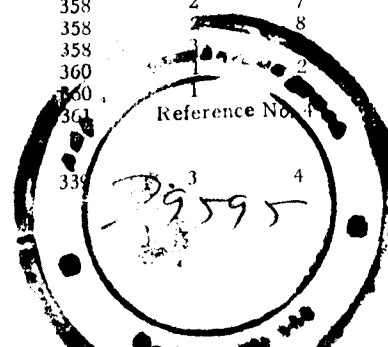
The book is commended to every student.

V.R.R.

Errata

Vol. XXXII, No. 5 (March 1956).

Page	Para	Line	Should be	Instead of
335	1	5	3 cows and 3 calves	3 cows and calves
337	5	4	round cell infiltration	round cell. Infiltration
337	5	6	lumina	lumina
358	2	7	extremis	extremes
358	2	8	extremis	extremes
358	2	8	extremis	extremes
360	1	2	Information	information
360	1	2	Nasal	nasal
361	1	2	Nasal Schistosomiasis in	
361	1	2	Buffaloes. <i>Ind. Vet. Jour.</i>	
361	1	2	1, 356-358.	
335	3	4	Add:—Grateful acknowledgment is also recorded to the Board of Scientific and Industrial Research, Orissa, for their financial help.	



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