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The Council of the South African Veterinary Medical Association acknowledges with thanks the Services of Miss R. van Zyl of Pretoria who designed the Outside Cover Page.

——: :——

Die Raad van die Suid-Afrikaanse Veterinêr-Mediese Vereniging erken met dank die dienste van Mej. R. van Zyl wie die Buiteblad geteken het.

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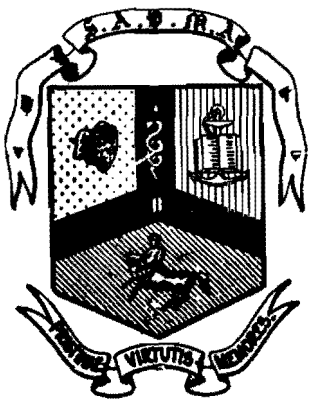

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EDITORIAL

It is a pleasure to present to members of our Association and other readers, our Journal in its new format.

The Journal first appeared in August, 1928, thereafter the first five numbers appeared in November, 1929, October, 1930, May, 1931 and October, 1931. The Journal appeared four times a year from that date.

The Editorship of the Journal was always on an honorary basis until 1961; only since then has our Association been able to afford a full-time Secretary-Editor and since then the Journal has appeared at regular quarterly intervals.

The format of the Journal has remained unchanged through all these years.

Our Editor recently considered that the time had arrived to modernise the appearance of the Journal, and after consideration by the Editorial Committee it was decided to publish it as you now see it.

There are many advantages to the present format. Besides the change in appearance, which we hope you will agree is an improvement, printing can be done more economically and there is greater adaptibility in regard to size of print which can be used, column breadth etc.

For the first thirty-one years of its life the Journal remained at more or less the same size i.e. approximately 50–60 pages per issue, but during the last five years it has rapidly increased to 150–175 pages per issue and twice has exceeded 200 pages. The overall growth covering a period of thirty-six years has not been spectacular but it has roughly paralleled the growth in the membership of the Association, which has increased from 135 to 520 during the same period.

Considering the functions which our Profession should have performed in this country this growth has been painfully slow. It is tragic that the Profession itself is to be blamed for this retarded growth, but we hope that a new realization of its responsibilities and of the significance of the service which it should render to the stock industry, public health etc. of the country, will be displayed by the Profession in future, and that it will continue to press for the establishment of those facilities which are needed for the proper fulfillment of these functions.

It is a remarkable fact that the only serious opposition to any proposed progress and change which has been suggested in the past has come from the Profession, and still is encountered from within the Profession.

In launching our Journal upon a new phase in its existance it is our ardent prayer that the Profession will develop a bolder and more adventurous spirit of development, expansion and adaption to modern needs, very soon. If it does not do so it will lag still further behind the rapid development which is taking place in all spheres of activity in this young, robust and growing land of ours.

H.P.S.

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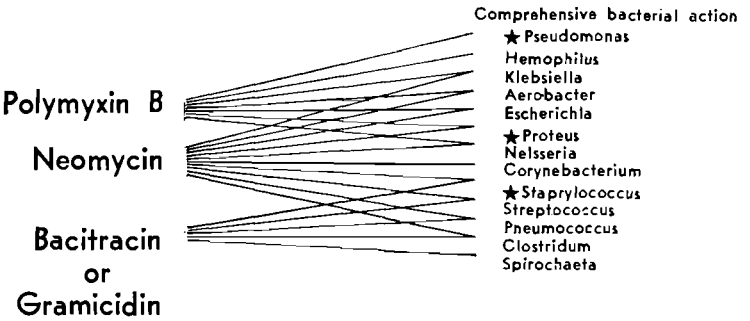

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THE IMMUNITY IN EAST COAST FEVER

W. O. NEITZ — Department of Protozoology, Veterinary Research Institute, Onderstepoort.

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The discussion on the immunity of the tick-borne disease, East Coast Fever, was preceded by a very brief description of the mammalian life cycle of *Theileria parva* (Theiler, 1904). After attachment on cattle, infected nymphae or imagines liberate sporozoites which invade lymphocytes in which the schizogonous phase develops. The mature schizonts liberate merozoites which either re-invade lymphocytes or alternatively enter erythrocytes. The latter developmental stage is commonly referred to as the endoglobular parasite. The vector becomes infected when either larvae or nymphae ingest the endoglobular parasites and transmission follows when the ensuing stages feed on cattle. A transovarial transmission does not occur in the vector.

East Coast Fever was introduced into the Transvaal in 1902. Since then it spread within this province and from there to Natal and the Eastern Cape Province. The mortality rate varied from 95 to 100 per cent. From 1910 to 1914, 900,000 head of cattle died in the Transkei.

Effective control measures only became possible when systematic dipping in association with rigid quarantine measures where introduced in 1912. The results were very satisfactory, and large areas in South Africa were cleared of the scourge, even though a very few East Coast Fever survivors were known to exist on some farms. In the absence of a recrudescence of the disease on such farms during the first decade of the campaign, Theiler (1921) advanced the theory that recovered East Coast Fever cattle develop a sterile immunity. The endoglobular parasites disappear completely from the blood, and this disappearance is absolute, for ticks can no longer be infected from them. The splenectomy of recovered East Coast Fever cattle by Du Toit (1930), Neitz (1948) and Barnett and Bailey (1954B1955) was not followed by a relapse of the endoglobular parasites as is known to occur in splenectomized cattle that have recovered from either a *Th. mutans* or *Th. annulata* infection. These observations thus seemed to support Theiler's theory.

Doubt was, however, cast on the sterile immunity in East Coast Fever when Barnett (1955–1956) showed that recovery from an artificially produced disease is followed by a labile infection, and that the Kenya form of East Coast Fever can be maintained by delayed serial passages in susceptible cattle. Both schizonts and endoglobular parasites were demonstrable. These tests, however, did not reflect the behaviour of the *Th. parva* endoglobular parasites. The argument could always be brought forward that they were derived from schizonts, and hence they were not able to exist independently. In other words, the disappearance of schizonts in a recovered animal would thus be followed by the disappearance of the endoglobular parasites.

Studies on the mammalian life cycle of the *Theileria* spp. were continued at Onderstepoort. Blood from an endoglobular *Th. mutans* carrier was injected intravenously into three susceptible splenectomized calves. When the endoglobular parasites appeared in the peripheral circulation four weeks later, clean brown tick nymphae were allowed to feed to repletion on these animals. After moulting, the ensuing stage was allowed to feed again on these three animals. After an incubation period varying from 12 to 16 days all these animals developed a thermal reaction which persisted for several days. Schizonts could be demonstrated in the swollen parotid, prescapular and precrural lymphatic glands. Consideration of these results permitted the conclusion that the endoglobular parasites can maintain themselves in cattle in the complete absence of schizonts, and that no cross-immunity exists between the latter

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and the former stages. In subsequent work it was established that *Th. lawrencei*, which is responsible for Corridor disease, behaves in exactly the same way.

Having established that the endoglobular stages of *Th. mutans* and *Th. lawrencei* can maintain themselves in cattle in the complete absence of schizonts, attention was paid to the behaviour of the endoglobular parasites of *Th. parva*.

A fully susceptible splenectomized ox No. 779 was injected intravenously with blood harbouring *Th. parva* endoglobular parasites and schizonts. The former stage of the parasite appeared one minute later and was demonstrable in blood smears for a period of 27 days. Blood smears were examined daily for 18 months. After an inverval of 76 days one and after 96 days another single *Theileria*-like parasite was seen in the blood smears. Brown tick nymphae were allowed to feed on this animal 233 days after the artificial infection. The ensuing stage failed to transmit East Coast Fever to two susceptible calves.

After an interval of 41 days after the artificial infection 500 ml. of blood of ox No. 779 was transfused into a fully susceptible splenectomized ox No. 741. Endoglobular parasites appeared 58 days later, and a low grade parasitaemia of less than 0.1 per cent persisted for two months. By applying the xenodiagnosis it was determined that the endoglobular parasites (the only stage seen in the blood smears) were those of *Th. parva*.

After an interval of 281 days after the artificial infection 10.0 ml. of blood of ox No. 741 was administered intravenously into a fully susceptible splenectomized calf No. 1354. Endoglobular parasites appeared 33 days later. A very low grade parasitaemia of less than 0.1 per cent persisted for 70 days. Clean brown tick nymphae were allowed to feed on this animal 9 days after the first appearance of endoglobular parasites. They fed to repletion and the ensuing stage was allowed to feed again on calf No. 1354. It reacted to East Coast Fever and died.

From these experiments it may be argued that the endoglobular parasites harboured by oxen Nos. 779 and 741 could have been derived from schizonts, possibly harboured by them. In the case of calf No. 1354, however, which harboured endoglobular parasites, and which was proved to be fully susceptible to East Coast Fever when challenged with ticks that derived their infection from it, one must accept the fact that *Th. parva* parasites can maintain themselves in cattle in the complete absence of schizonts. From this it must be concluded that the endoglobular parasites multiply by binary fission, even though divisional forms were never seen in the three animals despite careful daily blood smear examination.

Consideration of these results makes it apparent that the statement advanced by Theiler (1921) that cattle which recovered from the South African strain of East Coast Fever develop a sterile immunity has been disproved. The existence of endoglobular parasites in the complete absence of schizonts has been established. An explanation can now be given for the recrudescence of East Coast Fever after intervals varying from 2 to 13 years after the last death from East Coast Fever on farms as described by Sinclair (1914) and Diesel and Van Drimmelen (1948).

It must be stressed that the parasitaemia of *Th. parva* endoglobular parasites in recovered entire cattle is extremely low, and that even splenectomy of such animals is not followed by a microscopically demonstrable relapse. The chances of ticks becoming infected when feeding on such animals is extremely poor. It must also be pointed out that cattle in enzootic East Coast Fever regions invariably harbour *Th. mutans*. Recovered East Coast Fever cattle would thus harbour a mixed infection *Th. mutans* and *Th. parva* endoglobular parasites. In the event of a biological transmission it must be pointed out that an interference phenomenon between the two *Theileria* spp. comes into play, and that this is yet another hazard for the infection of ticks with *Th. parva* (Neitz, 1957). *Th. mutans* has thus played an important role in the biological control of East Coast Fever. It was also established that it served the same function for the control of Corridor disease (Neitz, 1957).

The last outbreak of East Coast Fever occurred in South Africa in 1954. The last foci of infection were eliminated by the slaughterout policy. The campaign against this disease cost the state 100 million Rand.

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GROUNDNUT POISONING, DUE TO AFLATOXIN, IN STOCK IN SOUTH AFRICA

J. A. MINNE, T. F. ADELAAR, M. TERBLANCHE, J. D. SMIT—Veterinary Research Institute, Onderstepoort.

SUMMARY

Four pigs and two goats died suddenly after eating mouldy groundnuts.

The groundnuts were found to be toxic to laboratory animals, causing an acute liver damage similar to that seen in the natural cases. The material proved to contain aflatoxin, produced by the fungus *Aspergillus flavus* Link which was found in abundance in the specimen.

HISTORY

During May 1963 four pigs died suddenly on a farm in the Northern Transvaal, after having eaten mouldy groundnuts on the previous day. Approximately ¾ lb. had been given to each of 5 adult pigs. One pig refused the nuts and was not affected. The remainder was then eaten by two goats both of which died within 24 hours. No symptoms were observed but at autopsy congestion and haemorrhages in the liver and haemorrhages in the intestines were seen. A liver specimen in formalin from one of these pigs was submitted for histological examination. It showed a diffuse necrosis and generalized haemorrhages.

EXPERIMENTS WITH LABORATORY ANIMALS

The groundnuts were fed to a young 18 Kg. Large White Cross gilt. On the first day 240 g. was eaten and on the second day it was found that, except for a temperature of 103°F, the pig looked absolutely healthy. Another 240 g. of groundnuts was, therefore, offered. On the third day it was found that she had not eaten, looked unthrifty and had a temperature of 99.4°F. On the fourth day she was found dead. The intake of the mouldy nuts was thus 13.3 gm. per Kg. live weight.

Chemical pathological studies made on the blood taken on the first and second days showed that an acute liver dysfunction had been produced from the first day. The Transaminase S.G.O.T. increased from 68 King Units to 382 King Units and the S.G.P.T. was 167 King Units. The conjugated bilirubin increased from 0.2 mgm.% to 0.8mg.% and the unconjugated bilirubin from 0 mg.% to 7.4 mg.%. The serum cholesterol was 333 mgm. per cent.

On Post mortem a generalized icterus was found. Congestion of the liver and a diffuse focal necrosis were present. These were confirmed histologically as central necrosis and generalized haemorrhages. The kidneys showed a slight nephrosis which was confirmed histologically.

The heart showed subepi- and subendocardial petechiae with subendocardial ecchymoses in the left ventricle. Histologically a severe degeneration of the heart muscle, a slight reactive hyperplasia in the lymph glands, and vacuolisation and fatty infiltration in the pancreas, were seen. The small intestine was very hyperaemic and contained free blood in the lumen.

It was also found that the groundnuts were toxic to a goat, a sheep and a rabbit but not to one rat. (These experiments will be described in a following paper).

THE TOXIC FACTOR

Cultures made from the mouldy nuts proved *Aspergillus flavus* Link to be the dominant fungus present, indicating that aflatoxin might be the active agent.

A dose of 2 g. per kg. live weight repeated on two consecutive days was found to be lethal to a rabbit. A hexane extract of 50 g. of nuts was then given to a rabbit. This dose, equivalent to 17.6 g. nuts per kg. gave a negative result. A methanol extract of the hexane residue proved toxic while the final residue again proved non toxic.

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The positive methanol extract was tested for aflatoxin by the method of Broadbent[1]) et al. Thin layer chromatography produced a typical fluorescent spot at Rf 0.5 which corresponds to that found by these workers.

As assay of the raw groundnut material used gave a concentration of 65 p.p.m. aflatoxin or 100 p.p.m. in the defatted material.

Allcroft[2] showed that aflatoxin in milk was heat-stable up to 130°C hence was not destroyed by pasteurization. To demonstrate this property, as further proof of the toxic substance being aflatoxin, samples of the toxic groundnut meal were heated to 100°, 120°, and 150°C for one hour respectively and a fourth sample was heated to 200°C for 20 minutes. The first three samples subsequently proved toxic to rabbits at a dosage rate of 4.5 g. per kg. per day for two consecutive days. The fourth sample which was charred by the heating proved non toxic.

Discussion

In 1960 Stevens[3] reported a disease in turkeys which Blount[4] in 1961 associated with the feeding of Brazilian groundnuts. Sargeant[5] in 1961 showed that the condition was associated with the growth of *Aspergillus flavus* Link on these groundnuts. Sargeant[6] 1961 showed that the toxicity was due to aflatoxin produced by the fungus.

In 1963 Terblanche[7] recorded that during 1962 it had been found that a commercial sample of groundnuts from this country and which had not produced poisoning contained a toxic strain of *Aspergillus falvus* Link. This indicated that when conditions for the growth of the fungus were suitable, the same trouble as experienced in Britain, could be expected here.

This is the first proven case of natural aflatoxin poisoning recorded in South Africa. In comparison with the outbreaks in Britain, the cases were extremely acute. This is probably due to the fact that the animals received a high concentration of groundnuts and not a compounded ration containing up to 15 per cent nuts. The South African nuts also contained an exceptionally high concentration of aflatoxin i.e. 65 p.p.m. as compared to 2–5 p.p.m. found in the Brazilian groundnuts tested in Britain[8].

ACKNOWLEDGEMENT

We are grateful to the Chief of the Veterinary Research Institute, Onderstepoort, for permission to publish this paper.

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Liver X240: Acute experimental case, note peripheral necrosis and haemorrhage, slight fatty infiltration towards central vein.

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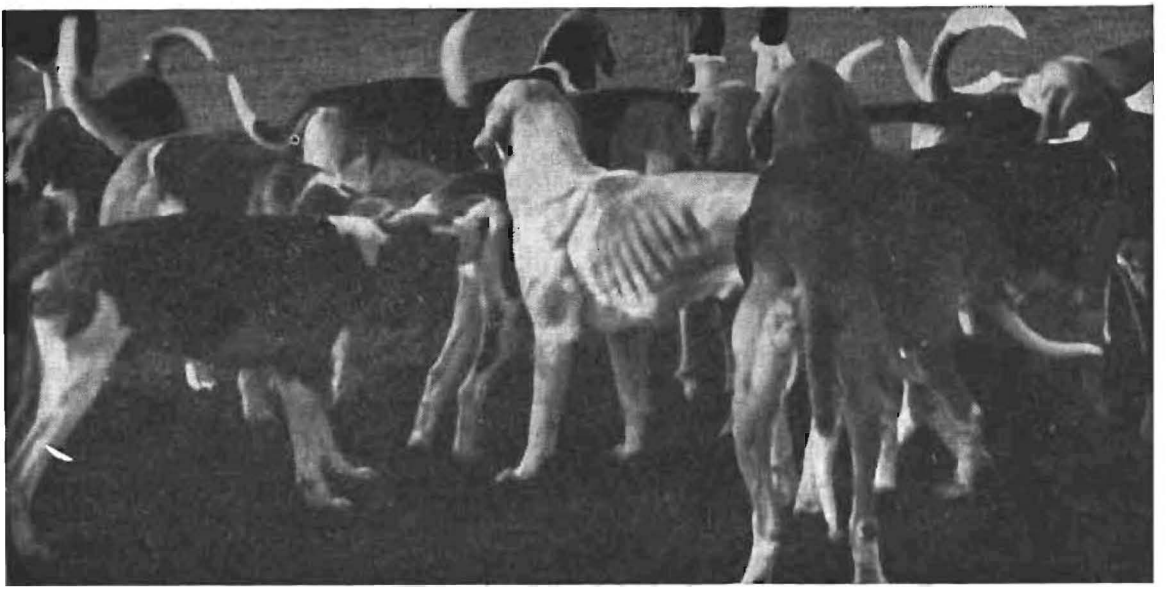

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A HITHERTO UNKNOWN POISONOUS PLANT: *LASIOSPERMUM BIPINNATUM* (THUNB.) DRUCE

PRELIMINARY COMMUNICATION

T. F. ADELAAR, M. TERBLANCHE, J. D. SMIT, T. W. NAUDE,—Veterinary Research Institute, Onderstepoort

L. E. CODD—Botanical Research Institute, Pretoria.

SUMMARY

Attention is drawn to the toxicity of *Lasiospermum bipinnatum* (Thunb) Druce.

The plant causes acute liver and kidney damage.

INTRODUCTION

During an investigation into mortality on a farm in the Cracock district in the Eastern Cape Province, the above plant was pointed out by the farmer as being a cause of Dikkop (swollen head) in his sheep. A specimen was brought back to the laboratory for indentification and investigation. It was found to contain a trace of HCN. The plant was found to be mentioned only once in the literature. Walsh in 1907 reported he had received a specimen from a farmer who said that it was the cause of death in his stock. He identified it as *Lasiospermum radiatum* Trevir, and classified it under the "Bietouws" in his book. The plant thus required investigation.

MATERIAL

Family: *Compositae*

Lasiospermum bipinnatum (Thunb.) Druce in *Rep. Bot. Exch. Cl. Brit. Isles*, 1916, 631, (1917). *Lidbeckia bipinnata* Thunb. *Prod. Pl. Cap.* 161, (1800); *Lasiospermum radiatum* Trevir. in *Nov. Act. Nat. Cur.* xiii. I, 205, (1926).

Common Names:
Ganskweek, Gansbossie.

Description:

Decumbent to erect, herbaceous perennials, up to 40 cm high, with stout, woody rhizomes. *Stems* numerous, seldom branched, arising from the crown of the rhizome, decumbent to ascending, terete, striate, glabrous. *Leaves* alternate, crowded at the base, sparser above, clasping at the base, bipinnatisect, up to 10 cm long, 2–4 cm wide, green, glabrous on both sides, lobes apiculate. *Capitula* solitary, terminal on long, ascending seldom branched peduncles up to 30 cm long, with membranous, entire to sparsely dentate bracts, capitula more or less discshaped, 3–3.5 cm in diameter, ray-florets white to pale purplish pink, reflexed with age, disc-florets yellow. *Involucre* somewhat discoid; bracts in 3 rows, more or less elliptic, green, with membranous margins, spreading as the fruits mature. *Achenes* ±5 mm long, 3-angled, the whole fruit covered with long, yellowish hairs, which gives a woolly appearance to the flowering head as the fruits mature; pappus none.

Flowering time:

Right through the year. (During the rainy season).

Distribution:

South Eastern and Western Transvaal, Orange Free State, North Western, South Western, Central and Eastern Cape and Basutoland.

Not recorded from Natal.

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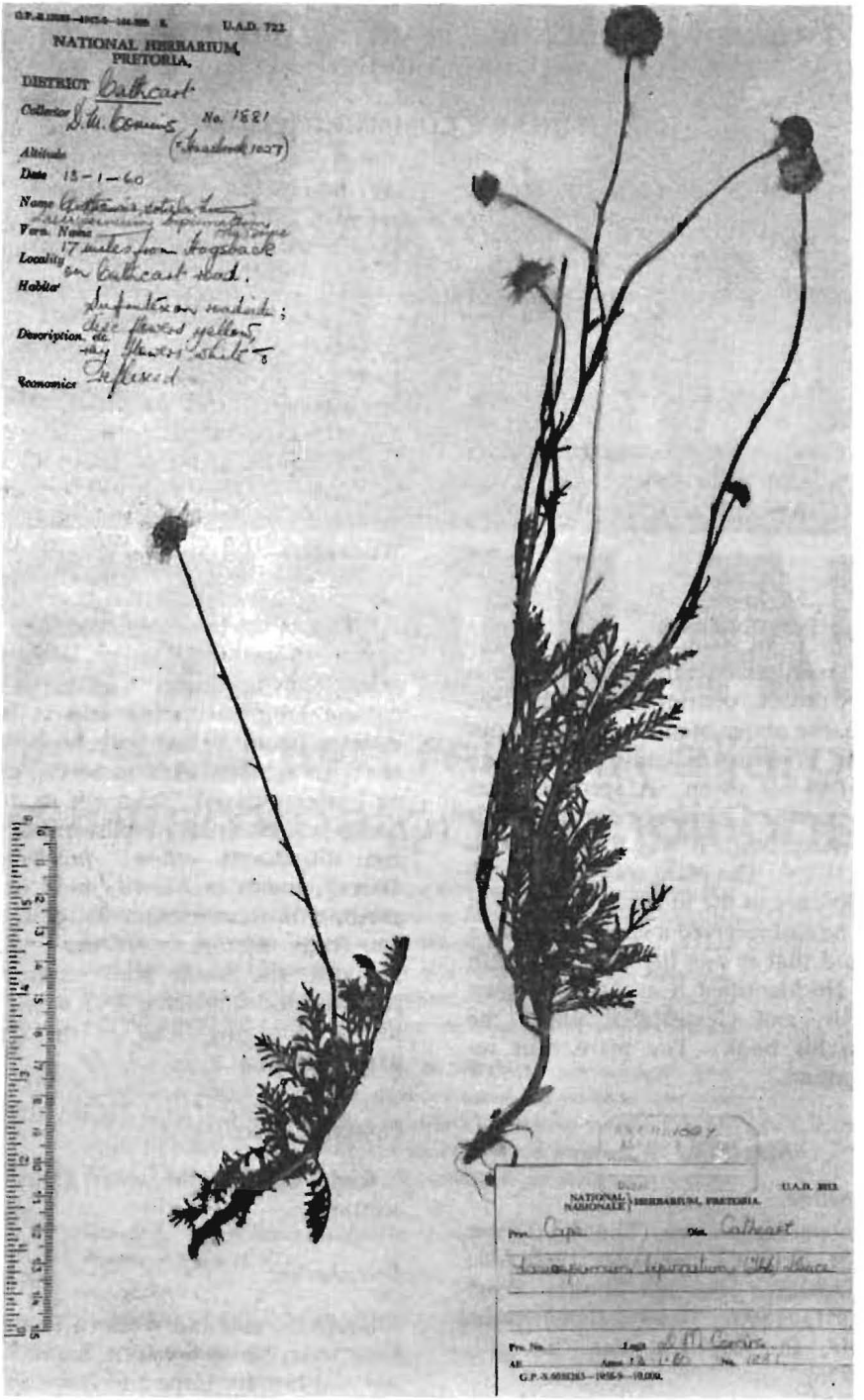

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Habitat:

The plant seems to be able to grow almost anywhere, but prefers vleis. It has been found on mountains, on flats, alongside roads, and in backyards. It seems to prefer sweet veld. (higher pH).

Methods

The plant was shade dried, finely ground in a hammermill and suspended in 1 to 2 litre luke warm water before dosing it by stomach tube to the sheep. A similar procedure was followed with rabbits.

The sheep were examined clinically daily. This included the recording of the pulse rate, respiration rate, temperature and ruminal movements per 5 minutes. Blood samples were taken periodically for chemical pathological examinations.

Experiment I

A merino sheep weighing 34 Kg. was dosed 200 g. of the whole plant daily for 5 consecutive days. On the 5th day a ruminal stasis was evident as the movements which had been constant at 10 in 5 minutes for the first 4 days had decreased to 1 in 5 minutes. She died during the night. The following was found at post mortem:—

A *tumour hepatis*, congestion and subcapsular extravasation and histologically early stages of lysis necrosis; extensive nephrosis and amyloid degeneration of the kidneys; hyperaemia and oedema of the lungs with focal ecchymosae; slight reactive hyperplasia in the prescapular lymph gland and spleen; subepicardial petechiae and congestion in the myocard and petechiae in small intestine. There was a slight *tumour splenis*. Histologically the malpighian bodies were indistinct.

Experiment II

A 36.4 Kg. merino was dosed 9.6g. plant material per Kg. liveweight. She died within 24 hours.

On post mortem much the same picture was seen. However the diffusely spread lobular necrosis could be seen macroscopically. Histologically it was found that the necrosis and haemorrhages were very definitely peripheral in the lobules. The kidneys were not affected.

Experiment III

A 36.4 Kg. merino sheep was dosed 7 g. per Kg. body weight on the first and 10 g. per Kg. on the second day. His mouth was injured and dosing was therefore stopped. However on the fourth day he died without having shown any symptoms.

A chemical pathological investigation of the blood showed an increase in serum glutamic oxaloacetic acid transaminase (SGOT) on the second (436 King Units) and third (376 King Units) days. This was followed by an increase in conjugated bilirubin from 0.2 to 0.6 mgm. per cent and unconjugated bilirubin from 0.8 to 1.8 mgm. per cent. This indicated both liver damage and dysfunction. Kidney function appeared normal.

On post mortem the liver showed diffusely spread focal necrotic and haemorrhagic areas which were confirmed histologically to be extensive central haemorrhages, early stages of lysis necrosis and prominent R.E. cells. The kidney showed congestion only, especially in the medulla. Again a reactive hyperplasia was seen in the lymph node. There was a slight *tumour splenis* with histoligical atrophy of lymphoid tissue; an ascites of ca. 300 cc and a distinct oedema and petechiae of the mucous membranes of the abomasum and small intestine.

Experiment IV

Another merino weighing 30 Kg. was dosed with 6.7 g. plant material per kilogram, once. She was kept under close observation and slaughtered after 40 days.

Symptoms:

On the second day of the experiment a tachycardia (160/min) was recorded. On the 3rd. and 4th. days there was no abnormalities, clinically. On the 5th day an icterus and congestion of the conjuctiva, together with an increased pulse rate (160/min.) was found. The icterus persisted up to the 9th. day. The pulse rate was normal on the following day. On the

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7th day a high temperature was present (104.6°F) which persisted up to the 13th day. (104.6: 104.5; 104.5; not taken; 104.6; 103.6°F).

It is interesting that she developed the high temperature five days after the liver damage was first apparent and two days after the peak of liver dysfunction. There may have been a secondary infection.

Chemical pathology: See Table I

back to the predosing value on the sixth day. As measured by the increase in total plasma cholesterol, the liver dysfunction reached a peak on the 8th day after dosing.

There was also a distinct kidney dysfunction which reached a peak on the fourth day after dosing, as shown by the increased blood urea nitrogen values. These however returned to normal rapidly.

TABLE I

CHEMICAL PATHOLOGY

The sheep in Experiment IV which weighed 30 Kg and received a single dose of 6.7 gram plant material per Kilogram body weight.

Day	P.C.V	SGOT	SGPT	UBR	CBR	SUGAR	CHOL-EST	TPP	BUN	Creat	U/A	SYMP-TOMS
1	27	162	42	0.1	0	50	100	6.5	22	0.8	1.9	
2	—	413	51	0.6	0	42	105	6.16	24.9	2.5	0.75	
3	—	413	63	1.2	0.8	63.5	95	6.68	47.8	3.3	3.38	
4	—	—	—	—	—	—	—	—	—	—	—	
5	37	393	67	5.8	3.0	55.5	200	7.56	60.7	2.5	2.87	Icterus
6	—	—	—	—	—	—	—	—	—	—	—	
7	32.5	350	36	3.9	2.4	42	240	7.38	22.0	1.6	3.5	Slight icterus
8	29	397	45	2.5	1.9	44.5	270	7.9	14.7	1.6	2.0	Slight icterus
9	27.5	390	48	1.8	1.2	49.5	240	6.75	22.0	2.5	4.26	Very slight icterus
10	24	289	24	0.8	0.6	35	240	5.46	11.04	2.2	2.25	Normal
11	—	—	—	—	—	—	—	—	—	—	—	
12	23	304	35	0.7	0.3	53.5	230	6.0	12.9	2.75	4.0	
13	24	274	30	0.4	0.2	17.6	180	5.8	17.6	2.75	4.24	
14	22	261	36	0.2	0.3	35	200	5.64	17.6	2.2	2.75	
15	22	297	92	0.4	0.2	41.4	180	5.46	22.0	2.7	1.88	
16	22	226	30	0.4	0.2	36	167.5	—	20.2	2.4	1.0	
17	20	236	12	0.6	0	—	170	5.64	20.0	2.2	1.37	

1. P.C.V. = Packed red blood cell volume in percentage.
2. SGOT = Serum Glutamic Oxaloacetic Transaminase in King Units.
3. SGPT = Serum Glutamic Pyruvic Transaminase in King Units.
4. UBR = Unconjugated bilirubin in mgm per cent.
5. CBR = Conjugated bilirubin in mgm per cent.
6. Sugar in mgm per cent.
7. Cholestr. = Cholesterol in mgm per cent.
8. TPP = Total plasma protein in Gm per cent.
9. BUN = Blood Urea Nitrogen in mgm per cent.
10. Creat. = Creatinine in mgm per cent.
11. U/A = Uric Acid in mgm per cent.

There was an extensive liver damage as indicated by increased concentrations of plasma transminases which was evident on the first day after dosing and did not return to normal till after 16 days. Liver dysfunction, as indicated by increased plasma bilirubin, reached a peak on the fourth day after dosing, but this was almost

The total plasma proteins were in the low range expecially from the 13th day onwards. This might also reflect liver dysfunction as an underproduction of plasma albumen.

Pathology:

The liver showed an infiltration of lymphocytes into Glisson's capsule and necrobiosis of

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the liver cell nuclei, peripherally in the lobule. Chromatin was prominent in the peripheral endothelium cells. In the periphery of the lobule a proliferation of fibroblasts was seen. There was reactive hyperplasia in the spleen and a slight oedema of the lungs.

Experiment V

A rabbit was dosed 4.5 g. plant material per Kg. body weight. It died within 24 hours, showing extensive necrosis and haemorrhages in the liver.

Discussion

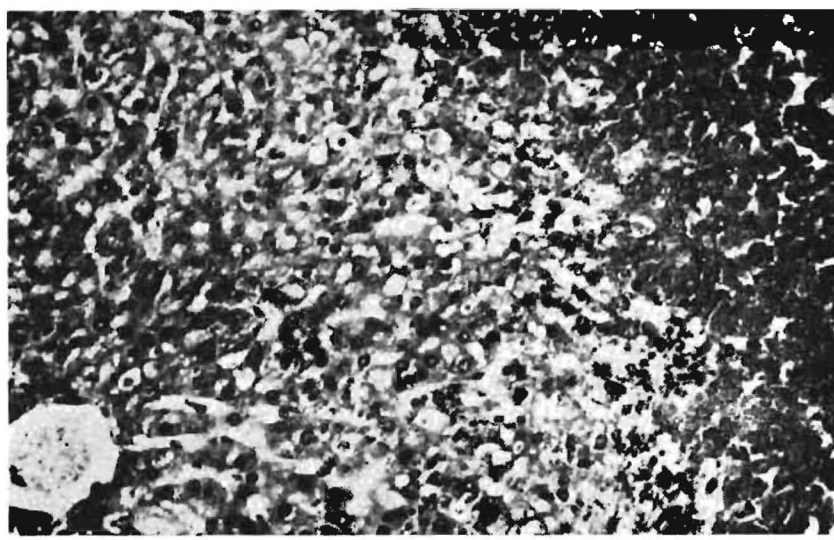
Many more cases of Ganskweek poisoning have been seen than are recorded here. The main lesions were observed in the liver and varied according to the duration of the illness. In the acute cases a diffuse liver necrosis with haemorrhages was observed. The less acute cases showed a constant tendency for the lesion to be confined to the periphery of the lobule. In a case that recovered and which was later slaughtered, proliferation of fibroblasts in the periphery of the lobule and in Glisson's capsule was the outstanding feature. The only other significant histo-pathological lesion was a varied degree of nephrosis.

Although this plant has a wide distribution, especially in the eastern Cape Province, this is only the second report of its toxicity and the first time that it has been proved to be toxic, experimentally. It is also the first time that the symptoms, pathology and chemical pathology have been described. The explanation may be either that it causes a liver damage not unlike that of seneciosis, especially in the subacute and chronic forms and has been mistaken for the latter in many instances or that stock do not eat it readily.

From farmers' descriptions it seems that the plants are somewhat more resistant to frost than are grasses, with the result that in the late winter and early spring, just before the rains, there is relatively abundant ganskweek and sparce unpalatable veld pasture, which makes poisoning very likely.

The single acute minimum lethal dose of this batch of ganskweek seemed to be between 7 g. per Kg. and 9.7 g. per Kg. for sheep.

Repeated dosis of 6.7 g. per Kg. per day to another sheep eventually killed it after five days. This might indicate an accumulative effect.



Liver X240: Acute experimental case; note peripheral necrosis and haemorrhage, slight fatty infiltration towards central vein.

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ACKNOWLEDGMENTS

We are grateful to the Chief of the Veterinary Research Institute at Onderstepoort for the facilities put to our disposal and for permission to publish. A special word of thanks is due to the officers of the Veterinary Field Service for the collection of plant material.

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FARM 11: Aborters were not eliminated but the rate of stocking was drastically reduced. The incidence of abortion remained constant at 32 per cent between 1959 and 1963.

FARM 12: Here a policy of gradual elimination has been practised in that many aborters were allowed to breed again. The percentage of ewes which aborted in the years between 1958 and 1963 were 17, 26, 20, 18, 12 and 15 respectively. The total kidding percentage also remained unchanged.

FARM 13: Only ewes which aborted for a second time were eliminated. The percentage of ewes which aborted since 1959 were 21, 18, 24, 13 and 12.

Discussion

These results prove conclusively that habitual abortion on the one hand and the production of virile kids on the other, are chaarcteristics of individual ewes nor primarily influenced by environmental factors. There is strong evidence that the production of still-born and non-virile kids is a manifestation of the abortion tendency[2]. Furthermore, the failure to reproduce without detectable abortion is undoubtedly often due to undetected early abortion or resorption of the foetus which are also caused by the same primary defect. The elimination of the affected animals has therefore resulted in a very high percentage crop of viable kids.

The long-term effect of selecting only those ewes which produce viable kids for future breeding will only be seen when the performance of the progeny can be assessed. The data so far available in this regard is encouraging but it is as yet too early to draw final conclusions.

Recommendations

In view of the above facts, the following recommendations can be made:—

1. All aborters should be eliminated from breeding flocks as subsequent surviving progency may perpetuate the defect.
2. All ewes giving birth to still-born full-term kids or weak kids which only survive a few hours, should also be eliminated. Where possible all ewes which fail to produce a normal viable kid should be culled.
3. Only rams from strains known to be free of the defect should be used. Although it has been shown that the tendency for a ewe to abort is not influenced by the ram to which she is mated, the sire may transmit the defect to his progeny. Breeding records should therefore be studied before rams are selected.
4. There is evidence to show that underdevelopment of the testes may be correlated with the defect. Only rams with well developed testes should therefore be used.
5. Where possible, and especially in stud flocks, the progeny of a ewe which aborts should be removed from the breeding flock. (Where a ewe aborts for the first time at an advanced age, discretion can be exercised in this regard.)

It is realised that on certain farms economic and other considerations may make it difficult or impossible to apply all these recommendations immediately but their general implementation will doubtless bring about a great improvement in the mohair industry.

ACKNOWLEDGMENT

The Chief: Veterinary Field Services is thanked for permission to publish this report.

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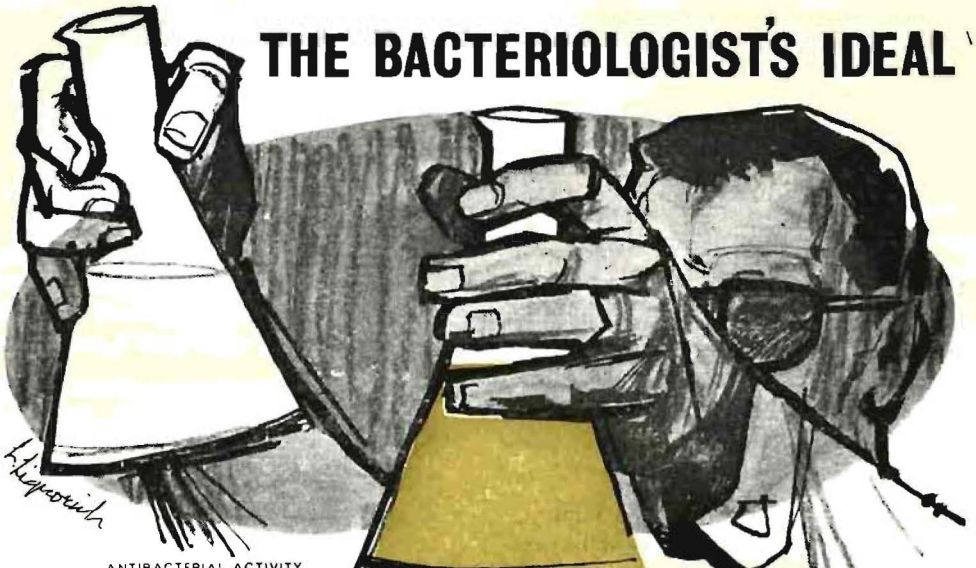

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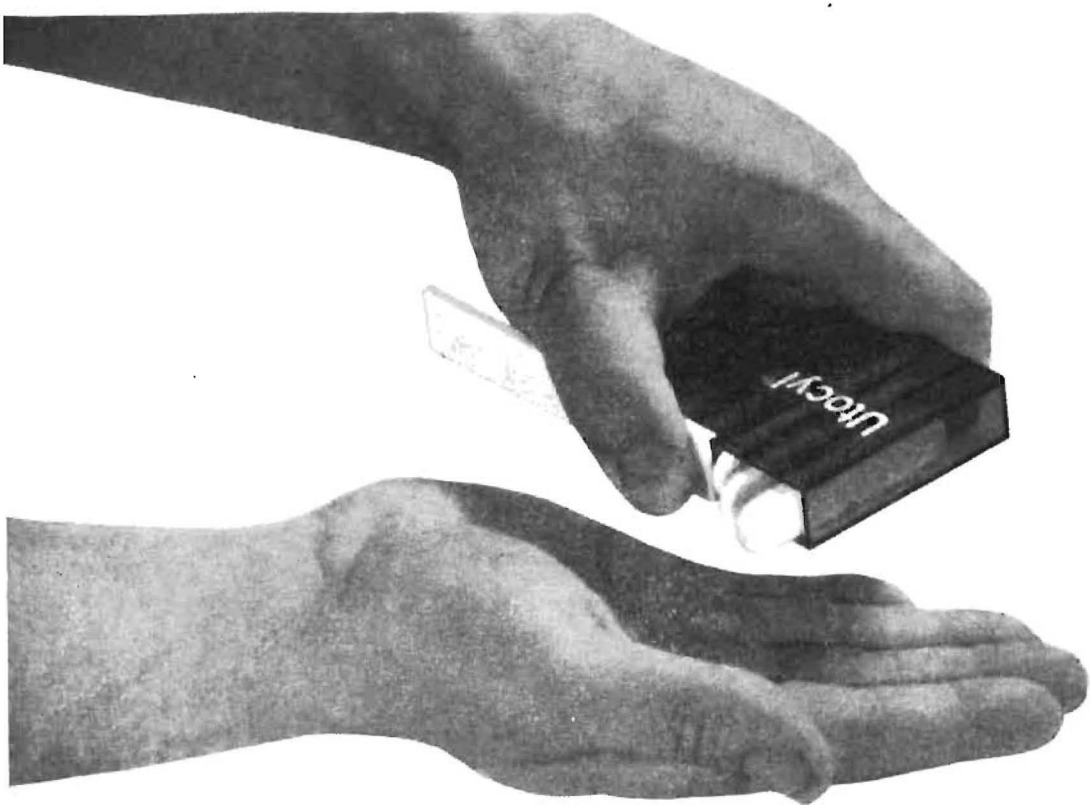

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BERENIL: EFFICACY AGAINST *BABESIA CANIS* AND COMPARISON WITH PHENAMIDINE

H. BOTHA — Private Practitioner

79 Havelock Street, Port Elizabeth.

SUMMARY

The properties of Berenil are described; the results of a clinical trial are given; the undesirable effects of Phenamidine are briefly discussed and compared with those of Berenil.

Berenil (dI-(4-amidinophenyl)-triazene-(N-I:3) -diaceturate. 3 H_2O 100 per cent) (Farbwerke Hoechst Ag.) is a chemotherapeutic drug against babesiosis, trypanosomiasis and theileriosis in antmals.

Manufacture's note:

Berenil granules remain stable for at least two years under tropical conditions. The toxicity has been tested with a maximum tolerable dose of 20 mg./kg. intramuscularly and 12.5 mg./kg. intravenously. When injected intravenously Berenil may cause a transient fall in blood pressure expecially in dogs where 2 mg./kg. may cause a state of collapse.

In the dog maximum blood levels of Berenil were found 3–7 hours after intramuscular injection. After 16 hours only traces of Berenil could be detected in the serum. The dose for all animals generally is 3.5 mg./kg. bodyweight. Since Berenil itself has a considerable antibacterial effect, the use of sterile water is not absolutely necessary.

Clinical trial:

All cases of biliary fever in dogs were confirmed by demonstrating *B. canis* in peripheral blood smears.

Granules weighing 1.05 gm. Berenil were dissolved in 50 c.c. boiled water, giving approximately 20 mg./c.c. The dosage used in the trial was 4 mg./kg. (1.cc/5kg.) bodnweight until the solution was 10 days old, and then at 1cc./4kg.

Injections were given subcutaneously in the neck region without producing any signs of pain, but in a few dogs a slight, transient, painless swelling developed at the injection site. Animals treated were in various stages of biliary fever, from early cases to animals in a state of collapse. Control peripheral blood smears were examined 15–24 hours later. No parasites were found in the blood after 24 hours and in some cases smears were negative for *B. canis* as early as 15 hours after treatment.

No ill effects were noticed after the injection, not even in the most prostrate dog. Emesis was occasionally reported at variable times after treatment, but this is more likely to be caused by the disease itself.

The temperature returned to normal (101–102°) in 14–24 hours in all dogs which showed a high temperature (104° and more.) Those with a lower temperature generally dropped to 100–100.5° in 24 hours before returning to normal. In advanced cases showing a normal or subnormal temperature, the temperature dropped a further degree or two in the first 24 hours before returning to normal, except in one case that showed a rise from 96° to 100°.

Stability of Berenil in solution:

According to the manufacturers a 7 per cent solution in distilled water keeps for 10–15 days at room temperature and up to three weeks in a refrigerator without any toxic products being formed. There is, however, a colour change which is unrelated to the potency of the solution. If the solution is stored for a longer time its efficacy diminishes. The author, however, has kept a 1.75 per cent solution for as long as 18 days at room temperature which still gave the desired results. Relapses did not occur in any of the experimental dogs.

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Phenamidine:

Phenamidine has been extensively used by the author, but effective as it is, it may cause the following undesirable reactions:—

1. The 5 per cent solution frequently causes an allergic reaction sometimes followed by abscessation and/or necrosis at the injection site even under the most sterile conditions. Using the 35 per cent solution diluted to 5 per cent with boiled tap water, no more than a painless swelling has been noted over two years.

2. At a dosage rate of 1c.c./3.3kg. bodyweight of the 5 per cent solution, a degree of shock developed, manifested in the majority of cases by emesis generally within half an hour after treatment. Apart from being distressing to the owner, this is also definitely dangerous in the weakened dog. Respiratory distress due to circulatory collapse can become marked shortly after treatment. Death nearly always follows in a few hours. Even divided doses given over a few hours do not eliminate this hazard satisfactorily.

Berenil vs. Phenamidine:

Since the acceptance of Berenil in the author's practise, hundreds of dogs have been treated, but unfortunately not all of them without undesirable side effects. A very small percentage, particularly Alsations, developed necrosis and abscessation at the site of injection. The percentage, however, has not been more than that experienced with 5 per cent Phenamidine, but decidedly more than with the 35 per cent Phenamidine diluted with boiled tap water. The author suggests that a 3.5 per cent solution (1.05 gm. in 25 c.c. water) given intramuscularly, as the manufacturers recommend, would eliminate this, provided that the quicker rate of absorption does not produce an adverse effect on the very weak and anaemic cases.

A case or two treated with Berenil developed a relapse approximately 14 days after the initial treatment. The possibility exists that too low a dosage Berenil had been used due to an incorrect estimation of weight or to decreased potency of an ageing solution of the drug. All dogs showing a temperature above 101.0° after 24 hours receive a second injection as well as the advanced cases which show a subnormal temperature at the same stage. Relapses with Phenamidine were frequently experienced in cases treated with a single injection of 1 c.c./3.3kg. of the 5 per cent solution. Resistance to Berenil was experienced in one Boxer. The bloodsmear was still positive after 48 hours. Phenamidine was given but the smear 24 hours later still revealed babesia. Berenil was given again at a 50 per cent higher dosage and 24 hours later the smear was negative. The dog recovered completely.

Conclusion:

Berenil is inexpensive, safer, more effective and saves a larger percentage of dogs than Phenamidine. It should find its way into every small animal practice. It is easily dissolved and offers a wide margin of safety.

The two drugs can be compared as follows:

	Berenil	*Phenamidine*
Shock and emesis	None	Frequent
Reaction at injection site	Seldom serious subcutaneously	More often serious
Prognosis in advanced cases	More favourable	Less favourable
Stability of solution	14 days room temp	Indefinite
Relapse	Seldom (to date)	More frequent
Resistance	Seldom	Occasional
Price factor	Cheaper	Cheap

ACKNOWLEDGEMENT

My sincere thanks to Farbwerke Hoechst (formerly Meister Lucius & Bruning) for their communication, and for the supply of Berenil to conduct the clinical trial.

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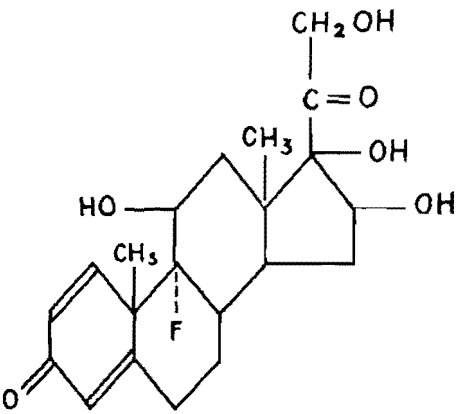

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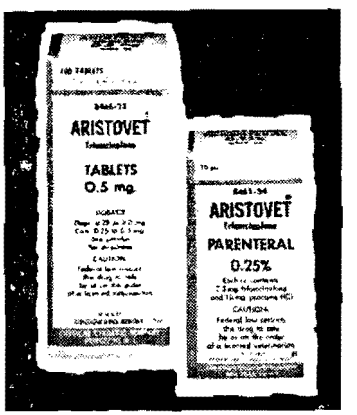

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THE CEREBRAL FORM OF BABESIOSIS IN DOGS

H. BOTHA — Private Practitioner, 79 Havelock Street, Port Elizabeth.

SUMMARY

A short report on nervous biliary fever in dogs in the Port Elizabeth area is given with special reference to an interesting case history with features of coma and intermittent convulsions. A histopathological report is given and the case is compared with cerebral malaria in humans to which it bears a striking similarity. The author expressed the opinion that a different strain of Babesia may be responsible for cerebral biliary in dogs.

INTRODUCTION

Cases of the nervous forms of biliary fever in dogs have been described in the past but as a rule without any pathological report[1].

In Port Elizabeth a number of cases have been observed having as their main feature the sudden onset of coma followed by death within twenty-four hours. In every case observed the mucous membranes were bright red, the temperatures were slightly elevated or sub-normal, the pulse variable and blood smears showed a large number of *B. canis*. Where the histories of these cases were reliable, a few dogs had shown signs of mild illness for a couple of days before suddenly going into coma. In one particular case the owner had noticed the dog leaving the house to lie on the lawn in an apparently healthy condition, but, when a sudden shower of rain failed to arouse the dog, they became suspicious and found the dog was unconscious. Specific treatment was unsuccessful and it died three hours later.

Cases showing convulsions similar to those of distemper are seen from time to time; the only apparent difference appears to be the continuity of the nervous symptoms and high temperature whereas in distemper the temperature is usually only slightly above normal at the onset of nervous symptoms. A blood smear examination is usually conclusive.

Mortality appears to be in the region of at least 50 per cent in all cases despite varying symptoms.

Case History

One evening I was called to a two year old cross Ridgeback dog which had come into the house and shown a series of convulsions with signs of paralysis. Strychnine poisoning was suspected but when I examined the dog it was having intermittent fits and appeared to be semi-conscious. The temperature was 104°F. A blood smear proved to be positive for *Babesia canis*.; 5 per cent Phenamidine (1 c.c. per 6 lbs bodyweight) and Chlorpromazine (Largactil; May Baker Ltd.) were injected. Pentobarbitone (Nembutal) capsules were given rectally at intervals during the night to control the convulsions. The dog got up the next day, staggered a few yards and drank a little water but did not regain consciousness completely and relapsed into a deep coma shortly afterwards. Another blood smear proved to be positive and Phenamidine was again injected. Pentobarbitone sodium was injected to control the fits which appeared at intervals of between 5–10 minutes, each lasting 10–60 seconds. The temperature at this stage was 102.4°.

The blood smear was still positive on the 3rd day (60 hours later) with very few parasites visible. The temperature was just above normal at 102°F. Phenamidine was again administered. There was no change in the dog's condition—when the barbiturates were withdrawn the fits recurred.

On the 4th day the smear was finally negative and the temperature normal. Five hundred ccs. of 5 per cent dextrose in saline was given intravenously in a slow drip as well as further doses of Phenamidine, Largactil and Barbiturates.

On the 5th day the smear was still negative and 200 ccs. 5 per cent plasma hydrolysate in 5

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per cent dextrose in saline plus 300 ccs. dextrose in saline was given by intravenous drip. Mild attacks of convulsions kept on appearing and the dog remained in a coma.

On the 6th day the temperature became subnormal. A cisternal puncture was carried out but did not improve the dog's condition—it remained in a very deep coma with very weak reflexes. All drugs were withdrawn for 12 hours, and the convulsions became more severe while the dog remained in a coma.

At this stage it was decided that permanent damage had been done to the brain and the dog was left to die of its own accord– which it did on the evening of the 6th day.

A post mortem was performed with specific attention to the brain. The cerebro-spinal fluid was clear with no apparent increase in quantity. Thrombosis of the small arteries and areas of necrosis could be distinguished macroscopically and sections of the brain were submitted in 10 per cent formalin for histological examination. Sections revealed liquefaction necrosis with extensive haemorrhages in the cerebral substance. No parasites were observed in the red blood cells in these sections.

Discussion

There was not only occlusion of the capillaries but also of the arterioles and even small arteries. It appears that the dog had recovered from biliary fever but in such cases medicinal treatment would appear to be of no avail.

Malaria in man is caused by four different types of Plasmodia viz: *P. vivax*, *P. ovale*, *P. malariae* and *P. falciparum*. Of these, *P. falciparum* can be the mildest but also seems to be the only species capable of causing a high mortality rate due to predilection to undergo gametogenesis in capillaries resulting in thrombosis haemorrhage and anoxia. It is especially fatal when the blockage occurs in the capillaries and precapillaries of the brain, which results in sudden loss of consciousness, coma and nervous symptoms with death in the majority of cases.

P. falciparum is blamed as the common, if not the only, cause of "Blackwater Fever" in humans—an acute haemolysis of red blood corpuscles which can terminate in death within 48 hours if untreated. Even with proper treatment, mortality can be as high as 30 per cent.

All the syndromes seen in malaria in humans can be observed in babesiosis in dogs.

It is possible that what was identified as *B. canis* was in fact a hitherto unrecognised strain of Babesia. It is notable that of the plasmodia only *P. falciparum* is capable of causing nervous symptoms in man[2]. Does *B. canis* resemble *Plasmodium falciparum* in that it can give several clinical pictures; haemoglobinuria ("Blackwater Fever") and icterus, capillary haemorrhages, nervous symptoms, (cerebral malaria) progressive anaemia and a mild form with spontaneous recovery or is there more than one strain or species each producing its own syndrome?

If the latter is the case, and a distinct strain of low virulence does exist, it might possibly be capable of producing a premunity in dogs similar to that produced by the benign strain of *B. bovis* and B. bigemina in cattle.

ACKNOWLEDGEMENT

Dr. J. L. du Plessis, Pathology Department, Onderstepoort, who did the histo-pathological examination.

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ISOLATION OF *MYCOBACTERIUM KANSASII* FROM BOVINES

R. W. WORTHINGTON AND H. H. KLEEBERG.

Section Bacteriology, Veterinary Research Institute, Onderstepoort.

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SUMMARY

The isolation of two strains of *M. kansasii* from healed tuberculous lesions in bovines, is reported. The two strains were found to be similar to reference strains of *M. kansasii* in biochemical characteristics, drug sensitivity, virulence for laboratory animals and specific sensitin reactions. The possible significance of this isolation is discussed.

INTRODUCTION

The bacteria belonging to the genus Mycobacteria have probably the most ubiquitous distribution of any micro-organisms characterised by a single definite feature viz acid alcohol fastness. The saprophytic species occur commonly in soil and water as free living micro-organisms. The classical pathogens like *M. tuberculosis*, *M. bovis*, *M. johnei* and *M. leprae* are strictly parasitic. Between these two extremes is a group of potential pathogens and potential sensitizers to the tuberculin test, which at the present time are receiving much attention from veterinary and medical investigators.

The system at present widely in use for grouping these unclassified, atypical or anonymous mycobacteria, is that of Runyon[1]:

Group I —Photochromogens—pigmented only after exposure to light.

Group II —Scotochromogens—pigmented in dark and light.

Group III —Non-chromogens—non-pigemented.

Group IV —rapid growers.

Runyon[2] himself expressed the wish that this scheme should be used only as a method of grouping until it was possible to define accurately separate species. It is becoming obvious that Group I—the photochromogens consists of one species only—*M. kansasii* (luciflavum). The organism was first shown to be a separate disease-causing entity by Buhler & Pollack in 1953[3].

M. kansasii is responsible for a lung disease of man clinically indistinguishable from tuberculosis. The disease occurs most commonly in the Middle Western States of the United States, but cases have been reported from England, France, Germany and other countries ([1,3-8]). It has the peculiarity of being non-contagious and the source of infection remains unknown. Efforts to isolate the organism from water, soil or hospital utensils have failed. Their existence in animals had not been reported until Chapman and Bernard[9] recently isolated six strains of *M. kansasii* from 150 milk samples in Texas. The authors suggested that milk may form a source of infection for man.

The disease has not been reported in Africa. The isolation and characterization of two strains of *M. kansasii* from bovines in the Transvaal, is described in this paper.

MATERIALS AND METHODS

The strains were isolated from 2 cows in a tuberculous herd. Both cows were tuberculin reactors and had been treated with isoniazid for eight months together with 150 other reactors. Twenty eight months after treatment commenced, both animals were selected for slaughter as they had failed to become tuberculin negative. They showed reactions with skinfold increases of 4 and 8 mm. On autopsy at Onderstepoort, both showed typical small healed tuberculous lesions, one in the lung and the other in the lung and mediastinal lymph

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glands. Thirty four culture media and four guinea pigs were inoculated with material from these lesions.

Primary isolation on Lowenstein Jensen medium was unsuccessful and only one of the guinea pigs developed a small abscess. There was growth of acid fast organisms in fluid Kirchner-Herman medium. Subcultures on Lowenstein—Jensen medium showed that in both cases there was a mixed population. Colonies were selected and subcultured, but complete separation was not achieved. The strains were then injected into guinea pigs. Pure cultures of *M. kansasii* were re-isolated from the local abscesses in the guinea pigs. Single cell suspensions of both strains were plated out and thousands of monobacillary colonies were examined; all were rough typical photochromogenic colonies changing colour from buff to orange on exposure to light.

The two strains W33 and W31 were compared with three world strains P1 & P8 received from Dr Martinaglia, King George V Hospital, Durban, and Hunt, received from the Trudeau Laboratory, Saranac Lake, N.Y., United States.

The strains were tested for pigment production when grown in the dark and in continuous light. Cultures grown in the dark were exposed to light for three hours and re-incubated in the dark.

The following biochemical tests were applied to the strains:—

(*a*) Niacin test as done in the Trudeau Laboratory[10].

(*b*) Nitrate reduction test as described by Bonicke[11].

(*c*) Urease test as described by Toda et al[12].

(*d*) Neutral Red test as described by Steenken[10].

(*e*) Direct Catalase test.

(*f*) Catalase test after heating to 68°C for 20 minutes[13].

Drug sensitivity tests were applied by inoculating one large loopful of a 10^{-4} suspension of each strain onto Lowenstein-Jensen slopes containing the following concentrations of drugs: isoniazid 0.2, 1.0 and 5.0 mcg/ml., P.A.S. 10 mcg/ml., Streptomycin 10 mcg/ml., before inspissation and Thiacetazone dissolved in propylene glycol 1 mcg/ml. One control tube containing propylene glycol and one without any additives were also inoculated. The tubes were incubated at 37°C and growth was compared with the controls after 2 and 4 weeks.

For virulence tests suspensions of strains W33 and W31 were injected into white mice, guinea pigs, rabbits and calves. Particulars are given below:

Homologous and heterologous sensitin specificity was tested as follows: PPB sensitins were prepared from the strains W33, Hunt, P8, the bovine tuberculin strain AN5 and a strain of *M. smegmatis*. Three guinea pigs were sensitized with each of the following strains, W33, Hunt, P8, our bovine test strain 9473, and *M. smegmatis*. Intradermal tuberculin tests were applied, using 25 sensitin units per injection. The injection sites for each tuberculin were varied in each guinea pig. The diameter of the reactions was read after 24 hours. Specificity differences (S.P.D.) were calculated according to the method described by Magnusson.

Results

The strains were found to be typical photochromogens being deep yellow to orange yellow when grown in continuous light or exposed to light for 3 hours, but pale when grown in the dark.

Animal	No. per strain	Dose (wet weight)	Route	Interval between infection and P.M.
Mice	9	0.3 mg	intravenous	4 & 8 weeks
Guinea pigs	4	0.1 mg	subcutaneous	6 weeks
Rabbits	1	0.01 mg	intravenous	6 weeks
Calves	1	1.0 mg	intravenous	8 weeks

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The results of the biochemical tests and the drug sensitivity tests are given in tables I and II. In all respects including growth rate, the bovine isolates were found similar to the reference strains.

nisms. In guinea pigs, they caused small local abscesses at the injection site only. Smears from the abscesses were found to contain acid fast bacilli. The calves and rabbits showed no macroscopic lesions and smears were negative.

TABLE I.

Biochemical Properties of *M. kansasii*.

Strain.	Niacin	Nitrate Reduction	Urease	Neutral Red test	Catalase (direct).	Catalase (68°C–20 min)
P_1 (U.S.A.)	—	+	+	±	+ + +	+ + +
P_8 (U.S.A.)	—	+	±	+	+ + +	+ + +
Hunt (U.S.A.)	—	+	+	±	± + +	+ + +
W33 (S.A.)	—	+	+	+	+ + +	+ + +
W31 (S.A.)	—	+	+	+	+ + +	+ + +

TABLE II

Drug sensitivity of *M. kansasii*.

Strain	Isoniazid.			PAS.	SM.	Thio.
	0.2 mcg/ml	1 mcg/ml	5 mcg/ml	10 mcg/ml	10 mcg/ml	1 mcg/ml
P_1	Res	Res	Sen	Sen	Sen	Sen
P_8	Res	Res	Sen	Sen	Sen	Sen
Hunt	Res	Res	Sen	Sen	Sen	Sen
W33	Res	Sen	Sen	Sen	Sen	Sen
W31	Res	Sen	Sen	Sen	Sen	Sen

KEY: Res = Resistant.
Sen = Sensitive.
PAS = Para-aminosalicylic acid.
SM = Streptomycin.
Thio = Thiosemicarbazone.

W33 and W31 caused fairly advanced miliary lung lesions in the mice which is a distinct characteristic of *M. kansasii*. Smears from the lungs showed large numbers of acid fast orga-

The average reactions of the intradermal tests in the variously sensitized guinea pigs are given in table III and the S.P.D's are given in table IV. It can be seen that W33 is very similar to the test strains P8 and Hunt in sensitin specificity.

TABLE III

Average skin reactions to various sensitins

Strain used for guinea pig sensitization.	Sensitin Strain.				
	AN5 M. bovis	M. smegmatis	W33	Hunt	P8
9473 M. bovis.	17.1	7.7	11.1	9.8	11.2
M. smegmatis.	3.0	15.0	3.0	4.5	4.0
W33 M. kansasii.	11.8	7.7	15.0	13.5	14.7
Hunt M. kansasii.	9.5	9.0	14.7	14.3	14.5
P8 M. kansasii.	6.8	3.8	13.0	12.0	13.5

KEY: Figures = mean diameter of reactions in millimeter.

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TABLE IV.

Specificity differences* of purified sensitins

Strain used for guinea pig sensitization.	Sensitin Strain.				
	AN5 M. bovis	M. smegmatis	W33 M. kansasii	Hunt M. kansasii	P8 M. kansasii
9473 M. bovis	—	21.4	9.2	12.1	12.0
M. smegmatis	21.4	—	19.3	15.8	20.7
W33 M. kansasii	9.2	19.3	—	1.1	0.8
Hunt M. kansasii	12.1	15.8	1.1	—	1.3
P8 M. kansasii	12.0	20.7	0.8	1.3	—

* *Specificity difference is the difference in mm between homologous and heterologous reactions, i.e.* SPD = (Aa + Bb) — (Ab + Ba) where Aa is the homologous reaction obtained with sensitin A and homologously sensitized guinea pigs and Ab is the reaction with sensitin A and heterologously sensitized guinea pigs. Similarly Bb and Ba are homologous and heterologous reactions of sensitin B.

DISCUSSION

The two strains of *M. kansasii* isolated from bovines were shown to be identical to American reference strains of *M. kansasii* isolated from man. Until recently, disease caused by *M. kansasii* was unknown in humans. With the advent of isoniazid and the intensification of tuberculosis control measures in many countries the tuberculosis infection rate has dropped sharply. In those countries where B.C.G. vaccination is not practised—particularly in the United States—a disease free, but highly susceptible, tuberculin negative population is arising. This susceptible population possibly enables atypical mycobacteria to become established as pathogens. It is probably not a coincidence that *M. kansasii* was isolated from two bovines in a herd in which tuberculosis eradication by means of chemotherapy had been intensively practised.

It has been suggested by Tarshis[14] that *M. kansasii* can develope as a mutation of *M. tuberculosis*, under the influence of isoniazid. This work could not be repeated by other workers. If this was the case with our isolates it would seem reasonable to expect that being mutations of *M. bovis*, there should be some difference between them and the *M. kansasii* type strains. No difference could be found. It is more likely that these organisms were able to multiply in the healing lesion. Isoniazid treatment would not have influenced the organism. It is likely that the as yet undiscovered source of infection is similar for man and cattle.

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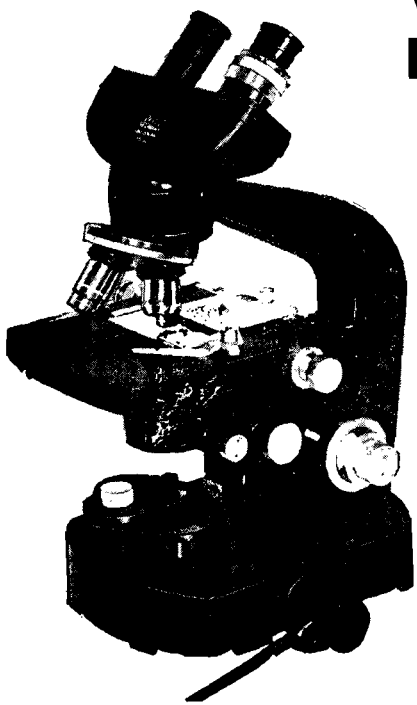

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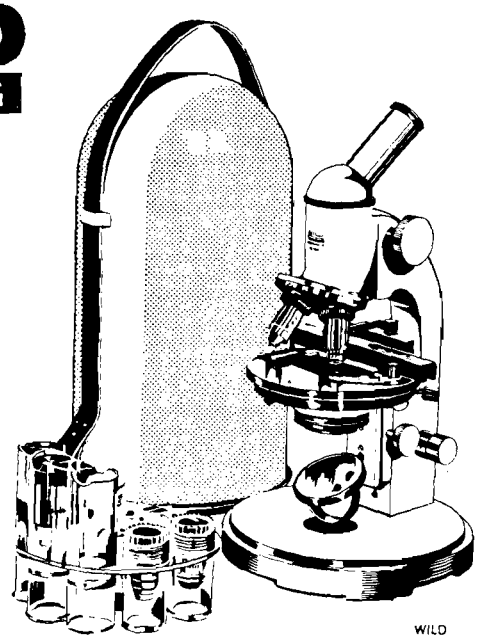

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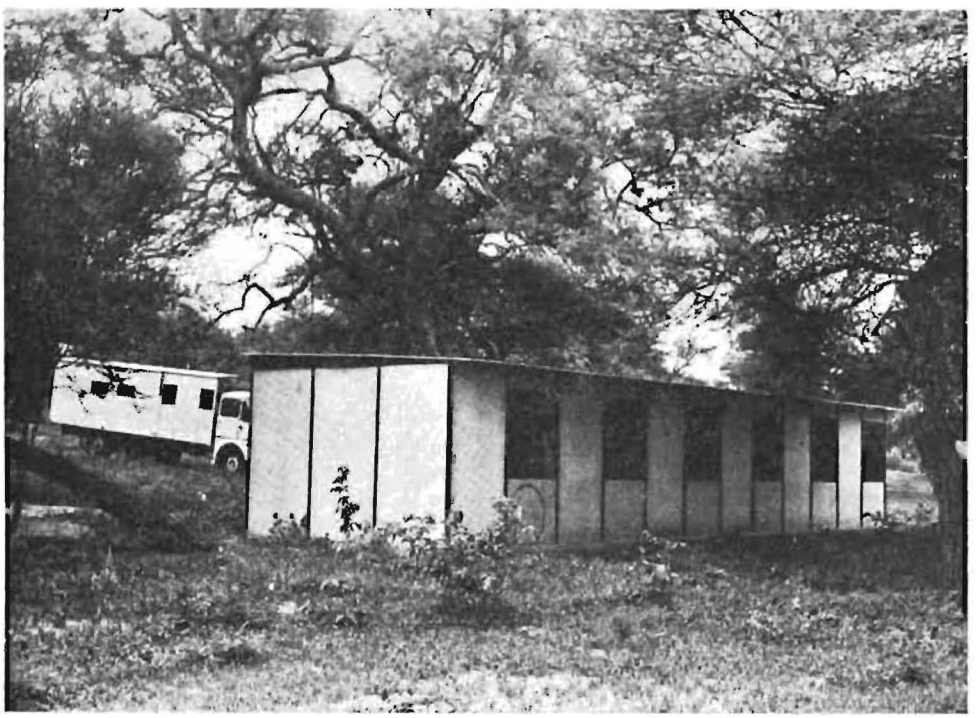
The vaccine is of course, autogenous, and as such, after typing of the virus, requires quite a time to prepare and transport to the infected area. In the Bechuanaland Protectorate, where livestock production is on the extensive free range system with few natural barriers, normal disease control methods are extremely difficult to apply and their institution presents many, problems. To facilitate disease control the country has been divided into four large areas by the erection of permanent cordon fences and five large quarantine camps, established at strategic points. The confining of infection to the original site by the application of the stand-still order, is a major exercise and, until this exercise is completed, the risk of the spread of infection to contiguous areas, is very grave.

For these reasons, it was felt that the production of killed homologous strain vaccine at the site of the outbreak, would be of infinite value in controlling the spread of infection, during the critical stages of an outbreak.

To produce such a vaccine would necessitate the establishment of a vaccine production unit in the field, at some considerable distance from normal accepted services such as water and electricity; in other words, the establishment at short notice of a functional laboratory unit adequately staffed, in the bush.

During 1963, the presence of foot and mouth disease was confirmed in an isolated area on the Botletle River, in the northern aspect of the territory. The opportunity to evaluate new approaches to the field control of foot and mouth disease were thus presented. From an experimental point of view the site was ideal, but gave rise to difficulties of organisation. It was situated 280 miles from railhead and from the nearest major centre of veterinary administration, and 600 miles from the research laboratories.

It was necessary to establish a "bush" laboratory at the site of outbreak and considering the distance involved, the difficulties attached to this exercise can be appreciated. However temporary buildings were erected, equipped and staffed by the research staff.



Prefabricated Laboratory at Makalawabedi

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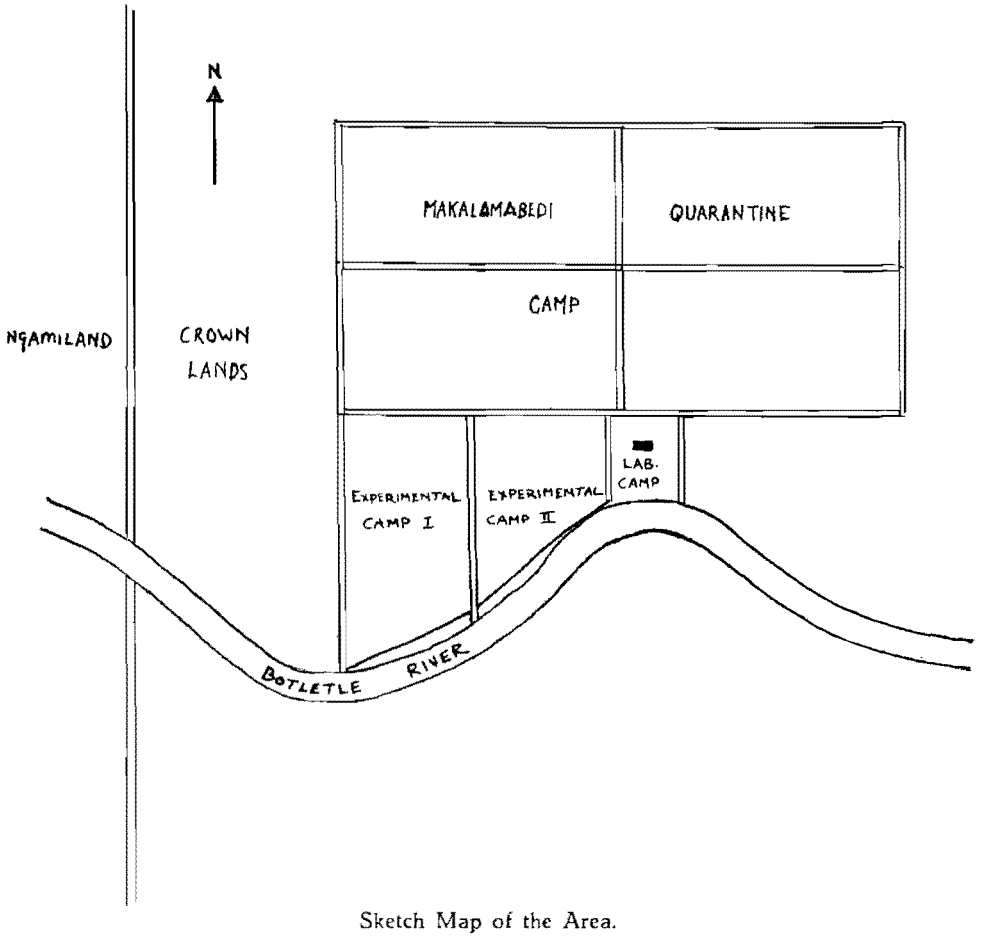
The building consisted of a five room prefabricated asbestos structure erected on a cement base. Electricity was supplied by a 5 kilowatt, 220 volt air-cooled plant. Water was pumped from the neighbouring river through a plastic hose to a point ten feet from the building.

No rain fell throughout the period (July to October) and shade temperatures ranged from 41°F to 97°F.

The staff, who were accommodated under canvas, consisted of two veterinarians, one laboratory technician and seventeen lay personnel.

The location of the field laboratory was in the infected area at a point between a permanent quarantine camp called MAKALAMABEDI and the Botletle River. MAKALAMABEDI is situated 24°30′ East 20°20′ South on the North bank of the Botletle River, close to the Ngamiland district of the Bechuanaland Protectorate. The veterinary quarantine camp consisted of a standard double fenced camp 10 miles by 5 miles, divided into four paddocks. The infected area was on the south bank of the river, opposite the quarantine camp. Three further camps were erected between the quarantine and the river bank, to provide quarantine facilities for the laboratory housing units and for two small experimental herds. These camps measured respectively 200 by 300 yards wide and $1\frac{1}{2}$ to 2 miles long.

The object of the experiments was to determine whether or not it is possible, under field conditions, to produce an homologous strain vaccine against foot and mouth disease, by the use of a prescribed tissue culture technique, or from naturally infected lymph.



Sketch Map of the Area.

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It should be stressed at the outset that this work was done under field conditions and that no claims can be made to the recognition of finesse in techniques, or the execution, as may be practised by the experienced virologists under normal laboratory conditions. All this work however, was carried out under the strictest veterinary control in a quarantine area adjacent to the site of a naturally occurring outbreak of the disease.

The susceptibility of the cattle under experiment was not demonstrated serologically but, as 80, two years old animals, were drawn from Ngamiland where the last outbreak of the disease (SAT 3) had occurred in 1958, it was assumed that the total susceptibility of those animals would be sufficient for the work invisaged. This was subsequently borne out in the actual experiments and no individual variance in the susceptibility factor was noted.

EXPERIMENT No. 1.

Object

To determine whether or not it is possible to culture foot and mouth disease virus in tissue culture under field conditions.

Materials and Method

Naturally infective lymph containing foot and mouth disease virus—SAT 3 (typing, Pirbright, July, 1963).

Tissue culture medium as per the Frenkel method practised by the *Centraal Diergeneeskundige Instituut, Amsterdam*, constituted as follows:—

Glucose	18.832 grm
Lactalbumen Hydrolysate	40.000 grm
Calcium Chloride	2.516 grm
Sodium Chloride	74.820 grm
Magnesium Chloride	0.950 grm
Sodium Bicarbonate	16.832 grm
Peptone	30.000 grm
Potassium Chloride	1.900 grm
Sodium Phosphate	0.475 grm
Chloromycetin	0.600 grm
Streptomycin	0.800 grm
Penicillin	1,000,000 Units
Distilled Water	10 litres

The pH of this culture medium is 7.4 and should not require adjustment. The medium, in a 20 litre container, was stabilised at a temperature of 37°C in a water bath and the following materials added:—

(*a*) 750 gm of finely minced epithelium obtained from the tongues and palates of three cows. The cornified layer of epithelium was not removed.

(*b*) 750 gm of finely minced foetal skin obtained from a five months foetus.

(*c*) 10 ml of seed virus in the form of naturally infective lymph thus giving a concentration of 10^{-4}. The infective lymph had been titrated using Henderson's technique (A.R.C. Report Series No. 8 of 1949).

The Amsterdam medium calls for 15% bovine tongue epithelium stripped of the cornified layers. Neither sufficient cattle nor the special instruments were available to supply this, and so recourse was made to the epithelia mentioned above. The culture was stirred mechanically for 20 hours, oxygen being bubbled continuously through the medium.

At the end of this period it was allowed to cool to atmospheric temperature and then placed in a refrigerator at 4°C for 24 hours. It was then filtered through (*a*) Filter paper (*b*) Seitz filter and serially diluted with phosphate buffer (pH. 7.4) and titrated by lingual injections of susceptible cattle.

Results

The culture filtrate proved infective at a dilution of $^1/_{10}$th ml of 10^{-6} but not at 10^{-7}

The original dilution of the virus in the culture was 10^{-3} and the final culture filtrate was infective at $^1/_{10}$th ml at 10^{-6}, which was equivalent of 10^{-9} of the original lymph. This lymph had been found to be 50% infective at $^1/_{10}$th ml at 10^{-7} but not in greater dilution. therefore growth of the virus had occurred.

This experiment was repeated twice in an attempt to give reproducible results. The first of these repeat experiments was unsuccessful because of the mechanical failure of an incubator which was used to replace the water bath. The

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second attempt however was successful and gave results similar to the initial experiment.

EXPERIMENT No. 2

OBJECT

To determine whether or not it was possible, under field conditions, to produce foot and mouth disease vaccine, using naturally infective lymph.

MATERIALS AND METHOD

The technique employed in the production of this vaccine is that used by *Das Eidgenossische Vakzine Te Basle, Switzerland*, with the following modifications:

(*a*) A final 5% concentration of Aluminium Hydroxide (dried gel B.P.) instead of 2–2.5%.

(*b*) Glycerine was added to give a level of a final concentration of 10%.

In this manner 5 litres of vaccine were prepared. The Swiss vaccine does not call for the incorporation of glycerine, however, Moosebrugger 1951[2] recorded that the prior addition of glycerine resulted in the more complete adsorbtion of the virus by aluminium hydroxide and Gerrard and Machowiak 1951[3], indicated that glycerine tended to stabilise the vaccine against adverse temperature fluctuations above 16°C. Since several workers had commented on the variable adsorbtive power of various samples of aluminium hydroxide, and it was not possible to test the sample nor was temperature control possible, an arbitrary 10% glycerine was added to the vaccine.

During the preparation the vaccine was subjected to continuous agitation for 48 hours at 26°C in a waterbath. At the end of this period it was stored, in the presence of melting ice, in an insulated box. It was tested for safety in the following manner, a random sample having been taken from storage after 24 hours.

Two susceptible cattle were each given 15 ml. of the vaccine intra-dermo-lingually in 121 and 133 sites respectively. No lesions were visible at the end of 24, 48 and 72 hours.

To test the efficacy of the vaccine, forty cattle were vaccinated subcutaneously at the following dosage levels:—

10 received 30 c.c. each on 1st day.
10 received 15 c.c. each on 1st and VIIth day.
10 received 15 c.c. each on 1st day.
10 received 7.5 c.c. each on 1st and VIIth day.

In two animals from each group, the immunity was challenged by the administration, intra-dermo-lingually, of 1 ml. of a dilution 10^{-3} infective lymph, given in three sites on the 14th day.

In the remaining 32 vaccinated animals the immunity was challenged by exposure to continuous natural infection.

The control group consisted of 8 susceptible cattle, 4 of which received a similar dose of virus to the 8 animals challenged as above viz. 1 ml of a dilution 10^{-3} infective lymph, given into three sites.

The remaining 4 were left as in-contact susceptible animals. Constant natural infection was maintained by the introduction of a further 12 susceptible animals virused at intervals.

RESULTS

All the above animals were kept under constant observation for a period of 7 weeks with the following results:—

1. Six of the experimental animals challenged intra-dermo-lingually, showed primary lesions on the tongue only, at approximately 24 hours after inoculation. No secondary lesions developed.
2. In the 32 vaccinated animals challenged by exposure to natural infection, no lesions developed.
3. All control animals showed primary lesions on the tongues and secondary lesions in the mouth and/or on the feet.

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EXPERIMENT No. 3

Materials and Methods

Five groups, each of two cattle, were taken ınd were vaccinated thus:—

A. Received 15 ml. on 1st day and 15 ml. on 14th day.

B. Received 15 ml. on 1st day and 15 ml. on 21st day.

C. Received 30ml. on 1st day and 30ml. on 14th day.

D. Received 30ml. on 1st day and 30 ml. on 21st day.

E. Received 30ml. on 1st day, 30 ml. on 7th day and 30ml. on 14th day.

These ten cattle plus one susceptible control animal were given 10,000 ID_{50} of virus intra-dermo-lingually at one site on the 23rd day.

Results

All the vaccinated animals showed no lesions whatsoever whereas the control animal showed primary lesions within 24 hours and secondary lesions within 96 hours.

EXPERIMENT No. 4

Object

The object of this experiment was to produce a vaccine in the field using virus produced by tissue culture instead of natural infective lymph. Essentially it was a repeat of Experiments II and III.

Materials and Method

The method of vaccine production was identical to that used in Experiment II except that the natural lymph was replaced by tissue culture filtrate; the same safety standards were applied.

Efficacy tests were as follows:

Eight groups of two cattle each were vaccinated thus:—

A. Received 15 ml. on 1st day.

B. Received 15 ml. on 1st day and 15 ml. on 7th day.

C. Received 15 ml. on 1st day, 15 ml. on 7th day and 15 ml. on 14th day.

D. Received 15 ml. on 1st day and 15 ml. on 21st day.

E. Received 30 ml. on 1st day.

F. Received 30 ml. on 1st day and 7th day.

G. Received 30 ml. on 1st day, 30 ml. on 7th day and 30 ml. on 14th day.

H. Received 30 ml. on 1st day and 30 ml. on 21st day.

This experiment was run in conjunction with Experiment No. III, the vaccinated animals running together and the same animal acted as control in both cases.

On the 23rd day these animals were virused intra-dermo-lingually with 10,000 ID_{50} of natural lymph virus.

Results

As noted in Experiment III the control animal developed primary and secondary lesions within 96 hours, whereas the vaccinated animals in this experiment showed no lesions.

CONCLUSIONS

1. It is possible to propagate foot and mouth disease virus under field conditions, in tissue culture, as described above.
2. It is possible to produce an effective inactivated foot and mouth disease vaccine, in the field, using either tissue culture filtrate or natural lymph.
3. It is considered that the success obtained in the propagation of this virus in tissue culture was largely due to the inclusion in the medium of fully susceptible material in the form of foetal tissues.

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THE CONTROL OF INTERNAL PARASITES OF SHEEP WITH NEGUVON AND ASUNTOL: FURTHER RESULTS.

S. STAMPA, Agro-Chem. (Pty.) Ltd., 60 Market Street, Grahamstown, C.P.
Received for publication January 1964

SUMMARY

(*a*) The efficacy of Neguvon A against HAEMONCHUS, OSTERTAGIA, TRICHOSTRONGYLUS, NEMATODIRUS, TRICHURIS, OESOPHAGOSTOMUM, MONIEZIA EXPANSA and AVITELINA CENTRIPUNCTATA was studied using Critical Anthelmintic Tests under grassveld and Karoo conditions.

(*b*) The product was found the more effective in sheep grazing on grassveld than in sheep kept in the Karoo.

(*c*) The product was found more effective against TRICHOSTRONGYLUS and OESOPHAGOSTOMUM in sheep with soft droppings before dosing than in sheep with well formed hard droppings.

(*d*) The efficacy against OESOPHAGOSTOMUM has no correlation with cholinesterase inhibition.

(*e*) Asuntol dissolved in oil was, in low concentration, less effective than in higher concentrations or in suspensions in water.

(*f*) A liquid formulation of Neguvon A was more effective at the same dosing rates than the wettable powder.

(*g*) Dylox was not effective against OSTERTAGIA, TRICHOSTRONGYLUS and OESOPHAGOSTOMUM in sheep. The efficacy against these worm species was somewhat higher in Angora goats but also not quite adequate. Dylox was not effective against mature *Dictyocaulus filaria* but may be effective against the immature stages.

INTRODUCTION

The efficacy of Neguvon (Bayer L.13/59) and Asuntol (Bayer 21/199) against internal parasites of sheep was examined under South African conditions during 1958–1959. The faecal egg count anthelmintic test was used and the results, as well as toxicity trials published[5], The drugs were combined in the ratio of 10 parts Neguvon to 1 part Asuntol, hereafter referred to as Neguvon A. At dosage rates of 50 mg/kg, Neguvon A was found to be effective against a large range of parasites; 100 mg/kg of this mixture was found to be the maximum safe dosing rate in the Karoo. In the winter rainfall areas of the Western Cape, sheep were found to be more susceptible to the toxic effects and 80 mg/kg was regarded as the maximum safe dose. Both anthelmintics when used alone, were only effective against a variety of parasites at dosing rates close to the toxic level.

Meldal-Johnson, Muller & Thomas[3], repeated the experiments with Neguvon A, using larger groups of experimental animals in three different regions of the country. They found the mixture generally less effective than Stampa[5], but confirmed the toxicity results.

Behrenz', found a high efficacy of the mixture at 60 mg/kg against immature HAEMONCHUS in sheep. At dosage rates of 40 mg/kg, Neguvon A was only slightly effective against 6 day old, but fully effective against 12 day old worms.

Knapp, & Mosher[2] subsequently studied the efficacy of Neguvon A in comparison with Neguvon (hereinafter referred to as Dylox) and Phenothiazine, employing the controlled test technique. In their trials, 50 mg/kg Neguvon A caused a marked reduction of OSTERTAGIA, TRICHOSTRONGYLUS, NEMATODIRUS, COOPERIA and STRONGYLOIDES; HAEMONCHUS and OESOPHAGOSTOMUM were not present.

Neguvon A has been extensively used during the last four years in South and East Africa. The recommended dosage rate of active ingredient is 52–70 mg/kg in semi-arid areas and 35 mg/kg in higher rainfall areas.

The contradictory evidence in the first three papers (References 2, 3, 5) and the recommendation of the low dosing rate of 35 mg/kg in grassveld areas, made it desirable to carry out further experiments.

MATERIALS AND METHODS: ANTHELMINTIC TESTS

The critical test was used in most trials; the controlled test and the faecal egg count test in one trial(4). The efficacy against lungworms

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is studied by counting lungworm larvae in the faeces as follows: 2 days prior to and on the day of dosing; again on the 14th and 16th day after dosing.

All OESOPHAGOSTOMUM spp. and TRICHURIS spp. as well as the Tapeworms SCOLICES are counted individually. A sampling technique is used for the other worm counts to estimate the total.

Neguvon A was given in all these trials, 4–12 seconds after 4–5 ml. of a 10% copper sulphate solution was dosed.

Naturally-infested Merino wethers were used throughout. During the trial they were kept in small paddocks with the same type of vegetation on which they had previously grazed.

EXPERIMENTAL

FACTORS INFLUENCING ANTHELMINTIC EFFICACY: (1) KAROO AND GRASSVELD

The efficacy is studied on two farms in the Karoo and compared with two farms in high rainfall grassveld areas.

RESULTS

TABLE I.—*Results of Critical Tests with Neguvon A under Karoo and Grassveld conditions*

Worm species	Dosage mg/kg	Percentage efficacy in Grassveld areas		Percentage efficacy in Karoo areas	
		Individual sheep	Average	Individual sheep	Average
Haemonchus	35	100, 100, 100, 100, 100, 100, 100	100	100	100
Haemonchus	50	100, 100, 100, 100	100	100, 100, 100, 100, 100, 100, 100	100
Ostertagia	35	100, 100, 99, 99, 97, 86, 77	94.0	46	46.0
Ostertagia	50	82, 79, 41, 25	56.8	100, 100, 84, 21, 14, 13	55.3
Ostertagia	60	—		91, 90, 84, 83, 81	85.8
Trichostrongylus	35	100, 92, 90, 87, 86, 67, 64, 60, 60	78.4	65	65.0
Trichostrongylus	50	95, 94, 78, 68	83.8	95, 93, 79, 74, 60, 15	69.3
Trichostrongylus	60	—		94, 89, 83, 71, 57	78.8
Nematodirus	35	100, 100, 87	95.7	76.8	76.8
Nematodirus	50	—		100, 89, 49, 23	65.3
Nematodirus	60	—		100, 100, 76	92.0
Oesophagostomum	35	100, 96, 86, 85, 79, 62, 58, 52, 10	69.4	6	6.0
Oesophagostomum	50	97, 96, 65, 22	70.0	81, 49, 44, 7, 6, 5, 1	23.9
Oesophagostomum	60	—		99, 88, 29, 17, 6	47.8
Trichuris	35	100, 100, 100, 100, 100, 100, 100	100	—	
Trichuris	50	100	100	—	
Trichuris	60	—		100, 100, 100	100
Tapeworms	35	0, 0	0	—	
Tapeworms	50	—		—	
Tapeworms	60	—		100, 100	100

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TABLE II.—*Results of a Controlled Test with Neguvon A under Grassveld conditions. Dosing rate 35 mg/kg.*

Worm species	Stage of development	Number of worms found in treated sheep	Number of worms found in controls	Reduction %
Haemonchus.....	5th & adult	0	616	100.0
	4th	544	1,640	67.0
Ostertagia.....	5th & adult	422	3,950	89.3
	4th	1,563	3,440	54.6
Trichostrongylus.....	5th & adult	1,818	30,240	94.0
	4th	20	280	93.0
Nematodirus.....	4th	0	360	100

(2) CONSISTENCY OF DROPPINGS

It was repeatedly observed during the first trials that the drug was more effective, in animals that had soft droppings prior to dosing, than in those with well formed hard droppings. Eight sheep kept on grassveld receive 35 mg/kg Neguvon A. Group I consisted of 4 sheep with soft unformed droppings. The droppings of 4 sheep in Group II were well formed. In addition, two Angora goats were included, one with liquid, the other with hard droppings; both dosed with Dylox at 60 mg/kg.

RESULTS

TABLE III.—*Results o, Critical Tests with Neguvon A and Dylox. Influence of consistency of droppings at the time of dosing.*

Worm species	Percentage efficacy in stock with soft droppings at the time of dosing		Percentage efficacy in stock with hard droppings at the time of dosing	
	Individual sheep	Average	Individual sheep	Average
Ostertagia.....	100, 100, 89*, 77	92.0	99, 99, 86, 15*	75.0
Trichostrongylus.....	92, 88*, 87, 86, 60	83.0	100, 67, 64, 60, 12*	61.0
Oesophagostomum.....	100, 100*, 86, 85, 52	85.0	96, 62, 58, 10, 2*	46.0

* Angora goat 60 mg/kg Dylox.

N.B.—These results are also included in Table I.

(1) Karoo and Grassveld.
(2) Consistency of droppings.
(3) Increased peristalsis and OESOPHAGOSTOMUM.

Faecal output increases 7–23 hours after dosing Neguvon A. At the same time cholinesterase levels are at their lowest; probably causing increased peristalsis. During this period most of the OESOPHAGOSTOMUM are excreted; some of them still being alive. There is no correlation however between increased faecal output and anthelmintic efficacy.

(4) The formulation and concentration of active ingredients.

It is possible that the solvent or diluent and the concentration of active ingredient influenced the efficacy. Two pilot experiments were undertaken to compare the efficacy of Dylox and Asuntol at different concentrations. The Mac-Master faecal egg-count technique was used.

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Results

A wettable powder and concentrated solution of Neguvon A at different dosage levels is compared.

Results

TABLE IV.—*Efficacy trials with Dylox & Asuntol: reduction in egg counts expressed as a percentage*

Worm species	Percentage efficacy in sheep dosed 8 mg/kg Asuntol			Percentage efficacy in sheep dosed 100 mg/kg Dylox	
	10% solution in oil	1.5% solution in oil	2.5% suspension in water	10% solution in water	40% solution in alcohol
Haemonchus.....	90.4	49.7	99.5	95.1	99.7
Ostertagia.....	94.7	0	91.6	0	18.4
Trichostrongylus....	63.0	0	73.3	58 5	58.0
Oesophagostomum .	57.0	0	78.2	85.9	81.8
Nematodirus.....	—	—	—	100	87.6
Strongyloides.....	—	—	—	0	57.1

TABLE V.—*Results of Critical Tests with Neguvon A wettable powder and Neguvon A solution concentrate*

Worm species	Veld	Neguvon A wettable powder			Neguvon A solution concentrate		
		Dose mg/kg	Percentage efficacy Individual sheep	Average	Dose mg/kg	Percentage efficacy Individual sheep	Average
Haemonchus.....	Grass	50	100, 100, 100, 100	100	40	100, 100, 100, 100, 99.6	99.9
Haemonchus.....	Karoo	50	100, 100, 100, 100 100	100	45	--	
Haemonchus.....	Karoo	60	—		50	100, 100	100
Ostertagia.....	Grass	50	82, 79, 41, 25	56.8	40	87, 80, 30, 28, 26, 16, 13	40.0
Ostertagia.....	Karoo	50	100, 84, 21, 14, 13	46.4	45	100, 80, 38, 37, 37	58.4
Ostertagia.....	Karoo	60	91, 90, 84, 83, 81	85.8	50	98	98.0
Trichostrongylus.....	Grass	50	95, 94, 78, 68	83.8	40	95, 76, 55, 55, 54, 51, 21	58.1
Trichostrongylus.....	Karoo	50	93, 90, 79, 74, 15	70.2	45	100, 100, 99, 95, 80	93.0
Trichostrongylus.....	Karoo	60	94, 89, 83, 71, 57	78.8	50	100, 96	98.0
Nematodirus.....	Karoo	50	49, 23	36.0	45	100, 100, 77	92.3
Nematodirus.....	Karoo	60	100, 100, 76	92.0	50	100, 100, 100	100
Oesophagostomum.....	Grass	50	97, 96, 65, 22	70.0	40	100, 96, 79, 74, 70, 35, 26	68.6
Oesophagost.....	Karoo	50	49, 7, 5, 1	15 5	45	100, 69, 28, 11	52.0
Oesophagost.....	Karoo	60	99, 88, 29, 17, 6	47.8	50	62, 43, 4	36.3
Trichuris.....	Grass	50	100	100	40	100	100
Trichuris.....	Karoo	50	—	—	45	100, 100, 100, 100	100
Trichuris.....	Karoo	60	100, 100, 100	100	50	100, 100	100

N.B.—Results with wettable powder are also included in Table I.

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(5) Dylox in sheep and goats.

Angora goats were found to be more susceptible to the toxic effects of Neguvon A than sheep[5]; Dylox, on the other hand, produced no ill effects in Angora goats at dosing rates well tolerated by sheep. The anthelmentic efficacy of Dylox is compared in sheep and goats.

RESULTS

TABLE VI.—*Critical Tests with 60 mg/kg Dylox in sheep and Angora goats.*

Worm species	Percentage efficacy in sheep		Percentage efficacy in goats	
	Individual animals	Average	Individual animals	Average
Ostertagia	47, 15, 14, 3	19.8	89, 69, 42, 30, 15	49.0
Trichostrongylus	8, 0, 0, 0	2 0	89, 87, 26, 22, 12	47.2
Oesophagostomum	54, 0, 0, 0	13.5	100, 42, 2, 2, 0	29.2
Trichuris	100, 0	50	100, 100, 96, 94, 67	91.4

(6) Dylox against Lungworm *Dictyocaulus filaria* of sheep.

On several farms sheep infested with *Dictyocaulus filaria*, sheep were regularly dosed at 3–4 weekly intervals with Dylox and Neguvon A. Coughing decreased after the first dose and ceased after three to four treatments. The possibility of an anthelmintic effect against lungworms is considered and a test started. Forty-five infested sheep were dosed at 70–100 mg/kg Dylox; 13 animals in the same flock were kept as controls; all sheep grazed on infested pasture.

RESULTS

TABLE VII.—*Efficacy of a single dose of 70–100 mg/kg Dylox against Dictyocaulus filaria*

	Before dosing			After dosing		
	Number of infested sheep	Total number larvae p.g.	Average number larvae p.g.	Number of infested sheep	Total number larvae p.g.	Average number larvae p.g.
Treated group	45	3,297	73	40	3,314	85
Controls	13	1,224	94	12	3,240	270

p.g. = per gram of faeces.

DISCUSSION

Neguvon A was more effective against OSTERTAGIA, TRICHOSTRONGYLUS, NEMATODIRUS and OESOPHAGOSTOMUM at 35 mg/kg on grassveld farms than at 50 mg/kg on Karoo farms. These differences in efficacy are likely due to the fact that droppings are usually hard and well formed when sheep graze on Karoo, where as they are soft when they graze on green grass. Neguvon A was more effective against TRICHOSTRONGYLUS and OESOPHAGOSTOMUM when droppings were soft at the time of dosing, than when they were hard and well formed. (Table III). The higher efficacy against OSTERTAGIA and NEMATODIRUS on grassveld farms still remains to be explained. Efficacy against HAEMONCHUS and TRICHURIS was very high at both dosage rates.

The results with liquid formulations of Asuntol, Dylox, and Neguvon A, are somewhat conflicting. An unsuccessful attempt was made to delay the action of Asuntol, until it had passed through the intestinal tract to the caecum and colon, by decreasing the concentration of active ingredient. Anthelmintic efficacy disappeared when too much solvent was added.

The efficacy of Dylox was neither influenced by concentration, nor aqueous nor alcoholic solution. This is to be expected as water and alcohol, as well as materials dissolved in either, are absorbed with similar readiness from the intestinal tract. That the combination of an Asuntol solution in oil with an alcoholic Dylox

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solution would be consistently more effective than the suspension, was interesting, and requires further investigation.

Dylox was more effective against internal parasites of goats than of sheep and, to my knowlege, is the first instance in which such a difference has been demonstrated. However, even in goats, the anthelmintic efficacy is erratic and of academical interest only.

On the whole, Neguvon A is effective against HAEMONCHUS and TRICHURIS. It is effective, although somewhat irregular, against OSTERTAGIA, TRICHOSTRONGYLUS and NEMATODIRUS. It is very irregular against OESOPHAGOSTOMUM giving only satisfactory results when the droppings of sheep are soft at the time of dosing. The efficacy is, generally speaking, improved by increasing the dosing rate; the results are also more consistent.

The only exception is the unexpected results against OSTERTAGIA and OESOPHAGOSTOMUM on grassveld farms. At 35 mg/kg Neguvon A was more effective, whereas at 50 mg/kg, the efficacy was lower and erratic.

The influence of the consistency of droppings may explain this feature as far as OESOPHAGOSTOMUM is concerned. The unexpected results against OSTERTAGIA cannot be explained.

The influence of consistency of the droppings at the time of dosing also explains why, generally speaking, a higher efficacy against internal parasites was found earlier[5]. Sheep in those trials were moved from Karoo veld to lucerne lands prior to the test, with a consequent softening of droppings, thus increasing the efficacy of Neguvon A.

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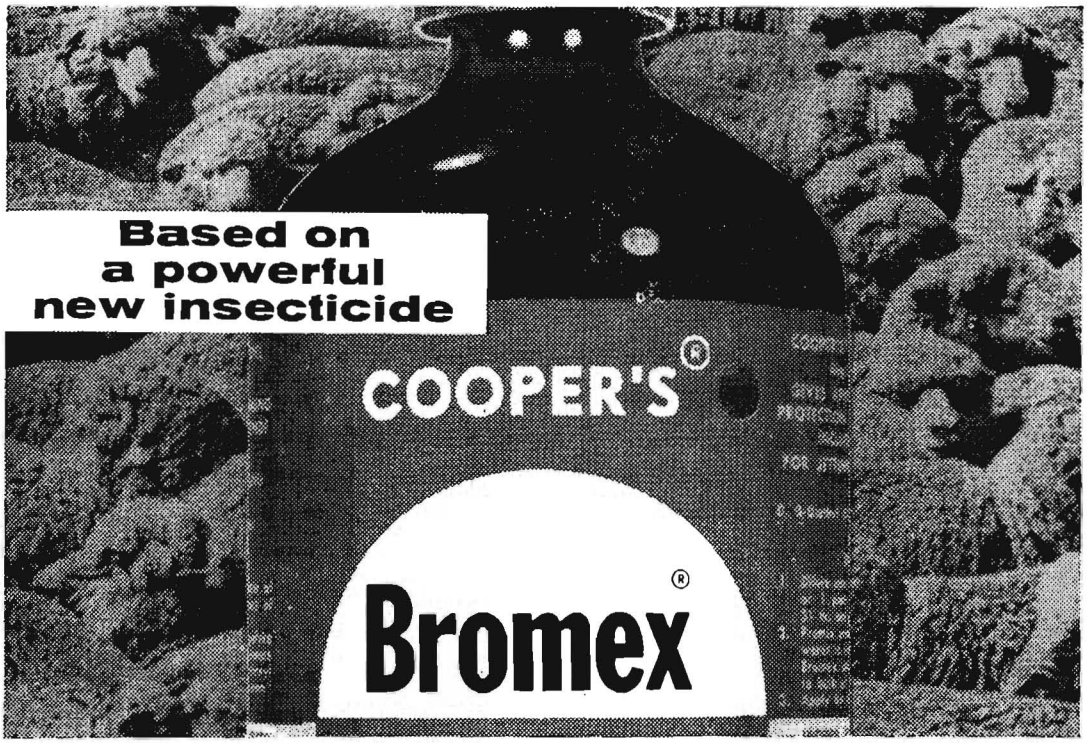

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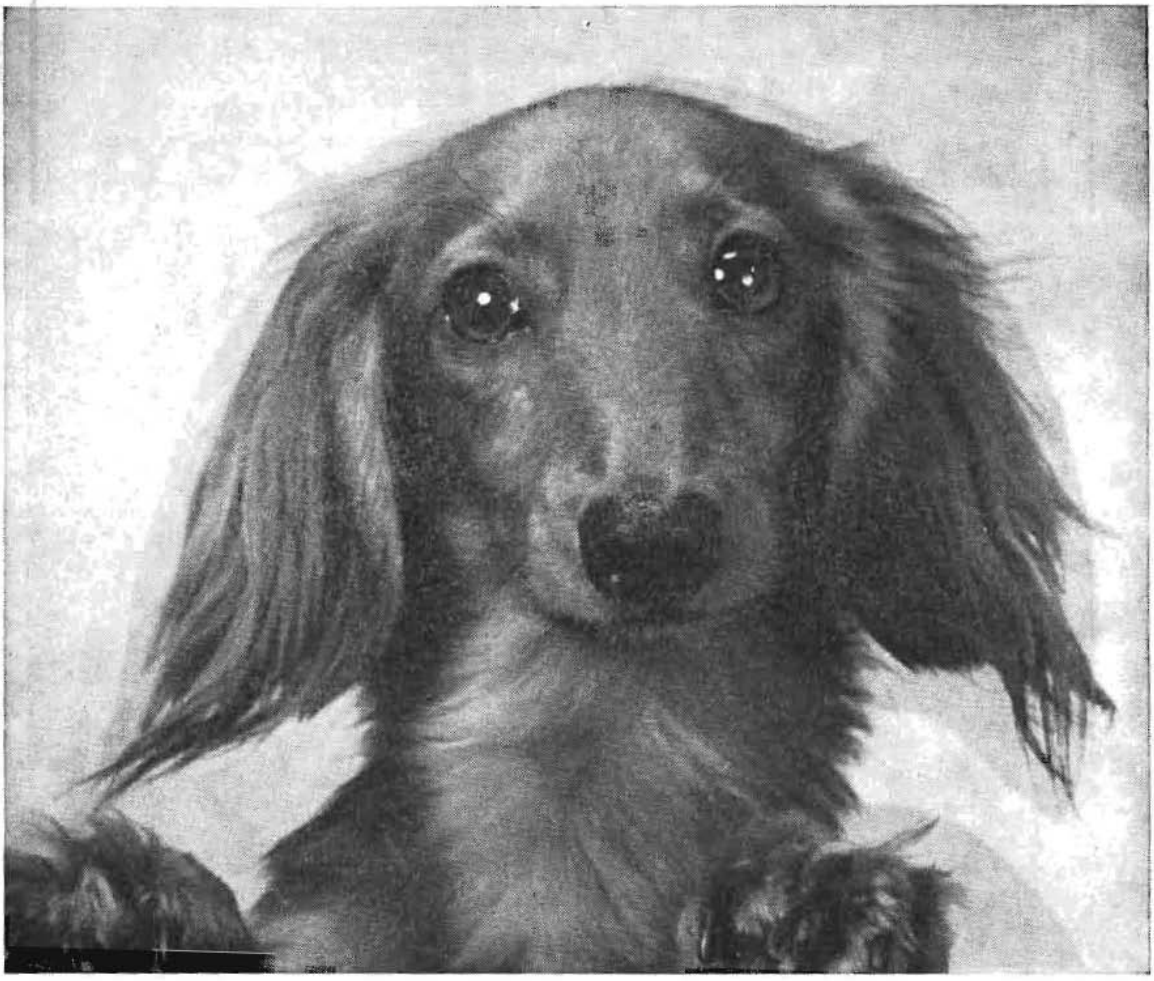

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SWINE DYSENTERY IN SOUTH AFRICA — REPORT OF AN OUTBREAK

R. K. LOVEDAY, Department of Medicine, Faculty of Veterinary Science, Onderstepoort.

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SUMMARY

The epizootiology, symptomatology and bacteriology of a severe outbreak of swine dysentery in a large "deep-litter" type piggery are described. The grave economic effects of the disease are stressed and the results obtained with chemotherapy are discussed.

INTRODUCTION

Swine dysentery, also known as bloody diarrhoea or black scours, was originally reported from Indiana in 1921[1]. Years later, one of the co-discoverers of the disease isolated from the colon of affected pigs, a vibrio capable of producing in experimental pigs, a diarrhoea similar to the naturally-occurring disease, but with less severe effects[2]. In later experiments[3], symptoms of the disease were reproduced in 50 of 60 pigs dosed with vibrio cultures suspended in gastric mucin. The disease is easily transmissable by the feeding of infectious minced colon.

In recent times, outbreaks of dysentery, associated with the isolation of vibrios, have been reported from many countries, including Switzerland[4], Netherlands[5], Australia[6], England[7], Scotland[8], Sweden[9], and Canada[10]. The organism is not, however, believed to be a frequent primary pathogen in the United Kingdom[11].

Divergent views regarding the aetiological significance of vibrio in this disease have been expressed and several investigators[4, 8, 12] have been largely unsuccesful in reproducing the disease by the dosing of pure cultures. The milder and more transient syndrome often produced by cultures[2, 6] has led many workers to doubt the primary role of the abundant vibrios noted in the faeces of affected animals[13]. The vibrio strains isolated by various investigators have generally resembled *Vibrio foetus* in their morphological and cultural characteristics. There appear to be two main strains of vibrio, distinguishable biochemically, viz. those producing H_2S[14, 15] and those not producing H_2S[6, 16].

The purpose of this report is to describe the investigation of an outbreak of an highly infectious dysentery of pigs associated with the isolation of vibrios, and to draw attention to the serious economic implications of this disease for the pig industry in South Africa.

HISTORY

In October, 1961, the manager of a large piggery containing some 200 sows and their followers consulted the writer regarding a persistent, black, sometimes bloodstained, diarrhoea which had appeared in a sty of 12 week old pigs. Growing pigs in this herd were maintained in large groups of up to 40 pigs, under deep-litter conditions, where large amounts of dung were allowed to accumulate before being removed to the lands. Seven clinically affected animals in the original group were destroyed, in an effort to eradicate the disease, but within 3 weeks a further 15 clinical cases of dysentery had appeared in two large adjacent groups of 14 week old pigs. The section of the piggery where the outbreak commenced contained about 350 weaners, all receiving the same home-mixed ration, utilising brown fishmeal as a protein supplement and fortified with "Hygromycin" and synthetic vitamin A.

Within one month of the original 7 cases being observed, a similar black diarrhoea was widespread among the weaners mentioned above, and had also spread to another fattening unit about one mile away. Morbidity was generally

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confined to growing pigs 12 weeks and older, but a few suckling pigs 5 to 6 weeks and older, also became ill with similar symptoms. None of the breeding stock were affected.

The owner had introduced about 100 weaners in poor condition into the herd three months previously. Since the piggery had been operated for many years under the "deep-litter" conditions described above, without the occurrence of an enteric disease resembling swine dysentery, it is presumed that infection was probably introduced by this group of unthrifty, bought-in pigs. Doyle[17] has mentioned the fact that symptoms may not appear in a herd until several weeks or months after the introduction of carrier animals.

An attempt to control the disease by means of medicated feed was made, utilising arsanilic acid and oxytetracline. These measures led to the remission of symptoms amongst treated animals during the period of medication, but symptoms often returned after the drugs were withdrawn. It was found that the drugs used, combined with improved sanitation, did not prevent the appearance of fresh clinical cases among weaner pigs and the dysentery persisted in the piggery for many months. Eventually one section of the piggery was depopulated, carefully disinfected and eventually restocked with breeding stock from another herd. The disease has not to date re-appeared in the new herd.

Symptoms

Diarrhoea, dehydration and failure to thrive, constituted the main symptoms noted. The morbidity rate was estimated at about 80% and some 10% of affected animals died. The diarrhoea varied in colour from muddy grey to black, often contained mucus, and was frequently bloodstained. These symptoms tended to persist for several weeks at a time, but temporary remission of symptoms was common for periods of a week and longer, and confused the assessment of the various treatment methods applied. Affected animals were hollow-flanked after the first few days but rarely ceased to feed, even when passing severly blood stained faeces. There was a large increase in the incidence of tailbiting among affected groups.

Weight gains were radically affected. Affected pigs not only lost considerable weight initially, but thereafter grew very slowly indeed. At seven months of age many of the originally affected animals weighed about 140 pounds and required a further 2 months to reach bacon weight. Four months after the commencement of the outbreak, it was estimated from the farm records that the disease had increased the average market age of baconers by no less than 30 days.

At *post-mortem* examination the carcase showed signs of emaciation and dehydration. Intestinal lesions were always confined to the large intestine. The serosa of the spiralcolon often presented a ground-glass appearance; numerous fibrinous tufts and adhesions often being seen. The intestinal contents were usually fluid and dark-grey in colour, sometimes slightly bloodstained. Large amounts of mucus adhered to the mucosal surface, which was a diffuse, purplish-red colour throughout the caecum, colon and rectum. Occasional small, discrete haemorrhages were noted in the congested mucosa, particularly in the rectum. In the more chronic cases the mucosa of the caecum and colon was thickened and folded, and showed either small, shallow ulcers, or larger patches of epithelial necrosis covered by an easily removed, yellow diptheritic membrane. Many of these chronic cases presented lesions often described as "necrotic enteritis" and formerly attributed only to salmonellosis or niacin deficiency. The associated colic lymph nodes were enlarged and peripherally congested. No other constant or noteworthy changes were seen.

Histologically, the colon presented the lesions of acute, catarrhal enteritis, the goblet cells being distended and easily seen. Many sections also showed the presence of *Balantidium coli* parasites, particularly in the submucosa of areas of epithelial necrosis.

Bacteriology

Smears of faecal mucus were airdried and stained for 30 seconds with carbol-gentian-violet. In acute cases such smears showed large numbers of epithelial and lymphoid cells, often in small clumps. Associated with these cell clumps were numerous vibrionic forms, sometimes in

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dense sheets of organisms, and also often seen intracytoplasmically in the associated cell.

Routine aerobic cultivation of small and large bowel contents on 5% sheepblood agar and MacConkey's plates did not result in the isolation of haemolytic strains of *E. coli* or Salmonella organisms. Utilising the method of Doyle[2], a large number of tryptose blood agar plates were streaked with material from the colonic submucosa and incubated for 48 hours under 15% carbon dioxide at 37°C. All plates were moderately contaminated with large, grey coliform colonies amid which, on some plates, a very few tiny, dewdrop colonies of vibrio, rarely exceeding 0.5 mm in diameter, were discerned with the aid of an handlens. Pure cultures of vibrio were eventually obtained from these primary cultures, utilising blood tryptose agar and 15% carbon dioxide for all subcultures. The organism was found to grow well at 37°C in 15% carbon dioxide on Bacto-thiol semisolid medium (Difco) forming a dense, grey pellicle. Such cultures stored well at refrigerator temperature for up to 6 weeks but cultures grown on tryptose blood agar could be kept for only a few days in the refrigerator. Freeze dried cultures were found to be viable after 2 months storage.

Colonies on solid medium were glistening, a grey colour in reflected light and mucoid in consistence. They tended to elongate along the stroke line; neighbouring colonies often coalescing.

Morphologically, vibrios from agar media cultivation were Gram-negative, slender, spirally curved rods of ½ to 2 turns, "seagull" forms being also relatively common. Organisms from Bacto-thiol cultures tended to be less curly. In older cultures, granular and later coccal forms appeared. The organism was actively motile.

Biochemically, the strain isolated from this outbreak produced abundant catalase but did not produce H_2S, or ferment any of the usual carbohydrates. It was methyl-red negative and did not produce indole.

In summary, the strain of vibrio isolated was micro-aerophilic, grew well on solid media and appeared to resemble the type I of Florent, as described by Deas[8].

Transmission

Two eight-week old littermate pigs from the disease controlled herd of the Veterinary Research Institute were utilised. Fresh diseased colon was minced with scissors and treated with an equal amount of isotonic saline in a Waring Blendor. Pig 2454 was fed 600 ml. of this material and placed in a concrete-floored sty with littermate 2455. Both animals thereafter received the same conventional growth ration. Faecal smears, stained with carbolgentian violet, from both pigs were examined daily. On the 9th day pig 2454 developed a grey, watery scour which persisted for 6 days, usually contained mucus, and was sometimes bloodstained. During this period cells and vibrios were numerous in smears. Thereafter the faeces were semi-soft for the next 10 days, smears containing a reduced number of cells but no vibrios. During the ensuing month this animal showed three short relapses of dysentery, each lasting 2–3 days. Vibrios were generally found in smears during these relapses. A further relapse occurred on the sixth day, after greatly increasing the crude fibre content of the feed.

The control animal (2455) did not develop clinical dysentery during the 6 weeks experimental period, even when fed the high fibre ration mentioned above, and grew more rapidly than the infected pig. Faecal smears from this animal were consistently negative for cells and vibrios.

Neither pig developed a temperature during the test period. After 6 weeks both animals were bled from the anterior vena cava for the collection of convalescent sera and were fattened for slaughter. At *post mortem* examination the colonic mucosa of 2454 was ridged and thickened, with a moderate serositis over the spiral colon. No lesions were found in pig 2455.

Hyperimmune sera in rabbits and agglutinating and complement fixing antigens were prepared according to the methods of Roberts[16] from the isolated strain of vibrio. Two vibrio foetus antigens and a high-titre vibrio foetus antiserum were available for the investigation of cross-reactions.

The *Vibrio coli* hyperimmune rabbit sera gave agglutination titres varying between 1:256 and

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1:1024 and complement fixation titres varying between 1:128 and 1:256 when tested with vibrio coli antigens.

The two pig sera gave the following results with the *Vibrio coli* antigens:

Serum	*Agglutination titre*	*Complement fixation titre*
Pig 2454	1:8–1:16	1:2–1:4
Pig 2455	1:2–1:4	0

The *Vibrio coli* hyperimmune sera and the two convalescent sera gave negative results at all dilutions with both agglutination and C.F. tests when tested against the two *Vibrio foetus* antigens. Similarly, no positive reactions between the *Vibrio coli* antigens and the *Vibrio foetus* hyperimmune serum could be demonstrated.

Discussion

The clinical and pathological features of the disease outlined here closely resemble those described by Doyle[17] for swine dysentery, the lesions being confined to the large bowel and associated lymph nodes. The crowded deep-litter conditions of this piggery constituted the ideal milieu for the spread of an enteric disease and accounted for the severity of the symptoms and high morbidity rate. A 25% mortality rate has been reported for untreated outbreaks[18]. Despite treatment, 10% of affected pigs died in this outbreak, a figure which agrees closely with the mortality rate reported from a Swedish outbreak treated with streptomycin[9]. Most descriptions of dysentery emphasise the serious weight loss occurring in stricken pigs, an observation which could be completely confirmed in this outbreak. This unthriftiness entirely overshadowed all other effects in economic importance.

Treatment with various antibiotics has been described[18], utilising either feed or drinking water additives for mass medication. Organic arsenicals have long been stated to control the effects of dysentery. Arsanilic acid (p- aminophenylarsonic acid) added at the level of 0.025% to the feed was reported to be most effective in reducing the effects of the disease[13]. Acetarsol, at the rate of 8 grains per pig every 10 days, was reported as an effective treatment[6]. More recently, tylosin has been reported to give excellent results in the treatment of dysentery[19] and will probably replace organic arsenicals for this purpose. It is, however, an expensive drug at the present time.

It must be emphasised that, with the location of the inflammatory process in the posterior bowel, it is unlikely that any chemotherapeutic agent will pass unchanged down the digestive tract in sufficient concentration to be completely effective in the terminal gut. All accounts of the chemotherapy of dysentery support this supposition, and there is general agreement that treatment modifies, but does not halt, an outbreak. Doyle himself states "The only sure way to get rid of swine dysentery is to dispose of the entire infected herd and restock from a healthy source"[18]. This dictum proved to be entirely true of the outbreak reported here. It is of interest that the first symptoms may not appear in contact pigs until several weeks or months have elapsed after the introduction of carrier animals into a herd. In this outbreak symptoms appeared two months after the weaners, believed to be the carriers, had been introduced.

Sufficient has been stated here to delineate the characteristic epizootiological and pathological features of this destructive disease and to emphasise the severe economic effects which may be anticipated where dysentery occurs under crowded or otherwise unfavourable environmental conditions. It is sobering to contemplate the fact that, in the present state of our knowledge, chemotherapy will certainly be expensive for the pigkeeper and will serve only to modify, but not to eliminate the disease, from the infected herd. The incidence of swine dysentery is undoubtedly rapidly increasing in the Republic — it would be realistic to introduce some form of control, restricting the movement of pigs other than slaughterstock from known infected premises.

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THE IMMUNIZATION OF COWS AND EWES AGAINST STAPHYLOCOCCAL MASTITIS WITH ADJUVANT CELL TOXOID — A REVIEW.

C. M. CAMERON, Department of Bacteriology, Veterinary Research Institute Onderstepoort.

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SUMMARY

Recent publications on the administration of staphylococcal adjuvant cell toxoid vaccines to dairy cows, sheep and goats are reviewed and discussed. It is concluded that despite their limitations, disadvantages and dangers, these vaccines have definite prophylactic value if they are of high antigenic potency and administered with discretion.

INTRODUCTION

The failure of antibiotic therapy to control staphylococcal infections in man and domestic animals has stimulated renewed investigation into the possibility of producing an effective vaccine.

The antigenic composition of the staphylococci and their extracellular products is extremely complex. As it is a practical impossibility to incorporate all the antigens in one vaccine, investigation has been centered on the identification of the protective antigens. This has proved to be an extremely difficult task; many conflicting results have been obtained by research workers throughout the world. The results which have been reported and the conclusions arrived at have recently been extensively reviewed. (Cameron, 1963)[1].

From this mass of data it would appear that the Smith Surface antigen is the antigen which has the greatest immunogenic properties.[2, 2a, 3, 4, 5, 6, 7, 8, 9, 10, 11]. However, research on this antigen is still in the early stages and vaccines composed of it are not yet available. Of the other antigens, there is general agreement that alpha haemolysin and, in animals, beta haemolysin play an important role in conferring a satisfactory immunity. They are however not the sole factors responsible for protection. The necessity of incorporating somatic antigens in the form of bacterial bodies or extracts in vaccines, is also universally accepted. The sum conclusion of these findings is that at present a polyvalent adjuvant cell toxoid vaccine (A.C.T.) is the type of vaccine which should give the best results, on condition that the components are prepared by techniques that are known to give maximal antigenic properties.

One of the greatest problems of research on staphylococcus is that there are no reliable methods whereby immunity can be determined. Serological tests, although they indicate antibody response, are no criterion for immunity[12, 13, 14, 15, 16]. The only test which may have some value is the phagocytic index, but due to technical inaccuracies this test is also not very reliable[17, 18, 19, 20].

The alternative to serological tests is to rely on animal challenge.[21] This however poses many problems; the main one being that, as can be expected, immunity to staphylococcus is only partial. The result is that in order to obtain statistically significant results, exceptionally large numbers of animals must be used. As a number of strains have to be tested the amount of work entailed, and the cost involved, make the position impossible. This is especially true where dairy cows are immunized and challenged, and regular extensive tests have to be performed on milk specimens. Field trials are less expensive, but also less reliable.

Despite all these difficulties a number of articles have been published which report the effect of immunization of man, rabbits and dairy cows against staphylococcal infections. The object of this paper is to review only those

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publications which are concerned with the immunization of cattle, sheep and goats, against staphylococcal mastitis using A.C.T. vaccine.

Discussion

The French bacteriologists Ramon et al (1951)[22], (1952)[23] and (1953)[24] and Richau et al (1961)[25] were of the first to make a detailed and extensive study of the possibility of immunizing cattle against staphylococcal mastitis. Their work on the preparation of vaccines and the value of adjuvants, is of great significance. They obtained high antitoxin titres and excellent immunity, against challenge with the homologous strain by both parenteral and intramammary administration of A.C.T. Similar results were obtained by their colleagues, Pillet et al (1959a)[26] (who used the vaccine in sheep) and Plommet (1960)[27].

Spencer et al (1956)[28] reported that they were able partially to protect cows against experimental challenge with inactivated and detoxified whole cultures. This type of vaccine seemed to offer more promise than purified toxoids. The antitoxin levels however dropped to ± normal again after two months.

Pearson (1959)[15] prepared vaccine and administered it according to the schedule devised by Ramon et al (1951)[22] and Ramon and Richau (1953)[24]; that is, A.C.T. containing both alpha and beta toxoids with cells prepared from the strain isolated from the herd in which the vaccine is to be tested. Each animal received three to four injections of vaccine at five day intervals, as well as an additional injection every six months. Antitoxin titres of 16 IU/ml for both alpha and beta haemolysin were thus obtained. In this field trial with regular milk examination, an overall protection of ± 6% was noted. Summarizing his results Pearson comes to the following conclusions:

> "There is no constant relationship between blood titre and staphylococcal udder infection, neither does it appear from our results that such titre, stimulated by an udder infection, gives any protection whatsoever against further bacterial invasion of the udder tissue".

In 1959 Slanetz et al[29] published their results obtained with an A.C.T. prepared from whole broth cultures of a selected strain (No. 7). This vaccine, which is now commercially available, was administered to cows and heifers by giving each animal two doses of 10 ml intramuscularly at an interval of four weeks, and a third injection of 10 ml, six months later. Hereby, alpha antitoxin titres varying from 12–96 IU/ml, were obtained. These animals were challenged by intra-mammary injection of virulent organisms, while others were exposed to natural infectiont over an 18-month period. Slanetz (1959)[30] summarizes his results as follows:

> "Based on studies over a 5-year period in two dairy herds, staphylococcal toxoid and bacterin-toxoid were found to stimulate the production of antibodies and increase the resistance of cattle to staphylococcal mastitis. The spread of the infection was almost completely prevented in the immunized cows and there was a marked reduction in the number of acute cases or flare-ups developing in such cows, when studied over periods up to 18 months. Immunization did not result in the cure or elimination of the infection in the majority of quarters with well-established chronic infections.
>
> When challenged with virulent mastitis staphylococci via the teat canal, immunized cows were highly resistant to infection. Only mild reactions of short duration followed challenge of the immunized cows with 1 to 5 billion organisms, while severe, acute reactions developed in the non-immunized cows. This vaccination procedure shows definite promise and may make it possible for dairymen to control not only *S. agalactiae* mastitis, but staphylococcal mastitis as well".

Two aspects relevant to staphylococcal immunity have recently been elucidated. While investigating the optimal conditions for A.C.T. production, Flemming (1960)[31] and (1962)[32], found amongst others that alpha toxoid prepared with beta-propiolactone had a much greater antigenic power than when formalin was used as the detoxifying agent. The contribution by Thörne at al (1963)[33], in proving

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that intramuscular administration of vaccine gave statistically significant higher antitoxin titres compared to subcutaneous administration, also has great value.

Of the contemporary workers on staphylococcal mastitis, the most extensive and detailed investigations have been done by Derbyshire. In 1960a[16] a paper was published in which he attempted to correlate serum antibody titres with actual immunity. The vaccine used was composed of toxin and cells separately prepared and to which 10% (w/v) Aluminium hydroxide gel was added. Goats were immunized by administering 2 ml, 5 ml and 5 ml intramuscularly at 2 day intervals, and a dose of 5 ml was given three weeks later. In cows, the doses used were 5 ml, 10 ml, 10 ml and 10 ml. The response and protective value of the vaccine was assessed by antilysin, precipitin, agglutination, passive mouse protection tests and intra-mammary challenge with 10^9 staphylococci. Titres were highest (alfa = 512 IU/ml, beta = 128 IU/ml, and aggl. 1/14) one week after the second injection and persisted for 14 weeks. A high level of protection was obtained on challenge of the nine immunized goats and cows, when the homologous strain was used. A correlation between antitoxin content of the serum and immunity was demonstrated, but no correlation was found between agglutination or precipitin titres, and it was therefore concluded that the incorporation of bacterial cells into the vaccine was only due to their adjuvant effect.

Derbyshire (1960b)[34] also showed that antitoxin could only be demonstrated in the whey of immunized cows, 6 hours after irritation of the mammary epithelium, with distilled water or by infections.

In an extensive experiment in which all the known staphylococcal antigens and their antibodies were determined, Derbyshire (1961a)[35] showed that the immunity of goats vaccinated with A.C.T. was strain specific. Immunity to mammary challenge by a particular strain was correlated with the power of the serum to protect mice against infection with the same strain. Attempts by Derbyshire (1961b)[36] to immunize goats by intra-mammary administration of living organisms, was disappointing. Antitoxin response was poor and immunity was localized to that half of the udder where the organisms were introduced.

The publication of Derbyshire and Helliwell (1962)[37] compares the value of an adjuvant cell toxoid and a vaccine composed of alpha haemolysin, coagulase and leucocidin. Goats were immunized and challenged and antibodies titrated as in the previous publications. Both vaccines conferred a good immunity to the experimental animals, which could be correlated with the antitoxin titres.

In 1962, Derbyshire[38] published a review of the literature and summarized his own work on staphylococcal mastitis as follows:

> "It seems clear from published reports that alpha antitoxic immunity is at least one important aspect of specific resistance in staphylococcal mastitis. Indeed this form of immunity appears to confer a high level of protection against certain strains of staphylococci. Against other strains, however, immunity to the alpha toxin does not prevent the severe manifestations of the disease; for this type of strain other antigens such as coagulase and leucocidin may also be important. Further investigation of methods of immunization against staphylococci of this type is indicated. This may involve testing further diffusible products or immunizing power and should perhaps include attention to the cellular antigens of the staphylococcus".

Similar studies have been carried out by Blobel and Berman (1962)[39]. They prepared a vaccine which was fortified with coagulase and egg yolk factor and administered it to 18 cows in a dairy herd while 18 others were kept as unvaccinated controls. Each cow received three injections of 6 ml, 10 ml and 10 ml at two-weekly intervals. A further injection was given every 3–6 months. To determine the resistance, two cows in the herd were infected with three different strains and the infection allowed to spread through the herd. Milk and serum specimens of the 36 cows were examined regularly over a period of 20 months for signs of infection and antibody determination, respectively. Antilysin titres rose to an average of 38.2 IU/ml for alpha and 48.4 IU/ml for beta lysin within a week, and declined after 3–4

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months, but rose on booster injections and then took longer to drop after subsequent injections. Anti-coagulase, anti-leucocidin and colony compacting antibodies followed the same pattern, but to a much lower titre. The serum of calves from the cows showed antibodies which persisted for 2–5 weeks. Examination of the milk specimens for the presence of the three infecting strains showed that there was a definite protection against infection with the vaccine strain, but not against the others. The severity of the reactions were however less than in the non-vaccinated cows.

A number of field trials which were not as accurately controlled as those discussed thus far have also been conducted. Philpot (1962)[40] administered repeated doses of a commercial bacterin toxoid to a herd in which staphylococcal mastitis was rife. At the termination of his study, the incidence of mastitis had decreased appreciabily. Similar beneficial effects have also been reported by Thörne and Wallmark (1962)[41] and Wallace (1963)[42]. In a trial comparing toxoid and somatic antigen vaccine, Barnum (1962)[43] obtained better results with the latter.

In contrast to the above promising reports, other authors have published less favourable results. Schulze et al (1963)[44] found a commercial A.C.T. to have no protective value whatsoever when administered to a herd of dairy cows. Poor results were also obtained by Butozan (1963)[45] who conducted a field trial with Ramon type A.C.T. in sheep and goats in Yugoslavia.

Not much attention has been paid to the use of A.C.T. vaccines in sheep. Except for the preliminary reports by Pillet et al (1959 a & b)[26, 46], Plommet (1960)[27] and Cameron (1963b)[47], the only other workers on this aspect are Plommet and Le Gall (1963a)[48]. Groups of ten ewes were given different types of vaccines consisting of mixtures of alpha, beta and gamma toxins, as well as suspensions of heat-killed staphylococcal cells. They were immunized by several successive injections, followed by a booster. Alpha antitoxin titres rose to 24–40 IU/ml, beta antitoxin to 80 IU/ml and an agglutination titre of 1/700 was attained. On challenge with the homologous strain all the ewes became infected. However, the severity of mastitis in those ewes which had received alpha toxoid, was appreciably less than the controls. Cell vaccine gave no protection nor did cells enhance the protective power of the alpha haemolysin when used in conjunction with it.

In a second publication, Plommet and Le Gall (1963b)[49] showed that the administration of vaccine into the udder induces the formation of serum antitoxins and agglutinins which are also to be found in the lactoserum. Vaccination by this method does not protect against infection, but the severity of the disease is decreased.

Two reports on extensive trials investigating the protective value of A.C.T. vaccine have recently been published by Slanetz et al (1963)[50], and Derbyshire and Edwards (1963)[51]. Slanetz immunized four cows with A.C.T. according to the usual procedure and kept four as controls. The average alpha antitoxin titre obtained in the immunized cows was 12 IU/ml. They were all challenged with 3.0 to 3.5 x 10^6 organisms and observed for four weeks. After this time, 14 quarters of the non-vaccinated cows had become infected against only 9 quarters of the immunized cows. In more extensive experiments designed to determine the value of larger doses and booster doses of vaccine, as well as to determine the value of a polyvalent vaccine with betapropiolactone inactivated alpha and beta toxoids, gave similar results. Alpha antitoxin titres up to 48IU/ml were obtained with the B.P.L. toxoids. On challenge with 1,000 to 1,600 organisms of a virulent strain, 46% of the quarters of vaccinated, and 85% of the non-vaccinated cows, became infected. However, it was apparent that vaccination did not produce marked increase in resistance to all the strains of staphylococci tested.

A field trial with 210 cows over a period of five years also showed that the vaccine had protective value. These animals were given two initial doses of vaccine of 5 ml each with an interval of one month and thence 5 or 10 ml at yearly intervals.

A herd of sixty-one cows, in which chronic mastitis had become a problem, was used in the recently reported field trial conducted by Derbyshire and Edwards (1963)[51]. All the cows were given a single dose of A.C.T. vaccine three

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weeks prior to calving, over a period of two years. This gave rise to mean antitoxin levels of 61 IU/ml and 62 IU/ml for the two years respectively. Regular bacteriological examination of composite milk samples, however, revealed that neither the incidence nor the severity of clinical mastitis was less in the vaccinated animals than in the controls. The incidence of staphylococcal udder infection was high throughout the trial, and was not influenced by vaccination. The failure of the vaccine in this trial could be attributed to two causes. Firstly it was found that at least four different phage types were present in the herd and it can safely be concluded that they differed antigenically from the vaccine strain (201 ph.t. 42 D). Secondly it is known that udder irritation is necessary for circulating antibody to pass into the milk.[34] Thus a vaccine could conceivably protect against severe mastitis in which there is tissue damage, whilst failing to influence the incidence of the mild mastitis which was characteristic of this herd.

Conclusions

From the foregoing summary and discussion of current literature, it is clear that staphylococcal adjuvant-cell-toxoid vaccines definitely have marked value as a method for the control of staphylococcal mastitis. Of the twenty one authors quoted who have conducted experiments on the protective value of A.C.T., only four have found this type of vaccine to give poor results[15, 43, 44, 45]. And in one of these instances the reason for this was readily explained.

Despite these most promising results, A.C.T. vaccines have two important limitations. In the first place, large repeated doses are required to induce effective antibody titres, which at best only maintain their effective level for a couple of months.[15, 24, 28, 39, 40, 47, 48]. Unless immunization is very regularly carried out (every 3–6 months after initial multiple doses), no continuous resistance can be obtained. Secondly, it must be very clearly understood that these vaccines are strain specific.[35, 38, 39, 50]. Unless the infectious strain in a herd is antigenically identical or very closely related to the vaccine strain, the administration of A.C.T. will be of no value at all.

There are also grave dangers attached to the indiscriminate use of staphylococcal vaccines. The possibility of both stockmen and veterinarians considering a vaccine against mastitis to be an answer to their problems, is great. This will however, never be the case. The use of these vaccines must not be allowed to replace sound hygienic principles in dairy herds[52]. Vaccination should only be resorted to when other methods of control have failed, and after the etiology of the mastitis outbreak has been bacteriologically diagnosed as *Staphylococcus aureus*. If this is not done, it is certain that more harm than good will follow.

Then there is also the possibility of inducing a carrier state[15, 24, 48, 49, 51, 53]. Evidence indicates that irritation of the udder is a prerequisite for serum antibodies to pass into the milk.[34] It follows, that infection takes place as usual, but that the clinical manifestations and progress of the disease is reduced by antitoxin and other inhibiting antibodies. The result will be that an animal which would normally have shown clinical mastitis and which would have been isolated, is now considered healthy and although it is a carrier of infection, is milked with the others. From a food hygiene and public health point of view the implications of such a state of affairs calls for serious consideration.

Nevertheless, high quality staphylococcal vaccines are of indisputable value to both the stock owner and veterinarian, when confronted with an otherwise uncontrolable outbreak of staphylococcal mastitis; on condition that the limitations and dangers of its use are fully realized and appreciated.

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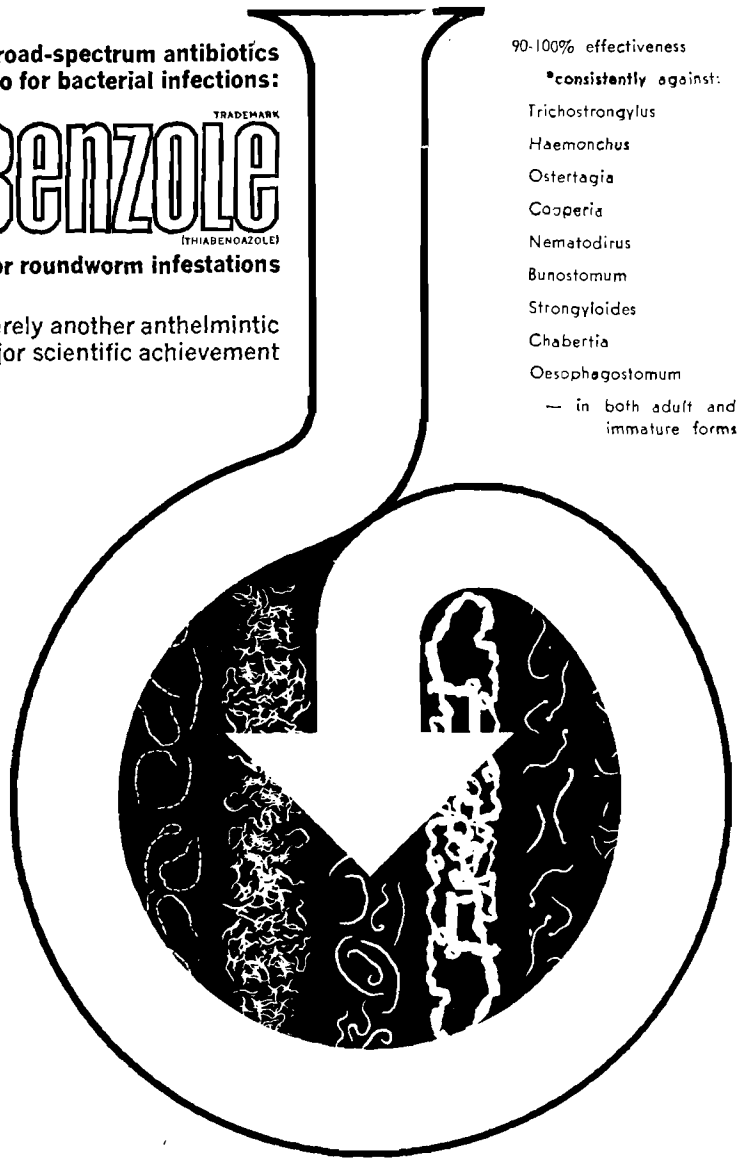

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GENETIC AND NON-GENETIC FACTORS AFFECTING THE PROTEIN CONTENT OF COW'S MILK

D. R. OSTERHOFF — Section Zootechnics Faculty of Veterinary Science, Onderstepoort.

SUMMARY

Evidence has been summarized from published studies which bear on the genetic and non-genetic influences of the protein content and solids-not-fat composition of cow's milk. Reports concerning the influence of stage of lactation and gestation, and age of cow appear to be consistent enough to point out the general nature of these relationships.

The results obtained in regard to bioclimatological effects are not conclusive and European and American results may not be appropriate for South African conditions. Testing under stress conditions should also be investigated.

In regard to nutritional effects it can be said that no feed additives or feeding practices can be recommended that will practically and profitably change milk composition of dairy cows. Research in rumen metabolism must be continued, to understand both the genetic and management aspects of the roughage-converting potential of the dairy cow.

Breeds differ in average milk composition, and between individual cows within the breed there is even greater variation. The correlations between the milk constituents and heritability estimates, indicate that it is theoretically possible to modify the composition of milk in the desired direction, by means of selection.

In recent years nutritionists have specially emphasized the importance of lacto-protein on account of its high biological value. In butter making of course, the importance of milk-fat is paramount; but where milk is used for direct consumption or for cheese-making, it is especially the protein content that is important. A switch over to a new evaluation of milk is difficult, and hampered by complicated tests which have to be rendered into simple mass-analysis tests.

Examination of milk on a large scale would be necessary not only in order to pay for milk by quality, but also create a basis for selection. Cows, sired by artificial insemination, and their daughters, should be the first animals included in such an important and highly recommended program.

INTRODUCTION

The increasing importance of the protein content of milk for human nutrition and the persistent discussions in many countries concerning the inclusion of protein in the evaluation of cow's milk, are the reason for this short review of present-day problems posed by variations in the protein content of milk.

THE POSSIBLE CHANGE TO A NEW BREEDING POLICY

The spotlight was turned to the protein content of cow's milk during the VIIth International Congress of Animal Husbandry, held in Madrid in 1956, where the solids not-fat content of milk was one of the seven subjects dealt with. The recommendations of the Congress "that considering the importance of the question, research on this subject, in its widest sense, should be intensified", reflected the situation in 1956: world-wide, there was and still is, a shortage of food calories as such, and an even greater shortage of high biological-value protein. The ability of the dairy cow as a ruminant to convert low grade roughage and nitrogen sources into high biological–value protein was recognized as one of its most important assets.

Since 1956 a large number of scientific papers on the genetic and environmental variations in milk composition have been published. The World Dairy Congress, held in Copenhagen in

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1962 recommended "that breeding programs should always be set up in such a way that both the protein and fat content of milk are kept at a satisfactory level". The appearance of the two recommendations show clearly the progress which had been made during six years from 1956 to 1962. The writer was able to appreciate this progress when attending the "Third summer course on organization and evaluation of animal production in larger areas" organized by the North Atlantic Treaty Organiszation (NATO) and held during August/September 1962 in Wageningen, Holland. Here, an excellent survey of the present knowledge on determination of milk constituents and on selection for higher percentages of milk constituents in cow's milk, was presented[40].

Great difficulties had to be overcome in finding a suitable method of mass-analysis for protein determination. It is necessary for a cheap and reliable method of analysis to be found which would be economical when used on a wide scale for selection purposes; and of course, the payment of milk on the protein basis cannot be made until such a test is devised. A good review is available which describes and compares the different methods developed for measuring the protein content of milk[2]. Refractometric, spectrophotometric, fluorometric and acidometric methods have been studied as well as formol titration, alkaline steam distillation, and dye-binding methods.

In England a new infra-red-spetroscope method has been developed. The Infrared Milk Analyzer, called IRMA, is reported to be capable of determining fat, protein, lactose and solids-not-fat on a 25ml. sample of milk in less than a minute through the use of infrared radiation[8]. The method is being tested extensively at the present time by the Milk Marketing Board in England.

At the present time the dye-binding methods are the most promising when accuracy, economy, speed, ease of performance and the possibility of adaptation to field use is considered. Although the dye-binding method is used on a large scale in the Netherlands, where protein determinations have been performed on 276,279 cows in 1962 (=32.2 per cent of all cows in milk recording or 21.5 per cent of all cows in milk)[38], American workers believe that additional to the present data considerable work has to be done before a standard dye-binding method can be recommended for widespread use[20].

The dye-binding method is based on the fact that in acid solutions the proteins of milk bind basic dyes to a precipitated protein-dye complex. The quantity of dye bound is proportional to the amount of protein and the amount of dye remaining in solution can be determined in a colorimeter. Belgian results showed that the protein content determined by this method agreed well with the standard Kjeldahl method throughout the whole lactation[40]. The greatest problem still to be overcome is the selection of the best dye; Orange G and Amido Black have been most popular but Acid Orange 12, Brilliant Orange, Cochineal Red A and Yellow 6 have also been used[13]. The hope is that an international standard method can be worked out within the next few months, which will be the basic instrument for a possible payment of milk on the protein basis and changes in future breeding plans and policies.

Non-Genetic factors affecting the protein content of milk

In any study of biological material the influence of genetical and non-genetical factors must be regarded separately. Studies of environmental and non-genetical influences provide data of the causes of variation in the protein content before genetic studies are attempted.

The influence of the lactation stage.

The productive capacity of an individual cow during the entire lactation has to be considered. First of all, it should be mentioned that the protein content remains constant during the milking process and varies less than the fat percentage from one milking to the next. Fig. 1 shows the relationship between milk yield and milk composition in different stages of lactation.

It is apparent from Fig. 1, that advancing lactation has a marked effect on the major constituents of milk, in addition to the well

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known effect on milk yield. The percentage of protein decreases during the two months following calving and then increases gradually. These

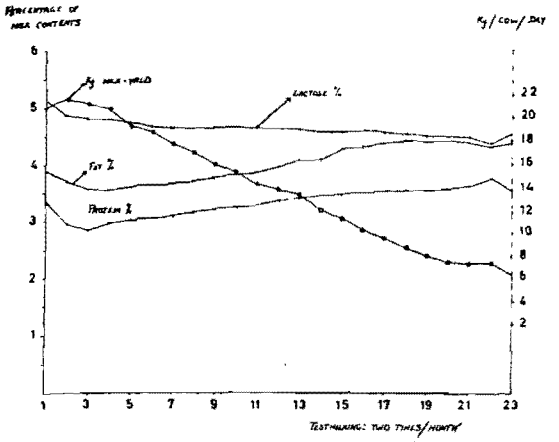

FIG. 1

THE EFFECT OF LACTATION ON YIELD AND MILK COMPOSITION.

(AFTER POLITIEK, 1957)

changes have been studied by many workers in Europe and USA. Fig. 2 gives the variation in protein content during the entire lactation as given by English, French, Belgian and German workers[35,15,40,27].

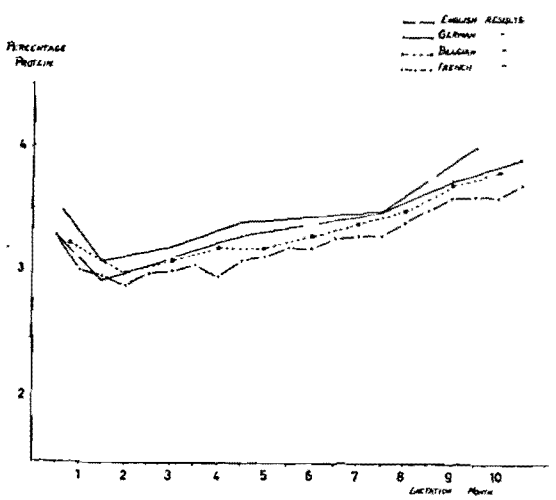

FIG. 2

THE INFLUENCE OF THE LACTATION STAGE ON PROTEIN CONTENT IN COW'S MILK.

The results agree very well, also with recent American results[39]. It is obvious that a definite change occurs in the protein composition of milk.

The influence of age

By means of lactation averages, the influence of age on the protein content can be checked. Here again, several European results consisting of many hundreds of lactations are shown together in Fig. 3.

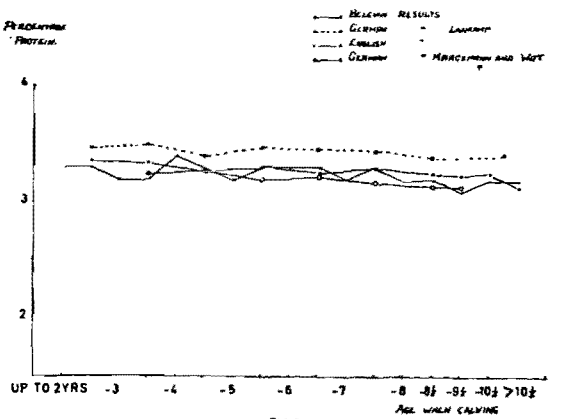

FIG 3

THE AGE OF COWS IN RELATION TO THE PROTEIN CONTENT OF MILK.

It can be seen that the protein content decreases from the age of 4–5 years to the age of 10 and more years. French workers[15], found that the protein content hardly varied in the first three lactations. Dutch results[3], indicated that the protein content of 2 year old heifers was lower than that of older cows, but no difference was observed between the three and the six year old cows. These findings are not in agreement with the values given in Fig. 3. As has often been mentioned where the effect of age on performance is being examined, the normal practice of culling uneconomic cows, and deaths from any cause, make the population of the older age groups highly selected, whereas the earlier groups carry animals which may later be culled. Such culling would be mainly for milk yield. Since there is a small negative correlation between quantity of milk and protein content of milk selection by quantity therefore results in a tendency towards a small

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decrease. According to Waite[42,43] this decrease has a margin of 0.1 per cent per 100 gallons.

Most workers, however, agree that it is not necessary to take the age difference into consideration when production figures are compared.

The influence of gestation

The increase in protein content during the last part of the lactation as shown in Fig. 2 is apparently influenced by the following gestation period. Cows that conceive generally show a steeper rise in solids-not-fat than cows that remain open through their lactation[1,24]. Politiek[34] proved that in long lactations lower protein values were obtained. He suggested the use of production figures of normal lactations (260–360 days) for comparison purposes only. Johnson et al[19] provide additional information and it can be said that an obvious increase in the concentration of protein appears between the 150th and 160th day of gestation, but any correction for the influence of gestation is not necessary if normal lactation periods are used for the comparison of production figures.

Bioclimatological effects

The studies on the influence of lactation stage, age of cows, and influence of gestation, can be regarded as correct and consequently accepted in the Southern hemisphere. On the other hand, the European results regarding the bioclimatological effects cannot be applied in South Africa. Although no direct comparison is possible with South African conditions, it is very interesting to see the great influence of climatological factors, mainly seasonal changes. Fig. 4 gives some of the seasonal variations obtained in European studies.

Season and area differences in composition of milk are due to a combination of factors including breed differences, lactation stage, climate and feeding practices. In well managed herds, those which are usually used in milk composition studies, a certain periodicity is practiced in management, with the result that most calves arrive in the period December—February. Thus, proportionally more cows start and complete the lactation at the same time, which in itself will inevitably have its repercussions on the composition of milk. The most important

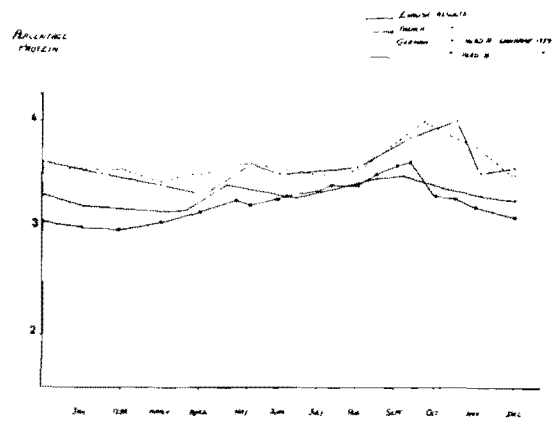

FIG 4

THE EFFECT OF SEASON ON PROTEIN CONTENT IN COW'S MILK

seasonal factor is the relatively abrupt change of diet and mode of living which occurs when the cows go out to grass in the spring and when they return to the byre for the winter.

The rise in milk protein concentration during May-June seen in Fig. 4 is most likely the result of a temporary change to a higher plane of nutrition. The increase in protein content from August to October, when the cows are still grazing, but also most probably receiving some stall feeding, might be ascribed to the same cause, but the stage of gestation definitely also shows its effect on milk composition. Other results do not show the marked increase of the protein content during the spring grass feeding period[39,12,40].

Johnson and Givens[19] studied the effects of ten climatic measurements, including several temperature variables, humidity, and wind speed on milk yield and composition. Increases in the temperature variables depressed milk secretion, and had much more effect on milk volume than they had on milk composition. Wayman[44] also studied the effect of temperature stress and found that cows subjected to a continuous temperature of 88°F and a 50 per cent relative humidity decreased in milk yield but showed little change in milk fat or solids-not-fat content. This is in contrast to earlier American, findings which indicated that most constituents were lowest in May through July and highest in November through January[24].

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A study of the bioclimatological effect on the protein content of milk under South African conditions would be an appealing task for the dairy scientist: the influence on environmental and body temperature, water intake, nutritional shortages, humidity, radiation, agricultural regions etc. being particularly investigated.

Fig. 4 also indicates the influence of the agricultural region. Herd A is on sandy soil and herd B on humus/clay soil and some differences in the protein content of milk between the two herds could be indicated.

The influence of the calving month on lactation average

As each lactation stretches over the greater part of the year it can be expected that only small differences, if any, should be found if the calving month is to be considered in relation to the lactation average. The results obtained by different workers are not in agreement as shown by the following figures:

Month of calving	Protein percentage on lactation average		
	Belgian results	German results*	
Sept.—Nov.	3.24	3.20	—
Dec.—Febr.	3.24	3.14	3.44
March—Aug.	3.27	3.07	3.36

* Sernylan—Parke Davis

English results indicated a 0.08 per cent higher protein content for cows calving in May than for cows calving in December—the opposite to the above figures[42].

It will always be a difficult task to separate the influence of the calving month from the effect of season and nutrition.

Nutritional effects

During recent years a great deal has been added to our knowledge of the effects of feeding on milk composition of dairy cows. The progress in rumen metabolism and milk secretion research, could give the explanation of the effects of grinding roughage, of feeding oils and fats, and of other alterations of kind and amount of feeds on milk composition. Two recent reviews cover rumen metabolism with reference to milk composition[26,41].

Feeding has a profound effect on milk composition, but to date no profitable means of changing milk composition has been found. When the energy content of the ration increases, the protein content also shows an increase which may amount to several tenths of a per cent. Feeding a little above or below protein requirement standard has a small influence on the protein content. Feeding high quantities of protein, by which the starch value/digestible protein becomes 2 or 3, the protein content may be raised by 0.3 per cent. This narrow ration is however uneconomical and therefore of little practical application[3,4].

In general it can be said that a shortage of energy has a far greater influence on the protein content than that of protein shortage in nutrition. Under normal conditions one may come to the conclusion that the influence of feeding on average protein content is less important than on average fat percentage.

A great number of feeding experiments demonstrated the influence of various feedstuffs on protein content, and some dairy production research workers believe that, through feeding a lower fat product a higher protein product could be produced and results realized, in a relatively short period of time. At this stage, however, no drastic changes in feeding procedures are expected mainly for economical reasons.

Further research work will be necessary, also into the normal rationing system used today. A rationing system based on a constant addition of food for each gallon of milk may be incorrect, and if so, the high yielding cow will suffer most with consequent damage to the milk composition. Through proper nutritional understanding, adjustments can be made to allocate the dietary intake of well balanced materials, including the compensation for possible deficiencies in minerals and trace elements.

Disease effects

Disease, or environmental temperature and humidity conditions that cause a rise above the normal body temperature of the lactating cow,

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affect milk yield and composition[35]. The reported effects of mastitis to date are discussed by Rook in his review[37]. A decline in solids-not-fat, fat percentage and protein and lactose content from 10 to 12 per cent during mastitis infection has been reported[30]. The greatest problem which still remains is the possibility of subclinical mastitis or other inflammation of the udder capable of lowering the protein content.

It could be shown that subclinical streptococcus and haemolytic staphylococcus infection, which may persist at a low level for months, have a significant effect on protein content. The milk from infected quarters was 0.5 per cent below the protein content of the uninfected quarters[43].

Successful treatment of the bacteria with penicillin may or may not restore the level of protein, depending to some extent on the stage of lactation of the cow and the severity of the attack.

The problem of mastitis has by no means been solved by the use of antibiotics. This in turn means that the composition of much milk will continue to be affected.

Genetic aspects of the protein content of milk

The evidence for genetic variation in the composition of milk may be divided into three sources: Breed differences, sire differences and individual differences.

Breed differences

The fact that characteristic differences exist in milk composition between the dairy breeds is well known. Recently, new data have been added by Gaunt et al[7] and Nielsen[29].

In general it can be said that the breeds with the higher milk fat test are also higher in protein. Already this interbreed variation indicates that the composition of the milk is genetically determined. In Table 1 the most important substances of milk are shown together with the relation of these substances to each other.

The evidence from breed data certainly is indicative of a genetic difference in composition of the milk of dairy cattle. However the interbreed differences can only occasionally be used in order to change the quality of the milk. Therefore the main interest has to be concentrated upon within breed selection. The different averages given for Jersey in Table 1 indicate the possibility for this selection.

Sire differences

Variation among sires in the protein content of their daughters' milk has been reported by several workers. However, it must be mentioned that the interpretation of such data has to be made with caution when the data extend over a long period of time, where all the non-genetic factors mentioned in the last chapter may be responsible for a sizable portion of the sire differences. This difficulty can be overcome almost entirely if the daughters of sires are tested in special progeny test stations or when data of

Table 1. Composition of milk in some dairy breeds.

Breed	Fer cent of			Protein per unit of fat	Lactose per unit of fat	Authors
	Fat	Protein	Lactose			
Ayrshire	4.00	3.53	4.67	0.88	1.17	ESPE[5]
Brown Swiss	4.01	3.61	5.04	0.90	1.26	,,
Guernsey	4.95	3.91	4.93	0.79	1.00	,,
Holstein	3.40	3.32	4.87	0.98	1.43	,,
Jersey	5.37	3.92	4.93	0.73	0.92	,,
Swedish Red and White	3.94	3.92	5.22	0.84	1.32	HANSON[9]
German Lowland breeds	3.20	3.10	4.60	0.97	1.44	LEYDOLPH[25]
German Highland breeds	3.64	3.45	4.96	0.95	1.36	,,
Red Danish	4.64	3.88	—	0.84	—	JAKOBSEN[14]
Black Danish	4.47	3.75	—	0.84	—	,,
Jersey (Dan.)	6.40	4.36	—	0.68	—	,,

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large comparable daughter groups from sires used in A.I. centres are compared. An example of sire differences are given from the German progeny test station Loga[10,11]:

Sire	*No. of daughters*	*Protein content*	*(and its variation)*
"Harald"	15	3.40	(3.02–3.57)
"Jäger"	16	3.22	(2.96–3.28)

This comparison gives a good indication of the possibilities for selection on the basis of protein content of milk.

Individual differences

The evidence for heritable differences in protein content between individual cows and the great potentialities for selection can be clearly demonstrated if cows with extreme differences are taken as examples.

The extreme variation of all three constituents of milk shown in Table 2 gives an indication that the protein content might be controlled by many genes and that different sets of genes may be responsible for the three constituents. This question is of great importance because it would then be possible by means of selection to raise the percentage of protein in milk without simultaneously increasing the fat content.

Genetic correlations and heritability estimations

Studies of the genetic correlations between the most important milk constituents will provide the answer to the possibility of selection for high protein milk. In general, the genetic correlation is useful in that it shows the association between two characters on which the same genes have effect.

Values for the phenotypic correlations between milk constituents, which form the basis for the genetic correlations mentioned are given by different workers[24,16,17,20,37]. The most interesting correlation is the one between protein content and fat percentage and was given as high as 0.7–0.9 in data which were mainly derived from monozygous twins. Recent publications based on field data, however, indicate that this correlation is not as strong. Figures between 0.4 and 0.5 are given and the opinions are expressed that a selection for high protein milk with an intermediate fat percentage would be successful.

To illustrate these relations an example is given in Fig 5 from a Belgian publication[40].

Fig. 5 illustrates an investigation of 1,085 milk samples from as many cows, which were classified according to the lactation stage. Cows with high fat percentages and cows with low fat percentages were grouped together and it can be seen that in the former group the fat content was on an average 0.824 per cent higher, but the protein content only 0.173 per cent.

These figures and results obtained by other workers led to the conclusion that the fat percentage and protein content independently vary to a large extent. Kiermeier et al[21], were able to show that the ratio between fat and protein content of milk varies according to season. They observed a weaker correlation in

TABLE 2. COMPOSITION OF MILK OF INDIVIDUAL COWS.

Cow	Breed	Per cent of			Author
		Fat	Protein	Lactose	
No. 110	Friesian	3.80	2.59	—	KRIZENECKY[22]
No. 98	,,	4.10	3.77	—	,,
No. 46	,,	3.30	3.38	—	,,
A.	B. Swiss	3.20	3.95	—	MUSGRAVE[28]
B.	,,	4.20	3.10	—	,,
No. 1	Friesian	3.78	2.82	—	COMBERG (Cit.[10])
No. 2	,,	2.92	3.86	—	,,
Twin pair 1	Swedish Red and White	4.66	4.01	4.45	WINZENRIED[45]
Twin pair 2	,,	4.18	2.99	4.47	,,
Twin pair 3	,,	4.02	3.48	5.16	,,

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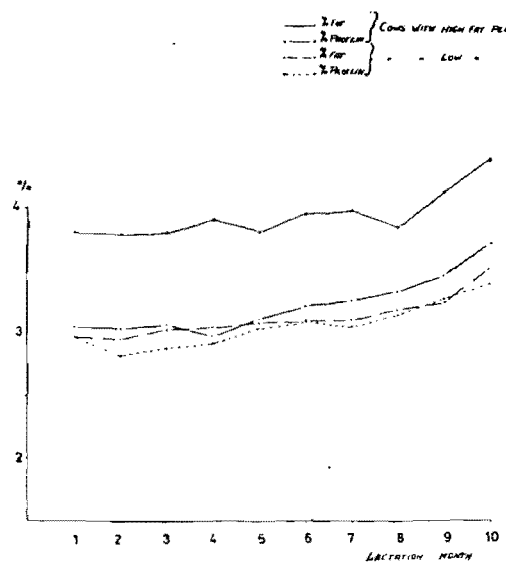

FIG. 5

THE CHANGES IN MILK PROTEIN OF COWS WITH HIGH AND LOW FAT PERCENTAGES.

summer. Corresponding results have been obtained in different countries and it is accepted that 60–70 per cent of the variation is independent and 30–40 per cent of the variation in protein content depends on the variation of the fat percentage[16,34,23].

Only two papers regarding the genetic correlations between fat percentage and protein content have been published and the values of 0.48 and 0.40 respectively are given[36,31]. There is no doubt that further estimates of genetic and environmental parameters are needed to elucidate these important relationships.

The available heritability estimates vary quite widely, depending on the material and methods used. There are many ways to estimate heritability, but the dam-daughter correlation gives the best information. When we have a series of dam-daughter pairs, we can look upon the daughter's performance as an indicator of her dam's breeding value. In Table 3 the heritability figures from four different studies are given for the important components of milk.

These figures show that the heritability estimates cannot be compared directly. Recent American estimations[2] lead to the opinion that the heritabilities of milk fat, protein solids-not-fat and lactose percentages all appear to be of the order of 0.50[39]. This means that these characteristics should respond to selection, and about half the superiority of selected parents should be realised in the records of their progeny.

In addition to the quantitative inheritance of the major milk components, research work has been implemented on milk protein fractions which are under simple Mendelian genetic control[33,6,20]. Thus far, lactoglobulin and casein fractions have been identified by paper and starch gel electrophoresis. The beta-globulin fraction of milk correspond to the transferrin types in the serum of the same cow in regard to the number and migration rate of the protein zones in starch gel. Transferrin types of South African cattle breeds have been studied extensively[32], and similar studies on milk protein fractions are initiated. Continued research in this field will add valuable fundamental genetic information about milk composition and secretion.

The possibilities of selection

Within the past 8 years preliminary estimates of genetic parameters have suggested that selection for protein content should be effective.

TABLE 3. HERITABILITY ESTIMATES (DAM-DAUGHTER DATA).

Author	Component of milk.				No. of dam-daughters pairs
	Protein	Fat	S.N.F.	Lactose	
ROBERTSON[36]	0.48	0.32	0.53	0.36	500
POLITIEK[34]	0.75	0.70	0.70	0.70	217
LANKAMP[23]	0.76	0.72	0.83	—	79
VANSCHOUBROEK[40]	0.74	0.59	—	0.89	180

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Johansson [17,18] could prove that the increase of fat content by 1 per cent was accompanied by an increase of the protein content by only 0.28 per cent. The corresponding increase obtained from Fig. 5 is 0.21 per cent. The results indicate that an increase in protein content cannot be obtained through a selection based on the determination of fat percentage.

Sijbrandij[38] obtained a variation between 2.20 and 4.80 per cent in protein content in a material of 23,000 cows which had an average of 4 per cent fat in their milk and he concluded that the fat content cannot be used as the only base of measuring protein content. The great variation between individual cows indicate the possibilities for selection.

On account of the partial independence of the fat content it seems possible to raise the percentage of milk by means of selection without currently increasing the fat content. The change in milk composition will be slow and marketing problems have to be considered in the definition for optimum milk composition in terms of food production and profit for the milk producer. It would seem appropriate, in this age of advanced technology, to develop a mass analysis test for all components of milk for the sole purpose of producing a richer natural milk.

A mass analysis will be of value to the breeder only when the payment is based on all components and not on butterfat content alone. The Milk Marketing Board in England recently made the following recommendations for payment on quality basis:

Six hundred thousand cows (about 20 per cent of all cows in milk recording) were tested in 1962 in England and Wales for solids-not-fat. The European Committee for milk recording recently recommended the protein determination in milk for all European countries[38].

When definite goals become more clearly established and more research data become available from large scale testing, breeding, plans for certain breeds and also herds, can be outlined. The first task of a protein-testing-program, which seems to be very important is to prove sires for artificial insemination use.

Category	Total solids	Solids-not-fat	Price
A.....	12.6% and higher	Not under 8.4%	Standard + 2d
B.....	12.0 — 12.59%	At least 8.4%	Standard —
C^1.....	11.8 — 11.99%	Disregarded	Standard — 2d
C^2.....	Less than 11.8%	Disregarded	Standard — 3d

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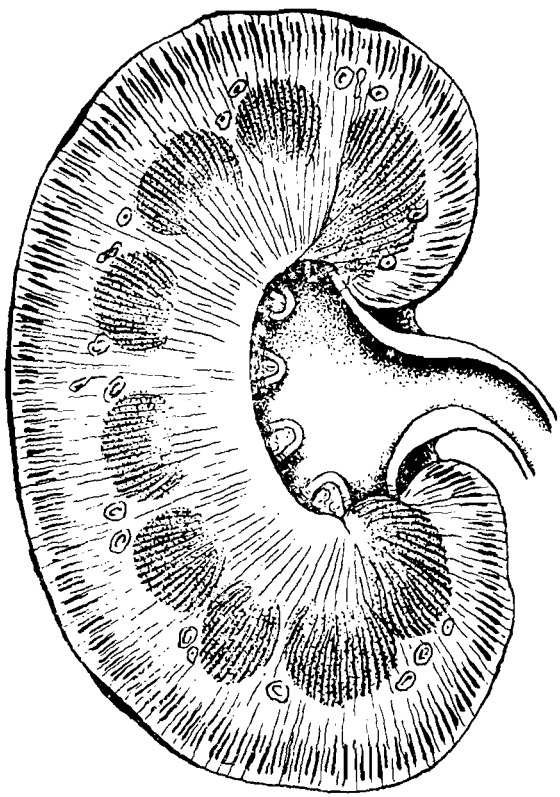

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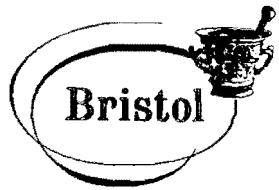

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SOME PROBLEMS OF AN EXPORT SLAUGHTER HOUSE

L. P. COLLY -- Department of Veterinary Services, Lobatsi, Bechuanaland.

A Paper delivered at the Meeting of the Public Health Group during the 58th Annual Congress 1963.

INTRODUCTION

In this paper an attempt is made to discuss firstly, conditions peculiar to the Lobatsi Abattoir, and then more general aspects which relate to meat hygiene in Southern Africa.

ORGANIZATION AND SET-UP

It is necessary to outline the set-up at Lobatsi because it is completely different from those obtaining in the Republic and very similar to the set-up at the Cold Storage Commission's abattoir in the Rhodesias.

In Bechuanaland we have only the one major abattoir, apart from village abattoirs, and this plant handles 90 per cent of slaughter-stock produced in the territory. The small balance is derived mainly from Ngamiland and crosses the Zambezi river to Northern Rhodesia for slaughter.

Our complete kill is for export with approximately 50 per cent to the Republic of South Africa, 5 per cent to the Congo through Katanga and the balance of 45 per cent to the United Kingdom.

The Bechuanaland Protectorate Abattoirs Limited has, as major shareholder, the Commonwealth Development Corporation with the Government and a Producers Trust each having a quarter interest.

The role of the Veterinary Department originated solely as a Meat Inspection and Grading service but, especially since the development of overseas markets, we have become more and more intimately associated with all aspects of slaughtering and processing, because every item leaving the plant must be covered by a veterinary certificate. Thus we have to follow every stage, sometimes rejecting products long after actual primary inspection. Furthermore, attached to the abattoir and run by an ancillary company, is a deboning and canning factory which also falls entirely under our supervision.

Our biggest difficulty in this aspect is that we have little direct authority apart from the standard meat inspection laws; consequently any demand for improvement has to rely largely on persuasion, with threats of withdrawal of certificates if one gets no response. This latter course is a step not lightly to be taken unless one is in a very strong position—especially as many aspects requiring improvement include those small but so important points that people outside the Veterinary Public Health sphere do not always feel, really justify such attention. It is significant that we have made our greatest strides in hygiene when we have run into trouble with our various markets, and have had thereby a very powerful weapon.

SAI MONELLOSIS

This is by far the most worrying condition, being always a hidden danger and a very important entity for which the United Kingdom and other European countries are particularly on the lookout.

Initially, we experienced some difficulty with contamination in boneless beef and offal shipped to Britain, and the various cuts incriminated showed a predominance of forequarter contamination, with isolated hindquarter cuts.

We found that by paying particular attention to the following aspects and generally keeping a tight rein on hygiene, the contamination has disappeared and subsequently our laboratory

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has only picked it up when the abattoir slackens its general standards:—

(1) Washing down feet, legs and belly immediately after stunning to remove gross dirt.

(2) Insistence that slaughtermen rinse hands after cutting off legs and before ripping.

(3) Very important is it to completely protect the lower shoulder and skin while backing off takes place.

(4) Protection of shins during evisceration by use of sidehooks.

(5) Correct handling of offal with avoidance, in tongues, of exposure of tongue meat until the head is thoroughly cleaned.

(6) Introduction of a high pressure spray at 350 lbs/sq. in. pressure or alternatively but less desirable a sterile cloth for each carcase.

Referring to point (1)—there is no doubt that the ideal is a sprayrace immediately before slaughter. Water should be changed frequently to avoid any buildup of bacterial load through recirculation.

There is no doubt that salmonellosis is the biggest threat to one's export market and by its nature requires perpetual vigilance; in particular to basic hygiene practices. When one is unfortunate and gets a consignment detained, the United Kingdom authorities keep a tight control for many months on sampling, distribution and sales.

One tip received, indirectly, from Australia and which is of great value is—that whenever any meat is seized the veterinary authorities of the exporting country must insist that an adequate sample of the offending consignment is returned for them to carry out their own tests: For example, one consignment of Lobatsi livers was stated as being grossly (up to 10 per cent) infected with fluke, hydatid cysts and bacillary necrosis. It is our experience that hydatids in the bovine liver do not exceed 1 per cent and bacillary necrosis is even more rare; nor have we ever received a consignment of cattle that have anywhere near shown such a high rate of liver fluke; which in this country is limited to a well-defined area from which not many slaughter stock are derived. Thus samples of the offending consignment could have either enabled us to be satisfied as to the contamination or enabled us to refute the allegation.

Oedema

This is a term perhaps coined by ourselves and refers, not to a pathological condition, but to a physiological one, which is primarily the result of fatigue in fairly lean, even at times fat, well-fleshed carcases, coupled with inadequate rest. It appears more frequently in cattle trekking long distances. Our longest trek is from Ghanzi, nearly 500 miles taking three weeks. Distances of 150/200 miles are not uncommon; often with a further 250 miles by train.

This condition is not as gross as bull oedema and does not show the classical oedema between the dorsal spines; often not around the kidneys. The gelatinous fat shows especially in the prefemoral region of the flank and the axilla. By incisions an endeavour is made to assess whether the fat will set or not; the more seen of this condition, the more difficult it is to set a consistent standard.

Where this meat is for local consumption one could quite safely be more lenient, but we burnt our fingers during deboning of a particular batch of which we had already condemned 50 per cent.

Although after chilling, these carcases appeared to have superficially set, it was found that on deboning the intermuscular septae were slimy and gelatinous. When frozen and then thawed the meat presented an unpleasant appearance, with excessive drip. Arrangements were made for one of these carcases to be processed as corned beef and it was found that the loss in weight during pre-cooking rose from a normal of about 35 per cent to as high as 46 per cent. The bully beef produced was perfectly satisfactory except for its pale colour. If worked in with normal beef it would have been unnoticeable. During the past three years we have condemned 833 carcases for this condition, and subject to further research and the finding of a suitable price structure. I feel we have every justification for attempting to save this meat for producer benefit, without sacrificing any of our standards as food hygienists.

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Subcutaneous Granulosis

For quite a number of years we have had a condition known as subcutaneous granulosis. This has been treated empirically on its merits of saleability, because of its apparent chronicity. Only recently was it discovered that this was in fact besnoitiosis (globidiosis). One is now very unsure as to how an export abattoir should treat this condition. In the vast majority of cases there are no skin lesions thus indicating a longstanding condition. This is not, we are assured, transmissable to man but what is our position if diagnosed for example during re-inspection in Britain? Is there any possible danger of mechanical transmission to animals in the United Kingdom? Are we laying ourselves open to criticism for passing this condition?

One's natural reaction is to condemn out of hand to be safe, but that would not be a correct interpretation; thus here is an urgent need for recommendations on the meat inspection aspects, with reference to judgment.

Blood-splashing

During deboning of carcases and even at final examination, we have had a lot of difficulty with blood spashing especially in prime cattle.

This occurs primarily in the longissimus dorsi muscle and even throughout the whole forequarter. This occurred through circumstances, due to the construction of the abattoir, whereby bleeding occurs on the first floor with a time lapse after stunning of ¾–2 minutes. This is essentially a problem of deboning as it is normally only seen as the carcase is processed. Such meat is unfit for export on the basis of marketing; in respect of corned beef the bloodsplashing shows as dark red-brown patches.

A temporary solution has been the use of pithing canes but the ideal is *immediate* sticking. An indication of the extent of the problem is the rejection during 1963 of some 1,366 lbs off a high-grade cut.

Bone Taint and Souring

These are problems more especially of hot weather and are often coupled with inadquate rest of animals. Knowledge of cold-rooms and local conditions assists one greatly in knowing when to anticipate trouble.

With deboning one has to be careful in judgment, bearing in mind that freezing stops the condition, but there is the timelag between deboning, freezing and then thawing at the consuming end. True taint is not often found but souring at the aitchbone is not uncommon. This latter can be remedied by sampling a generous slice of meat at the "split".

Canning

In the cannery the Veterinary Department has had to undertake the duties performed in the Republic of South Africa, by the South African Bureau of Standards and their coqperation has been of the greatest value to us.

The cannery inspection and deboning necessitates an inspector on full time duty and although much is dull routine, it is essential to be continually on the alert throughout the whole plant to ensure the highest standards at all time, and to anticipate the beginnings of trouble— so to avoid any check to the export markets.

Revision of Meat Inspection Laws

Many of our problems especially concerning salmonella can only be avoided by the constant application of the highest standards of hygiene and slaughter technique. The time has now come in Southern African where far greater use must be made, not only of veterinarians but particularly of food hygienists in public health. They must be given more direct powers.

It is therefore very important to implement proposals in regard to revision of our meat inspection laws. Dr. H. Thornton is strongly of the opinion that Southern African countries should get together and unify and revise its several laws, to present a strong and uniform front to their many importing countries. In Bechuanaland this is strongly supported.

A particular illustration is that of measles: In Lobatsi there is now a very serious storage problem in regard to detained measles as our daily kill has gone up from 350 to 630 with very little increase in cold-room facilities. Our incidence is 4–5 per cent and thus there is great difficulty in the flush season.

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As far back as 1961 the Federal German Authorities reduced their requirements to 6 days at —10°C (14°F) with an indication of shorter times at lower temperatures e.g. 3 days at —18°C (0°F) which is quite feasible in Lobatsi and even in many other existing plants.

Another aspect is the additional measle cuts; into fillet, brisket and chuck in particular. In Lobatsi these are of negligible importance in regard to *final* judgment in the bovine. Here is another big field for revision. In Lobatsi a survey of over 500 measly carcases revealed the following information:—

(*a*) In only 3 out of 117 condemned was it necessary to go beyond head, shoulder and heart inspection and in only 12 out of 383 detained carcases would one have needed only *one* more cyst to effect condemnation.

Is not the time then ripe to investigate, discuss and take action on these points?

Lastly but by no means least may it be emphasized that there can only be one standard of meat hygiene, and that is the highest.

ACKNOWLEDGEMENTS

I wish to thank the Director of Veterinary Services, BECHUANALAND for permission to publish this article.

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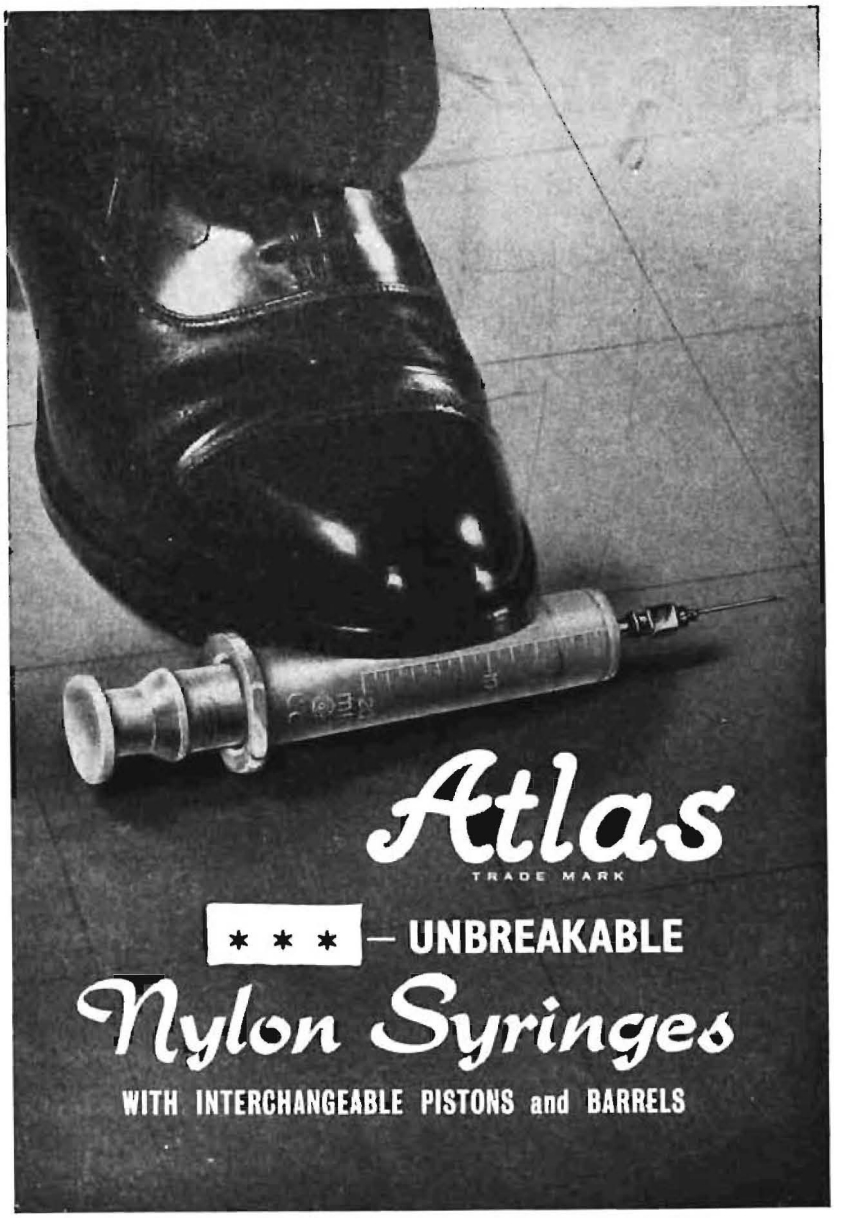

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Experimental Animals

Seventy-five weaners born 15 May to 15 June, 1961, were divided according to weight and type into three comparable groups of 25 each on 20 November 1961. Each group contained 18 German Merinos and seven Dormers (recognised breed originating from Dorset Horn x German Merino). Sex distribution was as follows:

Group 1: Thirteen ewes and twelve wethers.

Group 2: Ten ewes and fifteen wethers.

Group 3: Eighteen ewes and seven wethers.

All three groups ran together for the duration of the trial and were treated as follows:

Group 1

Treated on 1 December, 1961, with 22 grams of a commercial preparation of phenothiazine (97.5%) purity, 52% particles of not less than 5μ and 84% not less than 15μ (as determined by the Andreasen pipette method).

This group had access to a mineral lick containing 10% by weight of phenothiazine (as above) at night (5 p.m. to 7 a.m.)

Group 2

Treated on 1 December, 1962, with 2 grams thiabendazole (a 68% water dispersible powder was used) and had similar access to a mineral lick containing 1.25% thiabendazole.

Group 3

This group was treated with 2 grams thiabendazole at approximately six weekly intervals on 1.12.1961, 15.1.62, 1.3.62, 14.4.62, 2.6.62, 14.7.62, 5.9.62, and 13.10.62. This group received a non-medicated mineral lick at night.

All three groups were weighed at monthly intervals and one animal from each group was slaughtered on 1 March, 1962, and on 1.6.62, 3.9.62 and 10.12.62.

Composition of mineral lick

(*a*) *Basic lick*

40 lb. salt
40 lb. bone meal
10 lb. agricultural lime
5 lb. sulphur (flower)
4 oz. magnesium sulphate
1 oz. cobalt chloride
2 oz. manganese sulphate
8 oz. copper sulphate
10 lb. molasses

(*b*) *Phenothiazine lick*

Eleven pounds of phenothiazine was added to 100 lb. of the basic lick.

(*c*) *Thiabendazole lick*

Ten pounds of a mixture of 1.375 lb. thiabendazole and 8.625 lb. tribasic calcium phosphate was added to 100 lb. of the basic lick, thus providing a lick containing 1.25% thiabendazole.

The total amount of lick consumed was established and the average daily intake per animal estimated.

Grazing

All three groups grazed together during the day but were divided at night. Grazing consisted of cocksfoot grass, clover, oat stubbles, lucerne, kikuyu grass, babala grass, serradella, turnips, oats, vetches and lupins. Grazing camps were frequently rotated.

Exposure to other animals

From February 2, 1962, the three groups grazed together with other sheep and cattle which received anthelmintic treatment with various drugs at various times.

Other treatment

All experimental animals were treated with hexachlorophene for liver fluke in January, March, June, August and September, 1962.

Sheep were inoculated against blue tongue, enterotoxaemia and black quarter in October, 1961 and 1962.

Post mortem examination

The *post mortem* examination followed the technique described by Reinecke *et al*[8] with the following modifications: the duodenum was not separated from the jejunum and the caecum and colon walls were not digested after the first two examinations.

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WEIGHING AND SHEARING

All animals were weighed regularly and were shorn on 27.11.62 when pre- and post-shearing weights were obtained. Wool specimens were collected and submitted for analysis to the South African Wool Textile Research Institute, Grahamstown.

RESULTS

1. POST MORTEM

The numbers of nematodes and species recovered *post mortem* are summarised in Table 1.

The predominant genera present were OSTERTAGIA, TRICHOSTRONGYLUS and HAEMONCHUS, COOPERIA, BUNOSTOMUM, CHABERTIA, TRICHURIS, MARSHALLAGIA, NEMATODIRUS and OESOPHAGOSTOMUM were occasionally found.

Ostertagia circumcincta and *O. trifurcata* (c.f. Table 1). The largest number of worms was recovered from all three groups in March; less in June and September, and moderate numbers in December.

The group on low level thiabendazole (Group 2) had less worms than those dosed every six weeks with thiabendazole (Group 3). At every autopsy more worms were recovered in the group on low level phenothiazine (Group 1).

Trichostrongylus axei, *T. colubriformis* and *T. vitrinus* (c.f. Table 1).

With one exception (June, 1962) the number of worms recovered at *post mortem* was the least in sheep dosed regularly (Group 3); in moderate numbers in those on low level thiabendazole (Group 2) and the highest in those on low level phenothiazine (Group 1).

Table I.—POST MORTEM RESULTS OF EXPERIMENTAL SHEEP

Slaughter Date	Groups	Worms Recovered									
		Ost*	Trich*	H.c.*	Bun*	Tr.*	Chab*	Coop*	Nem*	Oes*	Mars*
1. 3.62	1	15,512 (5,568)**	1.676 (172)	150	—	—	20	—	—	—	—
	2	601 (5)	642	43 (2)	—	—	—	—	—	—	—
	3	1,677 (23)	423 (23)	797 (47)	6	—	—	—	—	—	2
1. 6.62	1	165 (1)	4,803 (7)	—	115	2	—	—	—	—	—
	2	5 (1)	25	—	5	—	4	—	—	1	—
	3	146 (1)	101 (4)	32	—	—	7	—	1(1)	2	—
3. 9.62	1	1	3,277	—	3	4	—	—	—	—	—
	2	15	104	—	3	—	—	—	5	—	—
	3	22	23	1	—	31	—	—	3	—	—
10.12.62	1	3,570	4,001	42	1	10	1	3,137	—	—	—
	2	287	629	20	—	6	—	170	10	—	—
	3	482	1	10	3	—	—	31	—	—	—

* *List of abbreviations*:
H.c. = *Haemonchus contortus*
Ost. = *Ostertagia* spp. (*O. circumcincta* & *O. trifurcata*)
Trich. = *Trichostrongylus* spp. (*T. axei*, *T. colubriformis* *T. vitrinus*)
Bun. = *Bunostomum trigonocephalum*
Tr. = *Trichuris* spp.
Chab. = *Chabertia ovina*.
Coop. = *Cooperia curticei*
Nem. = *Nematodirus spathiger*
Oes. = *Oesophagostomum columbianum*
Mars. = *Marshallagia marshalli*

** Figures in parenthesis indicate 4th stage larvae.

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Haemonchus contortus

All three medications apparently gave good control of this parasite which is of less importance in this area as judged by the counts. One relatively high count of 750 was recorded on 1.3.1962 in an animal dosed on 15.1.1962 with thiabendazole.

Cooperia curticei

The sudden occurrence of *Cooperia curticei* in the animals slaughtered on 10.12.1962 is probably due to the normal seasonal rise, Muller[7].

2. WEIGHT GAINS

Periodic average weights of the experimental groups are presented in Figure 1.

The graph in Figure 1 clearly shows a steady increase with a bias in favour of the group receiving low level thiabendazole.

3. WOOL WEIGHTS

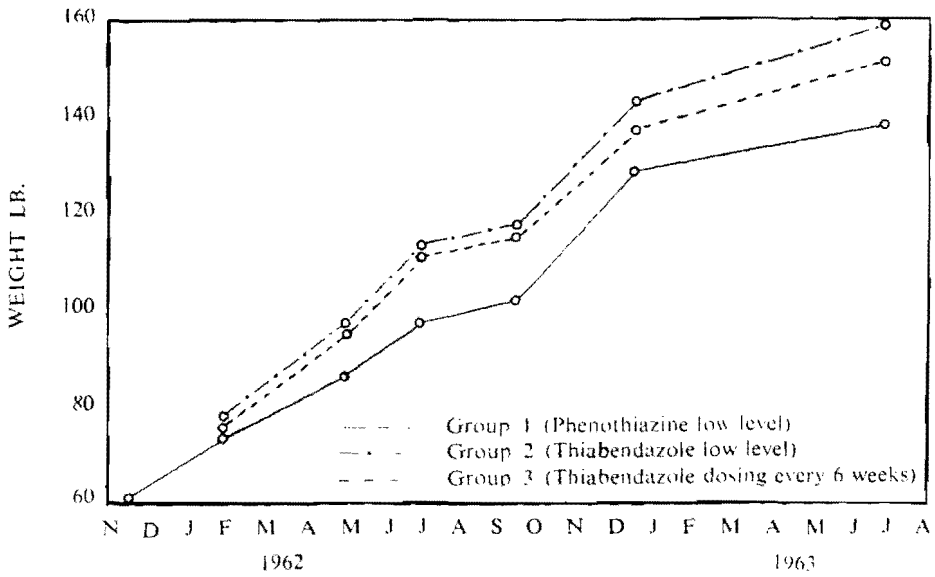
All the experimental animals were shorn on November 27, 1962. The wool weights of the German Merinos were recorded by weighing individual animals before and after shearing.

The average recorded wool weights for the groups were:

Phenothiazine 10% low level:	7 lb.
Thiabendazole 1.25% low level:	8 lb.
Thiabendazole six weekly.....	7.7 lb.

When interpreting these results the breed of the animals must be considered. The German

Figure 1.—LIVEWEIGHT OF EXPERIMENTAL GROUPS



Comparison of weight gains of experimental animals

The average weights on 14.11.1961 were 62.3 lb. for Group 1, 61.9 lb. for Group 2 and 62.2 lb. for Group 3. On 21.11.1962 the respective weights were 128, 143.3 and 138.2 lb. The gain per group over the period under survey was:

Phenothiazine 10% low level:	65.7 lb.
Thiabendazole 1.25% low level:	81.4 lb.
Thiabendazole six-weekly:	76 lb.

Merino is a dual purpose sheep and not primarily a wool producer.

Representative wool samples were collected from individual animals, ten each from Groups 1 and 2 and nine from Group 3, and submitted to the South African Wool Textile Research Institute. Examinations included fibre

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thickness, wool fat, sweat, dry weight, and weathering index.

Statistical analysis of these results did not indicate any significant difference between the three groups.

4. AMOUNT OF MINERAL LICK CONSUMED

The amount of mineral lick consumed was established and is shown in Table 2.

dosing of thiabendazole controlled these genera as well as *H. contortus* and *Cooperia curticei*. The last two species mentioned however were either absent, or present in small numbers.

Thiabendazole dosed at six weekly intervals gave almost as good results as low level administration of this drug and superior to low level phenothiazine.

The daily intake of phenothiazine was approximately 815 mgm., while sheep consumed

Table 2. AMOUNT OF LICK CONSUMED

Group	Period	Lick consumed in lb.	Number of Animals	Estimated Average daily consumption in grams	Active ingredient in grams per day
1. Phenothiazine Low level.....	1.12.61–5.6.62	84	24	8.5	0.82
	6.6.62–5.12.62	74.5	22	8.4	0.81
2. Thiabendazole Low level....	1.12.61–5.6.62	103.5	24	10.4	.13
	6.6.62–5.12.62	99	22	11.1	.14
3. Thiabendazole Sixweekly dosing.....	1.12.61–5.6.62	96	24	9.7	—
	6.6.62–5.12.62	100	22	11.2	—

The average daily intake of mineral lick showed a direct ratio to the weight gains of the three groups. The phenothiazine low level group consumed 158.5 lb. lick during the period under survey, the thiabendazole low level group 202.5 lb and the thiabendazole dosed group 196 lb. During the latter half of the trial, the average daily consumption of lick increased from 9.7 to 11.2 grams in the thiabendazole dosed group.

The phenothiazine group received an average of 815 mgm. pure phenothiazine daily and the thiabendazole low level group averaged 135 mgm. thiabendazole daily.

DISCUSSION

Gibson[1] reviewed the literature on low level phenothiazine dosing and concluded that *H. contortus* showed greater sensitivity than other species. Phenothiazine in a lick did not control OSTERTAGIA and TRICHOSTRONGYLUS spp. in our trial. On the other hand low level

135 mgm. thiabendazole daily. The intake of the former is more than adequate, Gibson[1]. The thiabendazole intake was probably excessive as the total worm burdens of OSTERTAGIA spp. and TRICHOSTRONGYLUS spp. were reduced 95% and 90% respectively, when compared to the sheep on low level phenothiazine.

The major defect of this experiment was that all groups grazed together with other animals during the day and were only separated at night. The main objective of low level administration is reduction of infective larvae on the pastures. This in fact, did not occur as evidenced by the presence of immature worms particularly in the group receiving low level phenothiazine. Few immature worms were recovered from animals in both thiabendazole groups. This confirms the observation by other workers of the high efficacy of this drug against immature worms.

These results not only confirm the efficacy of thiabendazole but are of practical value. Sheep can graze on infected pastures with a greater degree of protection from acute parasitism as

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fewer larvae develop to adult worms. This advantage over phenothiazine is undoubtedly due to the efficacy of thiabendazole against immature worms.

The increased consumption of medicated and non-medicated licks in both thiabendazole groups, was due either to palatability or increased appetite, Gordon[9]. This probably materially influenced live weight gains. The cost of anthelmintics varied with each group.

Groups 1 and 2 received an initial therapeutic dose of phenothiazine and thiabendazole respectively and thereafter medicated licks for a period of 369 days. During this period group 3 was dosed with thiabendazole at 2 grams per sheep on eight separate occasions. In Group 1 each sheep consumed an average of 0.8 gm. phenothiazine daily, i.e. 314 gm. plus an initial dose of 22 grams. At bulk prices the cost was R0.34 per sheep per annum. Similarly the cost of thiabendazole for each sheep in Group 2 was R2.17 while Group 3 received thiabendazole costing R0.67.

The liveweight gains over this period were 65.7 lb., 81.4 lb. and 76 lb. for Groups 1, 2 and 3 respectively. Thus Group 2 gained 15.7 lb. and Group 3, 11.3 lb. respectively over Group 1. When converted to dressed weight, Group 2 gained 9.4 lb. and Group 3 gained 6.8 lb. At current producer prices of R0.20 per lb. Group 2 showed an increased income of R0.05 and Group 3 R1.03 over Group 1. Obviously the most profitable method, of the three used in this trial, was dosing thiabendazole at six weekly intervals.

ACKNOWLEDGEMENTS

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ASSEMBLING AVIAN AND SMALL ANIMAL SKELETONS BY USING A CHEMICAL AID

W. A. DE KLERK, L. ABRAMS, L. S. PRETORIUS — Poultry Section, Veterinary Research Institute, Onderstepoort.

SUMMARY

An easy and practical method of preparing avian and small animal skeletons is described.

When carcasses are boiled in a solution of sulphurated potash of appropriate concentration for a short time, the removal of muscle and fascia is simplified. The ligaments are not damaged by this process, provided it is correctly used, but become dry and hard and thus hold the skeleton together. The concentration and period of application of sulphurated potash depend on the age of the animal. No major sex and species differences were noticed. It is difficult and impractical to prepare the skeletons of large animals like cattle and horses in this way but parts of their skeletons may be treated in this manner and then be mechanically joined together.

INTRODUCTION

Preparing skeletons by using wire is tiresome and time consuming. In most cases the carcass is boiled in water for lengthy periods to soften the flesh and to render it easily removable. After boiling and removing the flesh, the viscera being removed before boiling, the bones are cleaned and defatted. In many cases small dental drills are used to make suitable holes in the bones through which wire is threaded or small bolts inserted, but the mounting of skeletons of small animals by these methods is exceedingly impracticable. The spinal column when joined together with wire loses its shape and the vertebrae can ot be placed in juxtaposition.

Boiling the carcass in a solution containing sulphurated potash (B.P.C.) is a very successful and practical method of processing skeletons. Sulphurated potash, known as liver of sulphur, has a smell similar to that of hydrogen sulphide. It is almost completely soluble in two parts of water and should be stored in well-closed containers.

METHOD

The animal must be killed with an anaesthetic so that the bones and ligaments are not injured or displaced.

After the carcass has been skinned, the eyes, tongue, oesophagus, trachea and all viscera are dissected out. Muscles and fascia within reach should be removed with a scalpel and scissors. As much soft tissue as possible should be removed but without damaging the ligaments as they are the only means by which the skeleton is held together after the boiling process.

It is necessary to sever and remove all the flexor and extensor tendons before boiling as they contract to such an extent that it is very difficult to extend the toes after the boiling process.

Should it be necessary to stop work after the boiling stage, the skeleton wrapped in a damp cloth, can be stored in a refrigerator. It is not advisable to immerse the skeleton in water for long periods as the ligaments are weakened if soaked in water too often.

The sulphurated potash is pulverized, weighed and added to water; the mixture is thoroughly stirred and boiled for 3–5 minutes. At this stage the carcass is immersed in the solution, which should be used once only.

The corrosive action of the chemical will slowly soften and corrode away most of the remaining flesh and other soft tissue. The ligaments are not damaged provided that the concentration used is not too strong or that the chemical is not applied for too long a period. A low concentration applied for an extensive period is also harmful to ligaments and cartilages.

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At intervals of 2–3 minutes the muscles covering the cervical vertebrae should be probed with forceps to find if they are still firmly attached. As soon as they are soft and come away easily the carcass must be removed from the solution.

The skeleton is then immediately placed in water, and as sulphurated potash is harmful to the hands the use of surgical gloves is advisable. All the remaining flesh is now removed from the skeleton, a procedure that is the most time consuming. The limbs need the most careful handling. The thoracic and lumbar vertebrae are very rigid whereas the cervical vertebrae are more flexible. The brain must be removed from the skull as it will decompose if left *in situ*. This is done by making one small opening through the skull in each of the orbital cavities. The brain is forced out through these holes with water which is introduced with a syringe into the cranial cavity through the foramen magnum. This is repeated a few times to ensure that all brain tissue is removed.

After removing the skeleton from the water it must be mounted in the desired position as soon as possible, before the ligaments dry out and harden. Should work on the skeleton be stopped at any stage it is advisable to wrap it in a damp cloth and store it in a refrigerator. If the ligaments of any part are too rigid after refrigeration that part or the whole skeleton must again be immersed in water. By using retort stands and string the skeleton is suspended in the required position. Care must be taken that most of the weight is carried by the more rigid parts of the skeleton such as the thoracic and lumbar vertebrae, whilst the neck, legs and wings are so suspended that they carry a minimum weight. The toes are clamped to the wooden platform on which the skeleton is placed. All attachments can be removed after about 24 hours when the ligaments will have dried out and hardened. If the skeleton is well balanced it will stand without any support.

The skeleton can be submitted to the defatting or degreasing process before or after it has been mounted in the final position, but preferably after final mounting. A degreasing apparatus is used to extract all the remaining marrow and fat from the medullary cavities. It consists of large stainless steel compartments; electrically heated; one compartment is used as a boiling, and the other as an evaporation, chamber. A cooling coil is situated at the top of both of these chambers, through which cold water circulates to condense the vapour. The boiling chamber is filled with trichloroethylene and the skeleton is completely immersed and held in position by attaching small weights to it. A piece of string or wire must be attached to the thoracic or lumbar vertebrae to allow easy removal of the skeleton from the trichloroethylene.

The defatting process has two phases. The skeleton is placed in the boiling chamber and is boiled in trichloroethylene for a minimum of 48 hours but it can be boiled for 5 to 7 days depending on the size and species of the skeleton. During this period all the fat and medullary tissue is dissolved by the trichloroethylene which penetrates into the medullary cavities. In the evaporation compartment all the trichloroethylene still remaining in the bones is removed. The skeleton should remain in this chamber for about 48 hours. The defatting process is not harmfull to ligaments or bones. If this degreasing apparatus is not available, the skeleton can be defatted by placing it in trichloroethylene for 6 to 8 weeks. If the skeleton is not defatted the medullary tissue will decompose and ooze from the bones. After completion the carcass can be mounted in a perspex casing.

Results

To find the optimum concentration period of application of liver of sulphur in water, different concentrations were tested for various lenghths of time on different species. Animals of different ages were also tested because ligaments of young animals are softer and more friable than those of adults. Cartilage also contracts when boiled in sulphurated potash and the carcass of a very young animal must therefore not be boiled for too long periods.

Boiling the carcass of a three-months-old White Leghorn male for five minutes in 115 grams of sulphurated potash dissolved in 9 litres of water, has given good results. The carcass of an adult White Leghorn male can be boiled in a solution of similar strength for 10–20

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minutes without the skeleton falling apart. The ligaments of geese are very tenacious and their carcasses can stand boiling for longer periods. No other major species differences were encountered. It was found that the best results were obtained when adult dog, sheep, goat and rabbit carcasses were boiled in 120 gram of sulphurated potash dissolved in 9 litres of water for 15–20 minutes.

All the bones are very clean and white after the degreasing process and it is not necessary to bleach them. However any black specks still remaining are easily removed by placing the skeleton in 9 litres of water containing 500 ml. of commercial hydrogen peroxide for about eighteen hours.

It is interesting to note that all the aerated bones of birds such as the humerus are white and dry even before the degreasing process, while all the other bones still containing medullary tissue, have a darker colour and a fatty appearance. Sprinkling a proteolytic enzyme such as a meat tenderizer over the flesh still remaining on the skeleton after boiling, is of great help in the removal of tissue, but again care must be taken not to damage the ligaments. It is possible to use the meat tenderizer in smaller amounts on the cervical and other vertebrae as it will not reach all the ligaments in these areas because many of the ligaments here are not superficially situated.

If an enzyme is used the boiling time can be reduced. After the use of the enzyme the tissue is easily brushed off with a hard nylon brush. The enzyme should be applied for about 30 minutes.

ACKNOWLEDGEMENTS

The authors wish to thank the Chief, Veterinary Research Institute, Onderstepoort for permission to publish this paper and Mr. O. Prozesky of the Transvaal Museum, Pretoria, for valuable advice.

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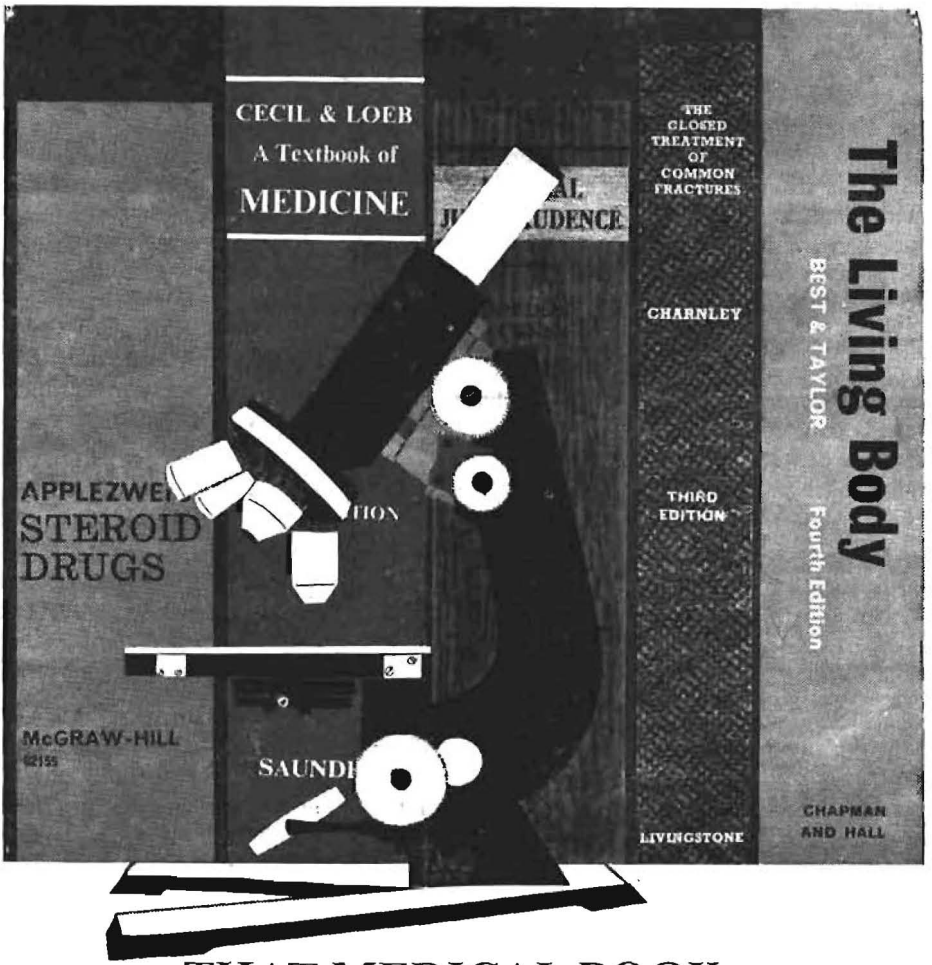

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THE VETERINARY SURGEON IN PUBLIC HEALTH

S. V. O'Brien — Municipal Veterinary Officer, Pretoria.

Introduction

In most modern and progressive countries throughout the world the Veterinary Officer of Health is an essential tooth in the cog of public health administration. The veterinary profession has firmly established itself as vital to the well being of the community and is generally regarded and accepted as the best qualified profession for the safe-guarding of food commodities of animal origin. In South Africa however, with the exception of some of the cities, veterinarians play a very small and inadequate role in our national public health programme.

Specialised Veterinary Services

Most professions have one or more subsidiary fields into which their members gravitate and specialise. The broader and more diverse the study of a profession, the greater becomes the opportunity for specialisation. This statement is prominent in the medical profession where a large percentage of graduates sooner or later become specialised in one or other of the professions' vast ramifications. The general practitioner, as the older generations knew him, is almost a non-existent entity, especially so in our larger towns and cities where the house doctor does very little surgery, and refers a great deal to specialists. Although veterinary science covers a very broad field of study, it has remained the exception to this pattern of specialisation.

Other than State service and private practice several fields have been created through personal endeavour, such as is found in municipalities, pharmaceutical and feed firms. At no time however, has the post-graduate been given the opportunity or the facilities for official specialisation; he has had to rely on his training and ability to equip himself for such employment. Consequently many veterinarians have shied away from these specialised fields, not only on account of lack of knowledge and experience, but because of the apparent lack of interest, reward and gratification that these fields offered.

It is not the intention to discuss here the relative merits of these various fields open to the veterinarian, but to confine the subject to Veterinary Public Health. As has been mentioned the tendency has been to shy away from the cinderella branches and to support those who claim that public health work can be soul-destroying although this soul destruction will only affect those who confine and limit themselves to purely veterinary matters. The demands of public health on the veterinary profession can be met only if the veterinarian has been suitably trained for work in this field. In his education he should be made familiar with the philosophy of a national public health programme and the opportunity to appreciate the role of the veterinarian in promoting community health and national welfare. His must be the dedicated approach to public health. From this will emerge unbounded scope and limitless interest. In order to break this barrier of limitations one must cross into fields apparently foreign to veterinary science as we know it. Only after exploiting all relevant directions, may one return to the science and its applications in public health.

Veterinary Public Health as a National Service

Public Health as a national service, was grossly neglected at the National Convention and by the South Africa Act of 1909 which gave legislative effect to the decisions of the Convention; only when the devastating influenza epidemic of 1918 swept South Africa causing the death of approximately 150,000 of the population, was public attention drawn to the inadequacy of the existing legislation. A public health conference was held in Bloemfontein in 1918. This resulted in the drafting

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of the Public Health Bill. This Bill was passed the following year as the Public Health Act No. 36 of 1919. Decentralisation was the fundamental principle of the Act and its passing imposed responsibility upon local authorities for the control of infectious diseases and environmental sanitation, in their respective areas of jurisdiction. Local authorities are obliged therefore, to supply adequate public health protection.

Public Health as we know it to-day has, therefore, only had a comparatively short life during which time spectacular advances have been made in preventive medicine and all allied sciences. During this rapid period of development veterinary science in South Africa has had to administer the limitless demands of country's animal population; this with inadequate facilities and shortage of qualified staff. The country was faced with apparently insurmountable problems in the field of animal diseases and yet, in spite of these formidable difficulties, through skill and dauntless perseverance, one after another of the animal diseases was conquered by our research and field workers. To-day, Onderstepoort and the profession is held in high regard throughout the world for its invaluable contributions to veterinary science. Little wonder, therefore, that during this period of emergence little time and attention has been devoted to the cinderella. We therefore, find ourselves left far behind in these other spheres. The medical profession has made vast strides in the field of public health whilst the number of veterinarians employed in this sphere has lagged lamentably behind.

As far back as 1943, Dr. Harry Nelson, Medical Officer of Health, Pretoria, and also at that time Director of Hygiene to the South African Military Forces, presented an almost prophetic paper at the Veterinary Congress. In it he stated the great need for post-graduate study and qualification for the veterinarian in public health. To-day almost twenty years later, this need has finally been recognised by the University of Pretoria who have this year inaugurated a two-year part-time post-graduate course for the Diploma in Veterinary Public Health. This course with the exception of some subjects, runs concurrently with the Diploma in Public Health, which is the qualification needed by the Medical Profession for public health work.

What is Veterinary Public Health?

At this stage one may enquire "What is Veterinary Public Health?" In reply the definition, as printed in a W.H.O. report 1955, is quoted:

> "*Veterinary Public Health is that field of activity which protects and advances human well-being by utilising the combined knowledge and resources of all those concerned with human and animal health and their interrelationships.*"

To many members of our profession Veterinary Public Health, to put it in a nutshell, is concerned with meat and milk hygiene. However, although these are certainly major aspects of Veterinary Public Health they are by no means the beginning and end of this field.

To clarify the above definition, the subject can briefly be considered as follows:

Food Hygiene

It must be emphasised that the primary purpose of food hygiene is to prevent transmission of disease to man through food products and to ensure that the consumer receives one which is wholesome, nutritious and acceptable. In addition adequate food hygiene not only helps to reduce food loss through poor production and preparation, but also serves to boost the country's production by requiring high standards.

Because man's most important food item is animal protein, immediate place of honour must be accorded to meat, milk and milk products, fish, poultry and eggs. Since these are all of a perishable nature and can, therefore, suffer severe nutritive losses, great emphasis must be placed on the standard of production, preparation, distribution, sale and consumption.

The veterinarian by virtue of his basic training is pre-eminently suited to supervise and guide the major aspects of food hygiene.

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Zoonoses

These are the diseases and infections which are naturally transmitted between vertebrate animals and man.

The report by the W.H.O. lists some 80 diseases which can be classified in this group but considerably less than this is of importance to South Africa; tuberculosis, brucellosis, hydatosis, Rift Valley fever, salmonellosis, rabies, taeneasis and cysticercosis being the most important.

With the advent of resistant strains of staphylococci one cannot dissociate contaminated udders and the possible production of heat-stable enterotoxins which cause such severe forms of food poisoning. To exhaust this field of zoonoses is in itself a major study and cannot therefore be enlarged upon here.

Laboratory work

This aspect of Veterinary Public Health is possibly one of its most important facets, since everything devolves about it. Physical, chemical and microbiological tests are essential features in the control of food, and the diagnosis of disease. To be thoroughly versed in these studies one requires considerable post-graduate study and experience. Every public health veterinarian must accept from the very outset, that a major portion of his time will be devoted to laboratory work, and will include the study of histology, pathology, bacteriology, immunology, pharmacology and related sciences.

Production and care of Laboratory animals.

An essential requirement of research is the readily available supply of suitable disease-free laboratory animals such as guinea pigs, rabbits, hamsters, rats, mice etc. This production and maintenance requires skill, knowledge and experience.

Training of professional and auxiliary Public Health personnel.

Members of all branches of public health require instruction and training in meat and milk hygiene and in other matters relating to veterinary science. The D.P.H., R.S. Institute or R.S.H., Meat and Other Foods, Tropical Hygiene, are all diploma courses which should include Veterinary Public Health lectures and as time proceeds this demand will increase considerably.

Zootechnics and meat and milk potential

The grading of beef leaves a lot to be desired in this country and although the demand may exist overseas for the subcutaneous fat deposits preference should be shown to the charolais type of carcase for consumption in our climate.

The small animal population.

A much neglected problem which confronts the majority of our larger towns and cities, is the control of the small animal population of cats and dogs.

Indiscriminate breeding often results in the production of undesirable and unwanted animals: add to this the usually existent number of waifs and strays and one finds the scene set for indescribable suffering, neglect, cruelty and outright sadism: S.P.C.A. bodies usually do a great deal to alleviate and eliminate these problems and are often subsidised by their respective local authorities but the results are far from satisfactory.

Prevailing legislation does not adequately empower the local authority to deal with this aspect of animal welfare. Measures should be adopted whereby local authorities can be approached to take more active steps in this direction, and with the assistance of their veterinary officers endeavour to educate and inform those sections of the community which are responsible for these misdeeds. Veterinary assistance should be given to the S.P.C.A. clinics.

In this manner a very positive service could be rendered to the more needy sections of the community, the many accidents caused by straying dogs and cats could be reduced; diseases such as hydatosis could be controlled; and a much healthier and happier slum-pup would emerge.

In this brief coverage an attempt has been made to show that the opportunity is now at

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hand for the veterinary profession to take positive action in consolidating the veterinarian in public health, not only in a local authority status but at provincial and state levels if necessary. At present the terms of employment are vague, requirements and duties vary considerably from local authority to local authority and no standard guidance from any official source exists. The attention of the S.A.V.M.A. is invited to this approach with the hope that a sub-committee might be appointed to consider this problem, so that local authorities desirous of employing veterinary assistance will be aware of a uniform code of practice.

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CASE REPORT

THE USE OF PHENCYCLIDINE* FOR IMMOBILISATION OF THE CHIMPANZEE

H. G. J. COETZEE — Veterinary Surgeon, Bloemfontein City Council, Bloemfontein.

SUMMARY

The experimental results obtained with Phencyclidine on chimpanzees is described.

INTRODUCTION

Two chimpanzees, a male and female aged 9 and 8 years respectively were to be moved to their new cage. Due to their enormous strength, intelligence and unmanageability it was decided to use a drug, by oral administration, for sedation and even partial anaesthesia if possible.[3]

After reading a report from Europe on the use of the abovementioned drug on chimpanzees, it was decided to try the drug in this case.[1]

METHOD OF ADMINISTRATION AND DOSAGE

Orange juice was used as vehicle for the drug and both animals took it readily.[2] In the case of the female chimpanzee, however, an estimated ¼ of the drug was spat out immediately after it entered her mouth. The dosage was 4.132mg/kilogram for the male with a weight of 72.7 kilograms and in the female the initial dosage was 4.395 mg/kg, weighing 45.5 kg. but only an estimated dosage of 1.099 mg/kg was swallowed.

REACTIONS AND OBSERVATION

Male.

Twenty-three minutes after administration of the drug, a sleepy appearance, yawning and sluggish movement of the arms and limbs was observed. Six minutes later the animal was lying down flat on the floor in a froglike manner but still looking around and trying to reach a sitting position with no success. After 34 minutes the animal was swaying its head from side to side and showing nystagmus. Handling of the animal was undertaken at 40 minutes post-administration. The animal was pulled out of the cage and put into a transfer box without any resistance whatsoever. The transport to the new cage as well as placing in the cage took place without any reaction from the chimpanzee. The degree of immobilization was that of surgical anaesthesia.

CLINICAL OBSERVATIONS MADE DURING IMMOBILISATION

The eyes were staring and the conjunctival mucous membrane was neither injected nor cyanotic. The teeth and buccal mucous membrane were normal. Inspection and palpation of the skin and the genital organs showed no organic disorder.

The body temperature was 98°F, heart 60 per minute (strong and regular) and respiration 20 per minute (regular). Bloodsmears as well as smears for differential counts were taken without any reaction on the prick of a needle.

At 70 minutes after administration the eyes started following moving objects, and nystagmus; while at 76 minutes the head was raised from the floor and the animal looked at is surroundings. Two minutes later an object was taken into the hand. At 96 minutes, it was able to turn on its side to grab the wire mesh. Three hours afterwards the animal could again walk with slight signs of sleepiness.

The next day (24 hours) the animal was walking around although slight laziness could still be detected.

*Sernylan—Parke Davis

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Female.

The female took only a quarter of the dosage administered and therefore the reaction was delayed considerably and the depth of anaesthesia reduced, but the reaction was still sufficient to enable the transfer to the new cage to take place. At 60 minutes and 3 hours 50 minutes post-administration no reaction could be observed but after 4 hours 5 minutes the animal was lying down showing very slow movements and drowsiness. There was no reaction during the process of transfering her to a new cage.

There was no resistance whatsoever when bloodsmears were made, blood drawn for chemical analysis, or during clinical examination of the eyes, skin and mouth. A number of pustules on the skin could be detected especially on the forearms and limbs. The eyes were staring as in the case of the male. Five hours after administration of this drug the animal was still lying down, looking around, lifting the head and grabbing the partition with her hands. After 24 hours the animal was completely normal.

LABORATORY RESULTS

A. *Differential Blood Count*

	Male	*Female*
Lymphocytes.....	65	13
Neutrophyls.....	28	84
Eosinophyls.....	3	2
Bosophyls.....	0	0
Monocytes.....	5	1

The marked increase in percentage neutrophyls in the female could possibly be due to the pustular infection of the skin.

B. *Blood Analysis* (Only a few determinations from the female)

Calcium.....	11.9 mgm%
Blood urea.....	28.0 mgm%
Sodium.....	277 mgm%
Uric Acid.....	4.5 mgm%

ACKNOWLEDGEMENT

I would like to thank Parke Davis Laboratories S.A. for Arranging the supply of the drug and also Dr. H. E. Stoliker, Clinical Investigation Department, Research Laboratories, Parke Davis and Company, U.S.A. for his helpful and useful advice on the drug.

The assistance of Mr. van Ee, Curator of the Bloemfontein Zoo is also highly appreciated.

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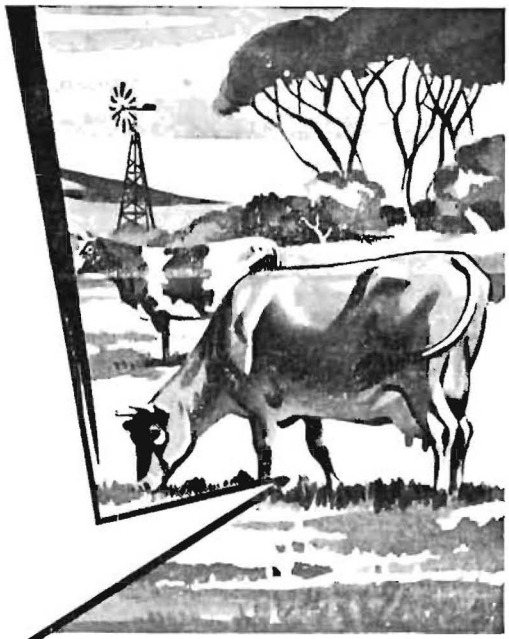

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OVERSEAS STUDY VISIT BY DR. H. H. KLEEBERG TO THE UNITED STATES OF AMERICA, CANADA AND EUROPE—10.7.61 to 31.1.63

Dr. H. H. Kleeberg of the Section Bacteriology of the Veterinary Research Institute, Onderstepoort has kindly supplied the following information relating to his overseas study visit to the United States of America, Canada and Europe.

General

The U.S. Public Health Service awarded an international post-doctoral research fellowship to Dr. Kleeberg. These fellowships are generally made available to scientists from abroad, on a limited programme, to foster the exchange of scientific information, techniques, philosophy and cultural values. Dr. Kleeberg selected the Trudeau Laboratory for Tuberculosis in Saranac Lake, New York, for his studies. With the help of a travel grant from Washington, he also visited a number of hospitals, universities and research institutes in the U.S. and attended the congress of the American Thoracic Society and the National Tuberculosis Conference. He travelled 11,000 miles by car, in order to see the institutes.

Funds from the Department of Agricultural Technical Services enabled him to take part in the International Congress for Microbiology in Montreal, and also to visit the laboratory in Hull, Ottawa, as well as organizations and institutes in Europe (in Paris, Geneva, Rome and Perugia). He also, on private initiative, visited the Tb. institute at Borstel near Hamburg and took part in the annual Veterinary Convention in Guelph-Ontario, Canada.

He left South Africa on the 10th November, 1961 and arrived in Southampton, by Union Castle Line; Left Southampton 2 hours later, by Cunard Line for New York. He started work on the 1st December 1961, and completed the work at the same institute on November 30th of 1962. He then took two months leave during which time he visited Institutes in Europe. He returned to South Africa on the 31st of January 1963.

Work at the Trudeau Laboratory

His sponsor in the Trudeau Laboratory was Dr. W. Steenken. Dr. Kleeberg took with him 33 strains of unclassified Mycobacteria, which had been isolated from S.A. cattle, reacting positive to tuberculin tests, and 25 strains of isoniazid resistant strains of bovine tubercle bacilli. In addition to studies on the S.A. organisms, he undertook miscellaneous studies in the institute on human Tb.; their methods of isolation, identification, and typing, and investigated guinea pig diseases in the local animal colony. In addition to general academic work, he participated in the Trudeau School of Tuberculosis in June 1962, which is a three weeks course for physicians specialising in tuberculosis. He delivered four scientific talks in U.S.A. and one in Italy. He also gave nine general talks on S.A. to local clubs and societies.

He studied the S.A. strains of Mycobacteria at Trudeau Laboratory, Saranac Lake, in great detail both as regards their characteristics and drug resistance.

During his visits to tuberculosis research institutes and conferences he studied the chemotherapeutic and chemoprophylactic value of new anti-tuberculosis drugs.

He was informed that bovine tuberculosis was not fully eradicated in the U.S.A. and in the recent years up to 14,000 new cases were found a year. However, 85 per cent of the animals that were slaughtered and compensated for did not present visible tuberculous lesions. In swine, tuberculosis accounts for one quarter of all lesions found at abattoirs and reach 4 per cent of the total killed. It was obvious that the lesions were not all caused by true tubercle

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bacilli and similarities with our findings at Escourt Bacon Factory and Johannesburg Abattoir can clearly be seen. Unclassified mycobacteria seem to be the main reason for these lesions in most countries with little bovine Tb.

Annual Congress of the U.S. National Tuberculosis Association and American Thoracic Society, May 20–23, 1962. Miami, Florida

During the Medical Session on Mycobacteria, Dr. Kleeberg's paper on the virulence of Isoniazid resistant *M. tuberculosis* variety bovis in 9 mammalian species, was delivered. A lively discussion in which veterinary and medical experts participated followed the paper. The chairman emphasized that it was in principle always better to kill the organism than to kill the host, meaning that chemotherapy would be preferable to the slaughter of reacting cattle. During the session on "mycobacterial antigens" the isolation of pure antigens was discussed. While antigenic relationships between the known groups were observed, there was a surprising antigenic difference between species in any one group.

During the different sessions it was surprising to note the extensive study to which the non-tuberculous mycobacterioses are subjected and how important the biochemical classification of these organisms is today. In contrast, the studies on tuberculosis vaccination seem of low quality compared with what is known from Europe. Greatest emphasis, especially in Federal offices, is placed on statistics. The statistician is first consulted before new research projects are started. The emphasis which is today placed on the field of tuberculosis-bacteriology was surprising. Different PPD antigens are under extensive testing. Variations in tuberculin test reading were studied on human patients comparing untrained nurses with physicians. There was consistant interpretative variation between observers in addition to random variation. The consistant variation between the reading of the physicians was great so that altogether nurses were found more suitable for reading tuberculin tests than physicians. Chemoprophylaxis in man for prevention of tuberculosis, using Isoniazid, was found highly effective in a study of Alaskan Natives and was responsible for a reduction in the incidence of active tuberculosis ranging from 70–90 per cent.

Atlanta, Georgia, Communicable Disease Centre and the U.S. Public Health Laboratories, Tuberculosis Unit

The unit is responsible for standardizing laboratory methods in the U.S.A. A method for the isolation of mycobacteria from soil samples was discussed, also the technique of intracutaneous inoculation of guinea pigs as a means of determining the virulence of acid-fast bacilli and a means of grouping the unclassified acid-fast bacilli. This Unit is actively engaged in the study of all sensitizing agents which might be involved in the tuberculin test. A round table discussion was arranged with the staff of the Tb.-unit on atypical mycobacteria. The tendency to classify these bacteria on the basis of our knowledge from the medical field was opposed by Dr. Kleeberg and examples given of the diversity of mycobacteria in the veterinary field.

Canada

The 14th Annual Convention of the Canadian Veterinary Medical Association together with centennial celebrations of the Ontario Veterinary College at Guelph were attended. The greetings of the President of the South African Veterinary Medical Association were extended to the President of the Canadian Veterinary Association. The Faculty of Veterinary Medicine was also visited, but no work on tuberculosis or other proclaimed diseases is being done since these are done at State institutes. Sixty students per year qualify from that college.

The International Congress for Microbiology in Montreal

Dr. Kleeberg attended this Congress. Of particular interest was a paper by Malman, from East Lansing, Michigan, on "Classical and atypical pathogenic mycobacteria of human and animal origin". Mycobacteria have been studied, which were isolated from numerous skin lesions and no-visible-lesion-tuberculin

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positive cattle. Isolates have also been obtained from bovine and porcine lesions. Over 300 isolates have been identified by morphological, cytochemical, allergenical and animal infectivity tests. They were identified as *Mycobacterium tuberculosis*, *M. bovis*, *M. avium*, and Runyon group II, III, IV, and so called pseudochromogens. The latter have characteristics intermediate of group I and II. The group I type of organism is now isolated in South Africa. (See article in this issue). Some of the organisms of animal origin were identical to group III strains isolated from man. Many of the groups III isolates, are more virulent.

An important report came from Castelnuovo and Morellini, of Rome, Italy, "On the antigenic structure of the so-called atypical anonymous mycobacteria and their relationship to other mycobacteria". The antigenic structure of *M. scrofulaceum*, *M. sp.-battey*, *M. balnei*, *M. kansasii*, and *M. minetti* has been analysed by immuno-electrophoresis. This structure has been compared with that of human tubercle bacilli and other pathogenic and saprophytic mycobacteria. The reaction of antigens to homologous and heterologous sera indicate that the antigenic structure of Battey-type strains is very similar to that of avian strains. The antigenic structure of *M. balnei*, is similar to that of *M. marinum*. The other three organisms are serologically distinct from all other species. All the above species have more than one antigen in common with human tubercle bacilli. The human, bovine and vole bacilli are antigenically very similar. The serological data agree with those obtained in the same species by other tests. Therefore, the anonymous mycobacteria can be classified according to the antigenic structure. This paper was a major breakthrough in the struggle to find new groups and types of mycobacteria amongst the so-called unclassified strains. The similarity of Castelnuovo's and Boenicke's tests would, for both types of classifictaion, be an important confirmation.

H. S. Hsu, from Philadelphia, spoke about "In vitro studies on the inter-actions between macrophages and tubercle bacilli." A tissue culture method was presented for a more precise interpreation of data concerning the inter-action between macrophages and tubercle bacilli.

The Trudeau School of Tuberculosis

The Trudeau School of Tuberculosis and other pulmonary diseases, was attended from June, 4th to June 22nd, 1962 at Saranac Lake, New York. It consists of continuous lectures by tuberculosis experts from all over the United States. The bacteriology of tuberculosis in laboratory routines was discussed. World problems in tuberculosis, the histopathology of pulmonary tuberculosis and the pathology of tuberculosis after prolonged chemotherapy was lectured on. There were lectures on tuberculin testing of man, the differential diagnosis of pulmonary tuberculosis, and BCG vaccination, and the trials done in Puerto Rico, where 70,000 people were involved in a big trial.

The visit to the Animal Disease Research Institute, in Hull Canada

A method for the comparison of the activities of different bovine type tuberculins by serological methods has been worked out. Tuberculins prepared from many bovine strains have been tested for complement fixing activity with antisera from guinea pigs, injected with various PPD and mixed with mineral oil. Relatively high complement fixing titres were recorded particularly with serum at the later stage of immunization, which presumably possessed a greater concentration of anti-tuberculo-protein antibody. All lots of tuberculin produced by uniform methods — with the standard strain of bovine-type tubercle bacilli—showed relatively comparable complement fixing titres in tests with individual anti-PPD antisera.

The results of early intradermal testing for Johnes disease were discussed and on the histories of seven herds the considerable economic losses resulting from the accumalated death toll, suffered over the years, were obvious. Periodical intradermal testing with PPD was used, with apparent success in eradicating the disease from four herds. Positive reactions were supported in the great majority of cases by clinical, autopsy and microscopic findings. Evidence was presented pointing to the weakness of the test to detect, in its present form, a percentage of animals in the preclinical stage of infection, but frequent periodic testing combined with

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strict sanitary measures, appears to be the prerequisite of success in the eradication or control of the disease. Our work with the Ermelo herd along the same lines has apparently been successful.

Second trip through the U.S.A.

During a trip lasting three weeks, covering over six thousand miles by car, another group of institutes was visited following invitations from most of these intitutes. Three scientific talks were given, all of them on recent research results of the Onderstepoort Tuberculosis Section. The response of the colleagues, during the visits, and after talks, was surprisingly keen and the contacts established, were not only pleasant, but will be very valualbe for the future work of this section. There is no doubt that this institute is leading in the field of chemotherapy of animal tuberculosis and is well placed in the field of tuberculin for cattle and production of other skin sensitins. We are in touch with all other recent developments. The biggest group in the field of animal tuberculosis research is that at the Michigan State University, at East Lansing. under Professor Malman, containing seven more veterinarians, of which three have a PH Doctors degree. It is operating with a grant of 200,000 dollars per year to study the problem of no-visible lesion reactors, which is costing the United States a huge sum of money every year. The research contract with the Department of Agriculture provides for a thorough study of bovine tuberculosis as to isolation of organisms from the tuberculin positive cattle, indentification of isolates, serological reactions, sensitivity tests and studies of no-visible lesion reactors from reactor herds with or without pathological findings. The specimens are sent from all over the United States, especially from the abattoirs at Chicago.

From cattle, all possible strains of mycobacteria have been isolated from no-visible lesion reactors, proving that the tuberculin test detects mycobacteria experiences in cattle of whatever origin. Atypical bacteria have been isolated from skin lesions. The skin lesion organisms were similar to our observations of three different groups: scotochromogenic, nonchromogenic and rapid growers. In swine, again similar to our Onderstepoort results, almost 100 per cent of organisms isolated belonged to the para-avian group III. They also isolated organisms from the soil, around stables and barns, but in total 75 per cent of their isolates belong to group III, avian-like orga nisms. The aim is now to distinguish tuberculins serologically or by specificity of fractions. This programme of the Malman-group is a serious attempt by the U.S.A. to solve their year-old problem of non-specific reactions. Most of these veterinarians have been trained in medical institutes.

Visit to National Animal Diseases Laboratory, at Ames, Iowa

This huge brand new institute costing 18,000,000 dollars has taken over research on scheduled diseases for the whole of the United States and is the most modern institute of its kind.

Rochester, Minnesota, Mayo Clinic

Dr. Karlson, being a veterinarian in the medical research field, invited Dr. Kleeberg to this clinic of a thousand doctors and showed him the research facilities.

It was surprising to see that hundreds of experimental animals were kept inside the huge building in several floors, under the control of another veterinarian. There were over 600 dogs, monkeys, calves, etc. Dogs were mainly kept for surgeons for experimental surgery. The cleaning of all cages was done automatically with water every hour. Feeding of experimental animals and their diseases was discussed.

Salt Lake City utah

This is the centre of the American collection of atypical mycobacteria. Dr. Runyon is the leading expert in this field. He maintains over 2,000 strains from all over the world.

Denver, Colorado: National Jewish Hospital

This is probably the world's best research institute for tuberculosis. In the past years a number of basic discoveries in this field were

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made at the institute. The Director personally introduced Dr. Kleeberg to his large staff and asked him to give a "seminar" on chemotherapy of bovine tuberculosis. Many microbiological procedures of value to tuberculosis were discussed. This group is convinced, that today more than ever, there is an increasing need for bacteriological diagnosis and monitoring of treatment in tuberculosis.

Cincinnati, Ohio—Christ Hospital, Institute of Medical Research

This institute uses mostly monkeys for the study of tuberculosis and is known the world over. Dr. Kleeberg could witness the post mortem procedures on monkeys where x-ray photos were used together with photos of the actual lung lesions in colour, and the post mortem observations were recorded on tape immediately. The keeping of hundreds of monkeys was demonstrated. Blood level assays for isoniazid and para-amino-salicilic acid were demonstrated and discussed.

Visits in Europe

The International Union against Tuberculosis—Paris

The Executive Director, Dr. Holm, was not available. Therefore, the co-ordinator of technical committees of the Union, Professor Cannetti, was visited. South Africa is associated with the Union through its S.A.N.T.A. Organization. Dr. Dormer of Durban is a member of the Council. The Union organises tuberculosis conferences at the international level and, through its nine technical committees which cover different aspects of the fight against tuberculosis, is engaged in international research. Professor Cannetti asked Dr. Kleeberg whether he would be available to serve on the committee on animal tuberculosis; so far no official invitation has been received.

Institute Pasteur—Paris: Prof. Grosset, Grumbach and Cannetti:

The tuberculosis section of this institute is housed in a three storied building and has a world wide reputation. Theoretical problems and practical solutions in the eradication of tuberculosis were discussed.

Hamburg, Germany: Tuberculosis Research Institute, Borstel. Prof. Freersken and Meissner, Dr. Boenicke:

Since this was a second visit to the institute, the experience with different test methods was discussed; also bacteriological, therapeutic and epidemiological aspects of primary drug resistance in different countries. With Prof. Freersken, the situation of bovine tuberculosis in Germany was reviewed, also the value of diluted tuberculin and the differentation of non-specific reactions. With Dr. Boenicke, his biochemical classification of mycobacteria was debated.

Prof Freersken has been on a study tour of South Africa from 4—21.2.1964 and has lectured at Onderstepoort.

Rome, Italy: Tuberculosis Study Centre, Forlanini. Prof. Omodei-Zorini, Prof, Morelinni and Dr. Castelnuovo.

New results with chemoprophylaxis by means of isoniazid in tuberculosis and agar diffusion techniques combined with electrophoresis, were discussed and the laboratories of the Forlanini Hospital and that of the Ministry of Health were visited. Dr. Kleeberg was invited to come to the next International Congress on Tuberculosis in Rome in September, 1963 and be a member of the Expert Group on Unclassified Mycobacteria.

Perugia, Italy: Regional Investigation Centre and Faculty of Veterinary Medicine, Prof. Badelli and Prof. Rosati.

The main aim was to deliver a paper to the Biological Society which had a special meeting for this occasion. All participants, about 120 veterinarians and medical doctors, received an outline of this talk in Italian. Dr. Boldrini, Rome, served as interpretor. It was a lively discussion since interest in chemotheraphy of bovine tuberculosis is very keen in Italy.

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OUT OF THE PAST

VETERINARY HISTORY OF THE BECHUANALAND PROTECTORATE 1905—1935

W. H. CHASE — Retired Chief Veterinary Officer, Bechuanaland Protectorate.

With due acknowledgement to the Director of Veterinary Services Bechuanaland.

INTRODUCTION

There is no official record of animal disease in the early days in what was to become the Bechuanaland Protectorate, but certain facts emerge from the writings of missionaries and the early big game hunters who visited the Territory half way through the nineteenth century.

TSETSE FLIES AND HORSE SICKNESS

MAJOR VARDON wrote that "*he caught tsetse flies on the banks of the Limpopo River in* 1848, *that he took them to London, where they were identified as the Glossina morsitans*".

DAVID LIVINGSTONE in his diary when on his way to Ngamiland wrote in 1850, "*Tsetse flies abounded on the banks of the Tamunakle river and that unless his waggons avoided the fly, his transport would be brought to a stand still*".

Horse Sickness, referred to as Horse Distemper, was also reported as occurring frequently on this journey.

GORDON CUMMING in his book "Five years hunting adventures in South Africa" wrote "*My losses in cattle were very considerable. In all 4 expeditions into the far interior (chiefly Bechuanaland) my losses were* 45 *horses and* 70 *cattle at* £600. *I also lost* 70 *dogs*". On page 366 of the same book, it is stated "*TheBechuanas stated that all the horses of the Boers (in the Transvaal) were dead with the Distember*". (Horse Sickness).

RINDERPEST

In March 1896 Rinderpest was brought into the Protectorate by ox transport travelling along the Bulawayo-Mafeking road, killing some 90 per cent of the cattle en route. A belated attempt was made to check the spread of infection south, by the construction of a fence running east and west of Palla Road, but it was unsuccessful and the disease reached Ramathlabama by the end of April.

The late Chief Sekgoma Khama informed me about the only district where there was any concentration of cattle that escaped infection was Lephepe, where he and his followers were living at that time.

The last case of Rinderpest occurred on the Transvaal-Bechuanaland border in 1899.

EAST COAST FEVER

In 1904 both the Cape and Transvaal Governments became alarmed at the near approach of East Coast Fever to the Protectorate border for the reason that there was no veterinary staff, not a single dipping tank and apart from the railway line, not a mile of fencing in the whole territory. Had the disease entered the Protectorate at that time, it would in all probability have spread throughout the North Western and other areas and taken many years to eradicate. A veterinary officer (G. W. Lee) was lent to the Protectorate Government for 6 months, and at the end of that period W. H. Chase was permanently transferred from the Cape Veterinary Department to the Protectorate on March 1st., 1905. Lectures were then given at the chief stads on the symptoms of the disease, how spread and the vital necessity of allowing no contact with cattle from Rhodesia or the Transvaal. With the full co-operation of the late Chiefs Khama and Linchwe the disease was kept out, and the country has remained clear of the disease to this day although spread throughout Rhodesia, Swaziland, and every province of the Republic.

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Contagious Bovine Pleuropneumonia

In order to show what extreme measures were taken, a transport rider brought a waggon, oxen and a load of tobacco into the Protectorate from Rhodesia without a permit which he had applied for, and the Resident Commissioner's instructions were "Shoot the oxen, burn the waggon and make the man a prisoner" (See Sir Ralph William's book "How I became Governor" for confirmation).

Fencing along the Transvaal border was rapidly constructed. But on his first inspection of cattle throughout the territory Chase found Contagious Bovine Pleuro Pneumonia (Lung sickness) which had existed in the Bamangwato Reserve for years prior to the Boer war, to be widespread throughout that reserve and that the disease would seriously impede the export of cattle when that was eventually allowed. In 1905 the disease broke out at Crocodile Pools, and shortly afterwards at Moshupa and Molepolole in the Southern Protectorate and later in the Marico district of the Transvaal. In each case, disease could be traced to infection being brought by cattle from the North.

Apart from quarantine, there was no legislation to deal with Pleuro Pneumonia and there was difficulty in bringing in measures to control it, owing to the fact that the potential harbourer of infection (the "Lunger", the "Salted" ox or the recovered animal) had acquired an enhanced value. Many of the books of travel up to that date had advised the use of "salted" animals for trekking and owners had come to look on these animals in a similar light to that of the "salted" horse.

The following is an extract from a book written by Elizabeth Hepburn, a lady missionary "*Leaving Kuruman for Shoshong it was discovered that our team of oxen not having been "salted" must be exchanged for a more hardy team as our team was liable to be attacked by the deadly Lungsick*".

It was 4 years before a Lungsickness Proclamation was brought into force. This provided for—

(*a*) The slaughter of any animal that became clinically affected with a third the market value paid as compensation to the owner.

(*b*) The collection of pleuritic fluid which if suitable was to be used to inoculate the incontact cattle.

(*c*) The return of the meat and hide to the owner.

(*d*) Quarantine of the herd for 6 weeks following the death of the last case.

The start of the first World War interrupted the eradication campaign as also did the outbreak of Spanish Influenza in 1918 and the disease smouldered on in the outlying district, the last case occurring in 1926, when the campaign ended.

Foot and Mouth Disease

Foot and mouth disease broke out in Southern Rhodesia in 1931 when Bevan introduced an intranasal inoculation of virulent blood to incontact animals in order to pass the disease quickly through the herd and so obtain an immunity.

Early in 1933 the Bechuanaland Protectorate became infected and at the same time there was a small outbreak in the Transvaal and the Cape Province. The Protectorate outbreak which on being typed was found to be a variant of the O type was dealt with by Bevan's inoculation.

It was particularly noticeable that the lesions and symptoms of foot and mouth disease on Protectorate native cattle were milder than those seen on cattle in Europe.

Lameness was mild, except when the animals were on trek or in wet weather. "Lip smacking" was absent but foot lesions sometimes caused a kick or double kick of the hind feet ending in a shake of the foot. Vesicles on the udder or scrotum as occasionally seen in Europe were absent. Sheep were unaffected naturally.

A sweet necrotic odour was perceived when standing in a kraal of badly infected cattle similar to the smell of lesion virus.

The only sequel to the disease was the separation of the hooves which was useful in indicating when the disease occurred.

The inoculum was virulent blood obtained from an affected animal at the height of pyrexia and shortly before the rupture of the vesicle; 2 c.cs were injected intranasally into the cattle to be immunized.: 800,000 cattle were so

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treated, starting at Ramathlabama and ending on our Northern boundary, with an effective cordon established on the Western side.

An active inoculator with good crushes, an electric prodder and efficient helper could inoculate 1,500 cattle a day. Five months after this outbreak, a few cases were found on the Baralong farms, due probably to a chain of cases in animals which did not react at the time of the general inoculation; these were quickly dealt with.

During the second week of May 1934, foot and mouth disease broke out at Sukwane near Rakops on the Botletle River among a herd of 300 cattle, trekking eastward from Maun.

Active disease was found at distant parts over a large area North and Northwest, and included the area from Rakops to Maun, the Ghanzi farms, Chobe River area, and the Okovango swamps.

It was decided to cordon off the whole area 60,000 square miles in extent, and establish a cattle free zone 30 to 100 miles wide around it.

An inoculation production station was established at Maun, and stock inspectors were stationed at selected sites. Speed of operation was recognised as the essential factor as all inoculations were based on the fact that they must be completed before the October rains, when transport would be difficult if not impossible. An aeroplane and three 1½ ton motor lorries were therefore engaged for the delivery of inoculum at regular intervals at required sites. Eight aeroplane landing grounds were constructed, but these were insufficient and a system of dropping inoculum by parachute was instituted. For instance on the Ghanzi farms 200 miles distant 6,000 doses were delivered every third day while the swamp areas were regularly supplied to keep the inoculations in full swing: 261,774 animals were immunized and the campaign was completed on September 24th, only four months after the report of the outbreak.

The inoculum used in this outbreak was the same blood virus as in the 1933 outbreak, but fortified by vesicle fluid collected from unbroken vesicles to which had been added free epithelium and fibrinous matter collected from such vesicles and macerated. From 4,000 c.c. to 10,000 c.c. of blood virus was obtained at each bleeding, and was fortified by adding 5 c.c. of macerated lesion virus to each Winchester quart. It should be added that the local traders at Maun and the Africans kept the virus reservoir constantly supplied with 50 to 150 cattle, and gave full co-operation at all times.

Lobatsi Abattoir

In 1927 Sir David Graaff negotiated with the Government for the erection of an abattoir and cold storage works at Lobatsi and eventually he received permission to erect this abattoir in exchange for an area of ground on the Molopo River west of the Baralong farms. This was cancelled in 1931; the Government purchased the buildings, and the land was returned to Government.

In August 1934 the Bechuanaland Cold Storage opened the works for slaughter of 650 cattle; the property of the Imperial Cold Storage. On completion of this killing, the buildings were leased by Messrs. Bongola Smith & Gelman, who exported frozen meat (principally boned beef) to Eritrea for the Italian military forces via the Union Cold Storage Durban and operations were continued throughout 1935.

Staff

Staff difficulties were experienced, particularly during the early years. After arriving in 1905, I obtained my first stock inspector in 1908 and a second veterinary surgeon was engaged in 1914. When I left in 1935 there were 6 veterinarians (all M.R.C.V.S.) on the staff.

LIEUTENANT-COLONEL H. WATKINS PITCHFORD, F.R.C.V.S. J. P.

Transcribed verbatum by Dr. J. H. Mason from The Veterinary Journal (1906) **62**, 61-62, *to the Editor of which Journal we extend our thanks.*

Colonel Watkins Pitchford was born at Tatten Hall, Cheshire, in 1866, and is the third son of the Rev. J. W. Pitchford, Vicar of St. Jude's, London, S.E., a representative of an old Shropshire family that is mentioned in the Doomsday Book. He was educated at the St.

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Olive's Grammar School, London, and the Royal Veterinary College, Camden Town, graduating on May 16, 1889, and taking the Fellowship in 1894. For some years he practised in the neighbourhood of Sandhurst, but, being offered the post of Principal Veterinary Surgeon to the Colony of Natal, he sailed for Durban in June, 1896.

At that period the Colony was threatened with rinderpest, and Colonel Pitchford was at once called upon to combat the disease. The undertaking was an arduous one, as there was little or no machinery, either legal or executive, in existence beyond some dozen stock inspectors, with whom his predecessor, Mr. Wiltshire, had for many years fought single-handed an uphill fight. He at once grappled the situation and made a journey to the North of the Transvaal to meet Dr. Theiler, of Berne, who at that time wat Veterinary Adviser to the Transvaal Republic. A joint scientific investigation of the disease, which had hitherto baffled any but the "stamping out method", was arranged and carried out in the Rustenburg district, whither a complete field laboratory, with all its accessories, was transported by ox-waggon, there being no railways in the country in those days.

Colonel Pitchford's and Dr. Theiler's efforts were so successful that on December 12, 1896, the former was able to report to the Natal Government: "*We have discovered a process by which undoubted immunity can be conferred, and I see no reason why the progress of the disease in South Africa should not be arrested by its means.*" The process alluded to is the present "serum system," the best of all the methods devised. It has stood the practical test of time, and there is not a shadow of doubt, that, in spite of numerous claimants for the honour, Colonel Pitchford and Dr. Theiler were the first discoverers of it.

To Colonel Pitchford also is due the credit of the organisation of the Natal Civil Veterinary Department on its present lines, and the Colony shortly after his arrival was divided into nine or ten districts, each under the charge of a qualified veterinary surgeon.

Shortly before the outbreak of the South African War he was asked by the Imperial authorities to undertake the formation of a veterinary corps for service in the field. The Civil Veterinary Staff responded to a man, and within a few weeks of the call for their services the Natal Veterinary Corps was enrolled, equipped, and in the field. The corps served throughout the war, and did yeoman service in helping out the sorely tried Army Veterinary Department, which from years of apathy and neglect, combined with systematic snubbing from the War Office, had been allowed to sink into an absolutely inefficient condition. The Natal Veterinary Corps is now part of the Militia Defence Force of the Colony, under the command of Major Woollatt, F.R.C.V.S., who assumed charge when Colonel Pitchford was appointed Principal Veterinary Officer on the permanent paid staff of the Natal Militia Defence Force. About the same time he was appointed Bacteriologist and Director of the Research Laboratory at Pietermaritzburg, and Analyst to the Colonial Government, giving over charge of the Natal Civil Veterinary Department to Major Woollatt. The work of the laboratory is of a most important nature, most of the preventive and curative serums, vaccines, calf lymph, & c., being prepared there; and the magnitude of the work will be realised by the fact that 40,000 doses of vaccine for quarter evil alone were distributed in Natal during the past year. Bacteriological work proper, such as the diagnosis for tuberculosis, enteric fever, glanders, diphtheria, & c., are matters of daily routine, and this work is daily increasing.

Many valuable reports have been lately issued from the laboratory under Colonel Pitchford's direction, on subjects such as "Horse Sickness", "The Characters of the Mark VI. Service Bullet," "The Bacteriology of the Plague Bacillus", "A Review of the Efficacy of Modern Disinfectants", "A Report on the Use of Copper Salts in the Treatment of Water Supplies", and "A Comparison of the Snake Venoms of Natal." The mention of these titles will serve to show the wide field of usefulness covered by this institution.

In addition to his other appointments, Colonel Pitchford is a Justice of the Peace, and the Analyst to the Corporation of Pietermaritzburg.

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THE BIGGEST PIG FARM IN EUROPE

With due acknowledgement to a contribution by R. Tray-Smith, appearing in *The Farmer and Stockbreeder* 77; 94-99 (1963).

The author describes a visit to the giant pig-producing factory at Ihan in Yugoslavia. Built only four years ago, Ihan has till recently contained 40 pighouses spread over 20 acres. It is now being doubled in size. Each house has a capacity of 1,010 weaners or 505 baconers. The 3,000 pedigree sows now owned were bred from 200 Swedish Landrace females imported four years ago, in order to produce 60,000 baconers per annum. The original sows, under the standard of management at Ihan, are claimed to have averaged 2.4 litters a year, with 25.34 piglets born alive and 21.26 reared to slaughter. The quality of this breeding stock is high: length at slaughter at six months averages 954 mm and conversion rate from weaning to slaughter is 3:1.

Before entering the piggery visitors are required to don sterile gumboots and overalls. Sows enter the vast seventy-four pen farrowing house in groups, 5 days before farrowing. Three days later the farrowing rails are placed in position to form a farrowing crate and remain until the litter is 10 days old. Infra-red lamps are fitted above each creep. The piglets are weaned at 28 days at an average liveweight of 19 pounds. Sows are removed for service by A.I. from one of the 95 boars five days later, and the entire house is disinfected and kept empty for 10 days before the next cyclical farrowing begins. There is one man on duty in the farrowing house; feeding and cleaning are done by farm service groups.

Weaners move into a 1,010 capacity house and at 60 lbs. the numbers are halved to 505 pigs per house until bacon weight; reached in an average of 172 days. These houses are of well-insulated Danish type, with electric extractor fans and removable windows. On a hot day there is no smell whatsoever. At the end of each house there are overhead feed hoppers for gravity-filling of food trollies. All pigs are fed under the supervision of a nutritionist and much of the success achieved is due to skilful rationing. A hundred-pig testing station is used to formulate and control rations, of which no fewer than 12 are in use, including rations for pregnant sows, lactating sows, two prestarter formulae, a starter ration, two growth and one finishing ration.

Renewal of the breeding herd is based on performance and progeny testing. About 2 to 5 boars are selected from 100 uncastrated males at 250 pounds liveweight after performance test, and thereafter proved by progeny test on 4 pens of 4 sows apiece. Females are selected from the best of the tested lines and from parents of proved performance.

Health appears excellent at Ihan although the venture was nearly wiped out by atrophic rhinitis shortly after it began 4 years ago. There is not a cough to be heard and less than 2 per cent of lungs examined at the abattoir show signs of pneumonia. Diarrhoea is checked by Terramycin in the drinking water, injectable iron is administered 3 and 10 days post-partum and a mineral-vitamin drench two days after birth. Progress does not stop here. Swiss veterinarians have been enlisted to carry out a hysterectomy scheme. A three-hundred sow elite breeding centre linked to a progeny testing centre will produce a top herd. This is likely to be composed of Danish and not Swedish Landrace, since Ihan already possesses a breeding-up herd of 40 Danish Landrace.

The whole venture is exceedingly scientifically and competently managed, there being a staff of 19 veterinarians and nutritionists to provide professional guidance. In Slovenia alone, there are three other similar pig-producing factories; one with 50,000 per annum output and two producing 30,000 baconers each.

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ANNUAL MEETINGS OF BRANCHES

REPORT OF THE 14th A.G.M. OF THE CAPE WESTERN BRANCH HELD ON 22nd NOVEMBER 1963.

Opening

In opening the meeting, Dr. Diesel conveyed the greetings of the President who was not able to be present on account of other duties which he was obliged to undertake.

A copy of Dr. Diesel's opening address appears in this issue.

Dr. Diesel stressed the wish of the Council of the S.A.V.M.A. that private practitioners should take a more active interest in the administration of the affairs of the Association. The Chairman then gave his report reflecting the activities of the Branch during the year. He reported that the Cape Provincial Administration had agreed to introduce legislation to reduce the tax on spayed bitches.

Business Meeting

A discussion by members then took place with regard to adherance of the schedule of fees by private practitioners. It was agreed that a revised schedule would be drawn up and circulated tc all members. The following Executive Committee was then elected.

Chairman — Dr. A. Albertyn.
Vice Chairman — Dr. G. L. Muller.
Secretary — Dr. P. M. S. Masters.
Treasurer — Dr. P. C. Belonje.
Additional Members—
Dr. J. Brownlie.
Dr. J. E. Dorrington.
Dr. G. L. Faull.
Dr. S. A. R. Stephan.
Dr. T. Veenstra.
Co-opted Members — Dr. B. Horwitz.
Dr. J. Thomson.

Scientific Meeting

The meeting was then adjourned for a braai-vleis lunch held in the office of the Director of the Maitland Abattoir. After lunch the meeting was resumed in the Lecture Hall of the State Pathological Laboratories, Orange Street where the film "To catch a rhino" was screened, followed by the paper "Salmonellosis in calves & poultry" delivered by Dr. H. J. Botes of Onderstepoort.

Social Gathering.

In the evening 24 members & guests attended a performance of My Fair Lady at the Alhambra theatre.

OPENING ADDRESS BY DR. A. M. DIESEL

The Affairs of the Association

At the recent 58th A.G.M. the suggestion was made that private practitioners should take a greater interest in the administration of the affairs of the Association.

The membership of the Association, which now stands at just on 500, is roughly divided into the following interest groups:

State Employed	
Field Services Republic	90
Field Services S.W.A.	12
Research Republic	60
Private Practitioners	
Republic	190
S.W. Africa	1
Municipal Employed	17
In Commercial employment including A.I. Coops	18
Miscellaneously employed and retired	45
Outside Republic	58
	491

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The inference from the A.G.M. suggestion is that practitioners should fill one or two more seats on Council.

The present Council consists of:

The President—Practitioner
The Vice President — State.
Elected Members — State 6.
Private Practitioners 2.

There are now 191 practitioners and 162 State employed members in the Association. Thus the representation on Council is disproportionate.

Many reasons are of course given why the State servant has greater opportunity to serve the Association in an administrative capacity, the chief one no doubt being their numerical availability at Pretoria, and consequent attendance without the need to travel.

Another very good reason is that the practitioner has his practice to attend to and finds it difficult to be away for 2 or more days at a time, six times a year.

The Association could of course be requested to pay the expenses of practitioners who were elected to serve on Council.

I am not able to argue the case for the practitioner, nor is it my intention to do so. The statement was made at Congress and the inference is that practitioners should be encouraged to make themselves available for election to Council.

As the membership of the Association increases, it is not unlikely that the proportion of non State to State members will be more in favour of the former. The time is not far distant when the number of Council members will increase. The British Veterinary Association must by now have over 8,000 members. They have a Council comprising more than 50 members.

It is true that the Association has six Branches and two Groups.

The prepresentation of practitioner-to-State employed members is possibly more representative on the executive committees of these subsidiaries of the Association.

I do not think that the suggestion made at the A.G.M. was in any way directed at the inability of the State employed Council member honestly to care for the interests of the non-State employed members. The possibility is that the suggestion called on the practitioner, whose numbers are now in excess of those of the State employed members, to share more proportionately in directing the affairs of the Association.

In recent years the Association has been encouraged to hold some of its Annual Meetings and Congresses away from Onderstepoort. The benefits which will accrue to it from this innovation are positive and in principle sound and progressive.

In principle the Public Service does not approve of requests to allow its personnel to attend conferences in unusual numbers in respect of which the State is asked to pay subsistance and transport allowances. The State servants are therefore expected to take leave and to pay their own expenses to attend these conferences.

The need for members to share and share alike in the administration of the affairs of the Association and in contributing equally to its success, is therefore fair and reasonable.

The State too suffers a certain amount of loss and inconvenience when its servants are away from their posts.

There are many ways in which members can contribute to the advancement of the Association, other than taking part in its administration through service on Council or on the executive of Branches and Groups.

They can contribute well prepared articles for publication in the Journal. This of necessity means the collection and preparation of material and its well arranged submission to the Editorial Committee.

The Association has had a Benevolent Fund for many years, which at present is financially in a sound state and stands at R8,444.90. It is largely developed by an annual allocation of R1.00 per member from the General Fund into which members subscriptions are paid. It is also increased through the benevolence of the exhibitors who donate R10.00 to R15.00 per stand at

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Congress Exhibitions, and through the thoughtfulness of one firm which exchanges items such as scissors, pen knives and the like for contributions to the fund.

This year the exhibitors contributed R290.00 and the firm referred to R75.97.

The profits of the Book Fund, until this year, were placed in a Prize fund a/c and the interest from the Prize fund was taken to the Prize Fund Reserve a/c. The Book Fund has now ceased to function. The Prize Fund at the end of the 1962/63 Financial year stood at R1,081.60 and the Prize Fund Reserve at R4,545.92. These two a/c's have now been consolidated and will henceforth be known as the *Major Brown Prize Fund*, which is to be used for educational purposes. This Fund thus stands at R5,727.52.

As the membership of the Association increases so will its obligations to its members increase — assistance to dependents of deceased members and assistance to members in the form of small educational grants.

Members can therefore make independent contributions to these funds.

I thank you very sincerely Mr. Chairman, ladies and gentlemen for inviting me to open this Annual Meeting of the Cape Western Branch.

I feel sure that you will plan the 1964 Congress at Cape Town to make it an outstanding success.

Council and its Congress Sub-Committee will collaborate with you in every detail and put certain funds at your disposal.

I wish you every success for today's meeting, both scientifically and socially, and now declare the Annual Meeting open.

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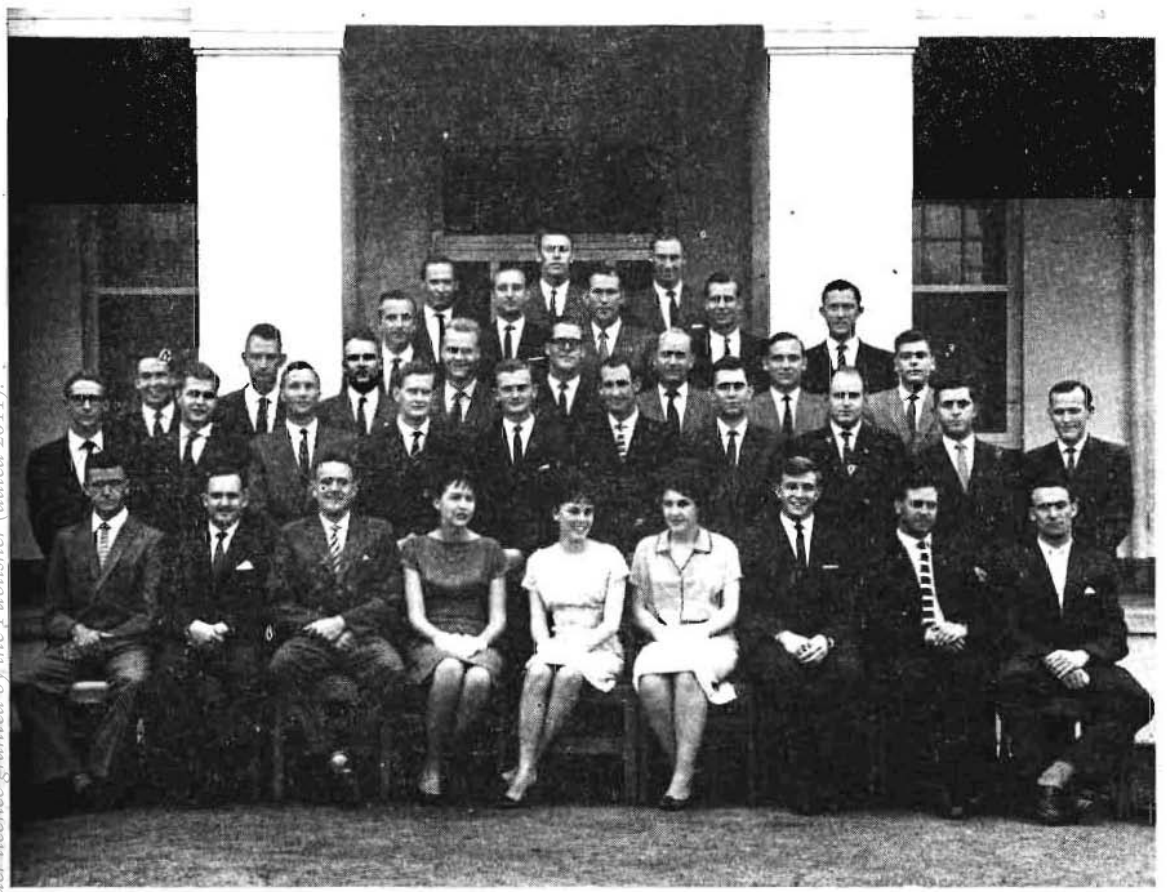
VERWELKOM AAN NUWE GRADUANDI VAN 1963

PROF. B. C. JANSEN, DEKAAN VAN DIE FAKULTEIT, SPREEK DIE NUWE GRADUANDI TOE

Op Vrydag 22 November is gedurende 'n gesellige en aangename byeenkoms van die 21 Graduandi afskeid geneem.

Nadat Prof. Hofmeyr as Sekretaris en Seremoniemeester, hulle aan die gehoor voorgestel het, wens die Dekaan Prof. B. C. Jansen hulle geluk uit die besondere prestasie wat hulle behaal het. Die mening word verder deur hom uitgespreek dat daar op elkeen van hulle



Voor ry L. na R. L. M. Orsmond., C. P. van der Merwe., J. C. Austin., G. Crewe (Mej)., A. Faul(Mej.), M. Thomson (Mej.), M. P. Brightman., J. W. van der Vyver., S. S. Lombard.
2de ry L. na R. R. D. Sykes., C. Beacon., F. M. Freeman., C. J. Visser., E. A. Jaques., D. B. Weaver., A. Immelman., R. B. Bilbrough., P. J. Pullinger., A. J. Jordaan.
3de ry L. na R. C. M. Veary., E. Young., F. W. G. van Ludwiger., G. H. Vogelzang., J. A. Chandler., A. C. Wellington., M. J. O. Taylor., C. I. van Wyk.
4de ry L. na R. I. Zumpt., J. H. du Preez., J. H. van Schalkwyk., S. J. T. Downes., W. D. Russell.,
Heel agter L. na R. R. J. Sutherland., C. P. Harte., R. A. Wilson.

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staatgemaak kan word om sy/haar bydrae tot die handhawing van die Professie se doelstellings met opregte eergevoel, te lewer.

Prof. Jansen wys op die interessante toekoms wat vir hulle voorlê, en vra hulle om van die „blinde entoesiasme" wat so kenmerkend van die jong lewe is, gebruik te maak. Die jare wat volg sal geleidelik deur vertroue versterk word.

Die volgende kandidate het die eer te beurtgeval om pryse te ontvang:

E. Young—Verwerf graad met lof.

(i) Theiler Medalje.

(ii) I.C.I. Prys vir Infeksie siektes en Geneeskunde.

(iii) Agricura Prys vir Patologie.

S. S. Lombard.

Kliniese Medalje.

C. P. Harte.

I.C.I. Prys vir Chirurgie en Geslagskunde.

M. J. O. Taylor.

Pfizer Prys.

R. D. Sykes.

Maybaker Prys.

Mev. de Wet word bedank

Daar word ook van hierdie byeenkoms gebruik gemaak om afskeid te neem van mevr. de Wet. Sy word deur Prof. R. du Toit, afgetrede Dekaan, hartelik bedank vir haar besondere bydrae. 'n Geskenk namens die Fakulteit word aan haar deur Prof. du Toit oorhandig.

Die byeenkoms word afgesluit nadat die innerlike versterk is deur verversings wat op 'n uiterse smaakvolle wyse deur die gades van Fakulteits lede voorgelê is.

Prof. R. Clark — Vise President van S.A.V.M.V. verwelkom die Graduandi tot die Professie

Prof. R. Clark, Vise-President van die S.A.V.M.V. het die pasgegradueerdes toegespreek. Hy het hulle in die professie verwelkom en hulle om die prestige van die professie te verryk en te verhoog. As lede van die S.A.V.M.V. sou hulle dan ook meer kan bydra hiertoe en is hulle adviseer om aansoek te doen vir lidmaatskap.

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AUSTRALIA

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION

DIVISION OF ANIMAL HEALTH

FELLOWSHIP FOR RESEARCH ON OVINE FOOTROT

The Australian Wool Board, through its Wool Research Committee, has established a Research Fellowship of three years duration for further research on the bacteriology and epidemiology of *Fusiformis nodosus* infections in sheep and other animals.

The Fellow will be appointed to CSIRO's Division of Animal Health but will be seconded to the Veterinary Laboratory of the Tasmanian Department of Agriculture at Launceston, Tasmania.

Salary will be within the range paid by CSIRO to Research Officers or Senior Research Officers, according to qualifications and experience. These ranges at present are: For R.O. £A1,794 to £A2,631 and for S.R.O. £A2,755 to £A3,115, (but these scales are under review).

Applications are invited from graduates in Veterinary Science, Agricultural Science or Science, who have had post graduate research training and experience in laboratory and field investigations of infectious diseases of animals. Previous experience of such work in relation to diseases of the feet of sheep will be an advantage but is not essential.

Consideration may be given to the continuation of F.S.S.U. arrangements. Fares paid for the appointee and his dependent family and return fares to point of origin will be paid upon termination of the Fellowship.

Background information concerning the problems involved and the conditions under which the appointee will work may be obtained on application to:—

Mr. W. Hartley, Chief Scientific Liaison Officer, Australian Scientific Liaison Office, Africa House, Kingsway, London, W.C. 2.,

to whom applications (quoting Appointment No: 201/224) should be addressed by the 18*th April*, 1964

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PUBLIC RELATIONS SERVICE

Dr. J. A. Thorburn has been elected to the Board of Directors of Cooper, McDougall & Robertson (C.A.) (Pvt.) Limited.

There are now three Directors who are veterinarians and born in Africa, on the Boards of regional Cooper Companies in Africa. Dr. H. S. Purchase is a Director of Cooper & Nephews S. Af. (Pty.) Limited, and Dr. H. G. Wallace is a Director of Cooper, McDougall & Robertson (East Africa) Limited. Dr. H. E. Harbour, who is a veterinarian and also a Director of the *mother company*, Cooper McDougall & Robertson, Limited, Berkhamsted, recently visited Kenya, Central Africa and the Republic of South Africa.

Dr. W. Plowright has left Kabete for Canada where he has been appointed to the Chair of Virology at the University of Toronto.

Capt. Robert M. McCully, of the Armed Forces Institute of Pathology, Washington DC, U.S. Airforce and his family have arrived in South Africa: Capt. McCully will spend three years at the Onderstepoort Veterinary Research Institute chiefly in the Section of Pathology.

Dr. Max Sterne, D.V.Sc. (S.A.), Dip. Bact. (London) M.R.C.V.S., has been appointed Head of the Bacteriology Department at the Wellcome Research Laboratories, Beckenham, Kent, in succession to the late Mr. Harry Proom.

Dr. Sterne, who has held a senior post in the Department of Anaerobic Bacteriology at the laboratories since 1951, played a considerable part in developing "Covexin", the first "seven-in-one" vaccine against clostridial diseases in sheep, and the deep-tank culture method of preparing vaccines.

Before 1951, he was on the staff of the Veterinary Research Laboratories, Onderstepoort.

Anyone visiting England with the object of being employed as an assistant in a veterinary practice should contact either Dr. J. F. W. Grosskopf of the Section Physiology, Onderstepoort or Dr. Dirk Neethling, P.O. Limburg, Potgietersrus. These colleagues will put him in touch with a practitioner at Metlock, Derbyshire who prefers South African veterinarians.

Prof. Freersken of the Tuberculosis Research Institute, Hamburg, Western Germany, was on a study tour of South Africa during February 1964, and delivered a lecture at Onderstepoort.

The Council of the Royal Agricultural Society of England, 35 Belgrave Square, London S.W. 1., has cordially invited all members who will be in England during July 1964, to visit their Royal Agricultural Show which is to be held at Stoneleigh Abbey, near Kenilworth, Warrickshire, from 7th–10th July 1964, at no charge for admission to themselves or their wives.

Anyone interested should communicate with Mr. Paul Osborn, the Deputy Secretary of the Royal Agricultural Society, giving his and his wife's name, his occupation, country of origin and address in England to where the tickets should be sent.

The National Grassland Demonstration will be held on the showground on 27th to 28th May 1964.

BOOK REVIEWS

THE EQUINE TARSUS

Topographic and Radiobraphic Anatomy Gyula Kovacs, D.V.Sc.
English translation by Pal Makay

97 pages text, 14 plates in colour, 8 plates black and white and 23 figures. Price R6.00

Akadrmiai Kaido, Budapest 1963.

As its subtitle clearly idicates, this book covers the topagraphic and radiographic anatomy of the normal equine tarsus, and is the outcome of a specially directed study. No data are given concerning the number of preparations studied, nor are age, sex and breed differences enlarged

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upon, except for a few incidental remarks concerning differences between "eastern" and "western" races. Kinetic aspects are not touched upon; only twice are structural arrangements predisposing to pathological states alluded to (luxation of the superficial digital flexor tendon, p. 58, and capped hock and curb, p. 57).

In the first chapter a critical and informative evaluation is given of the literature concerning topography and radiography of the equine tarsus. This is particularly useful to colleagues having little access to the scientific literature of Eastern Europe.

In the second chapter, six pages are devoted to a rather belaboured account of general concepts and principles of methodology of anatomy in general and topographic anatomy in particular — an account more in keeping with the introductory chapter of a textbook on anatomy. The second part of this chapter deals with principles and general techniques of radiographic anatomy. The value of stereoradiography is stressed and a general description of methods employed and snags encountered is given. For straightforward radiography of the tarsus it is recommended that a focussing distance of 70 cm. be used for general survey and one of 50 cm. for detailed study. Furthermore, two levels of focussing are necessary to obtain a complete picture of the tarsus in each of dorso-planter and mediolateral views. Examples are given in the form of six full page radiographs of fair quality. Beyond this, no technical guidance is provided. Poor quality of reproductions of radiographs is advanced by the author as reason for the paucity of radiographic illustrations.

The third chapter of thirty pages deals with the detailed topographic anatomy of the soft structures of the hock. The exterior is described as seen from each of the four aspects, then the externally visible and/or palpable structures followed by a stratigraphic account of the various structures in the same sequence. Minutiae concerning thickness of cutis, mobility of skin, the fascial layers, ligaments and bursae are given — information not found in the average run of text-books on systematic anatomy. An additional tendon of insertion of the *M. fibularis tertius* — a "deep" lateral branch, detaching itself from the medial tendon and inserting with the lateral ("superficial") branch is described. There is good detail concerning the tendon sheaths.

Some additional information over and above that commonly available concerning the course and finer branching of bloodvessels and nerves, as well as of the lymph vessels and their drainage, is also supplied. The author calls the prominent cutaneous branch of the tibial nerve to the medio-plantar aspect of the lower leg and hock the *N. cutaneus surae tibialis (posterior)* and employs the same name for the *N. cutaneus surae cavdalis s. plantaris* running on the lateral aspect of the crus.

Complete detail of attachments and extent of the joint capsules and of the various interosseous ligaments is lacking. It comes in for incidental mention in the next chapter, a ten-page systematic account of the osteology of the tarsus. In order to do justice to his subject, the author is forced to bring in additional osteological terminology; this he does with judicious restraint. One can only take issue with him on his usage of the term "cochlea" for "trochlea" of the tibial tarsal bone, and thus on his reference to the trochlear crests as "trochleae".

The description of the soft tissues are supported by fourteen full-page plates in colour, the excellence and clarity of which is only marred by the fact that some of the muscles are of the same general colour as that of the bone and tendon. The osteology of the tarsus is illustrated by twenty-four photographs of fair quality, contained in six plates. Unfortunately the useful practice of mentioning the indicator and plate number in the text as each structure is described has not been followed.

The final chapter of twenty pages of the radiographic anatomy of the tarsal bones constitutes the useful core of the book. The outlines of each bone in a radiograph of the tarsus are dealt with, as well as the shadows superimposed by contiguous bones. Seventeen text figures in line drawing and two radiographs with over-drawn lines serve to illustrate the descriptions. In this part of the text adequate reference is made to the individual figures and lines representing certain structures, but, by contrast, detailed legends to the figures have

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been omitted. Once again quick reference is hampered. Only long usage by radiographers will fully determine the value of this text, which appears to be a superb piece of painstaking work.

One has to bear in mind that this book is a translation into English by a Hungarian, probably not a specialist in the particular field. In a few fortunate instances the result is refreshingly original, sometimes bears a piquant tang, but at times is downright confusing (on pp. 50 and 56 the impression is created that the deep inguinal lymph node lies under the anterior tibial muscle) and erroneous (use of the term "lateral" for "collateral"—"the medial lateral ligament"—and the use of a redundant term "radial" when "radiological" is meant.) Despite this, it represents a creditable performance; anatomy produces a severe strain on any language, let alone translations. (Could the various national veterinary associations assist in this respect by offering free editorial service?).

The typography is very good, on art paper, with a minimum of errors. A heavy cover with an attractive reproduction of a painting by Hsu Pei-hung rounds off a neat publication.

Although not an exhaustive treatise on tarsal topography — the author freely admits as much — it constitutes a useful work of reference for the surgeon and a major contribution to tarsal radiography: it is to be regarded as a welcome addition to specialised veterinary literature.

H. P. de B.

MILK HYGIENE—Production, Processing and Distribution—Abdussalam et al.

W.H.O. Monograph Series no. 48, World Health Organisation, Geneva, 1962.

8 vo pp. 767, Figs. 191, Tabs. 36: R6.00.

This is a comprehensive manual to which a number of acknowledged authorities have contributed, and it covers all the ways and means of ensuring that milk and milk products are both harmless and wholesome. It deals extensively with diseases transmitted through milk, milking hygiene on the farm, handling and processing of milk in the dairy, regional and special problems in advanced as well as developing countries, and a chapter on training and administration is included. Modern practice relating to those problems which are likely to occur in the dairy industry at various levels of intensification is outlined in a clear methodical manner.

Persons interested or dealing with the various facets of milk hygiene will find in this monograph a wealth of knowledge and practical reference.

L. W. v.d. H.

PRINCIPLES OF VETERINARY RADIOGRAPHY

by S. W. Douglas and H. B. Williamson. Balliere, Tindal and Cox, London & Edinburgh.

pp. 243, Numerous illustrations. Price 45/-

If radiography is to adequately fulfil its purpose as diagnostic aid, the first essential is correct positioning, and equal to this, adequate radiographic technique. Failure to apply these principles leads to incorrect diagnosis and a waste of time and materials. A full appreciation of the dangers of x-rays and of protective measures is a sine qua non for the safety of the operator, his assistants and patients.

In the first 89 pages the theory and equipment of radiography are discussed. Without embroidery, the authors describe the use of various types of equipment and general routine, but also give the reasons, scientific background and theory. They thus enable the professional man to have an intelligent grasp of the matters at issue.

The rest of the book then proceeds to describe actual radiography with emphasis on positioning. The major portion describes radiography of the skeleton in the small animal. This is succeeded by relatively short sections on soft tissue radiography, where the technique requires more delicate skill in photography and interpretation. Discussion of contrast media techniques of the various systems is included in this section. As these techniques tend, more or less, to fall within the domain of the specialist, the authors have given them relatively little space.

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The final chapters are concerned with radiography of large animals — the head and neck and the limbs from elbow and stifle distally. Here, again, more valuable information is offered. Despite the most valuable clinical and physiological data that will accrue from large animal thoracic and abdominal radiography, these are a relatively closed book as apparatus powerful enough for these purposes are prohibitively expensive and thus few and far between. As this book was written for general practice omission of what is known of this aspect is justified.

The book under review is clearly printed on excellent paper with matching illustrations and has been a pleasure to peruse. As it is devoted to the radiography of normal tissues it is hoped that the authors will follow it with a companion volume dealing with radiological technique and interpretation of pathological lesions.

The acquisition of this book by those interested in radiography is recommended.

C.F.B.H.

BAILLIERE'S VETERINARY HANDBOOK (FORMERLY BANHAM'S VETERINARY SURGEONS' VADE MECUM). 9th EDITION.

p.p. VIII — 171. Edited by G. N. HENDERSON AND J. STRATTON.

Bailliere, Tindall and Cox, London. 1963 21s.

The editors are to be congratulated on the very thorough manner in which they have reviewed, regrouped and largely rewritten this handbook, last published in 1952. They have been ably assisted in this task by five contributors, and the result is an up-to-date and readable text which provides a wide variety of practical information in easily accessible form.

Chapter 1 on therapeutics includes sections on chemotherapy, posology, synonyms and tradenames, prescription writing, toxicology, anaesthesia and fluid replacement therapy. Although the modern method of writing prescriptions in full in English is illustrated, the editors have obligingly included 3 pages of Latin words and abbreviations "formerly used in prescription writing" for the less modern-minded amoung us. The chapter on bacteriology contains a useful classification of bacterial, viral and fungal diseases, as also a section on stains and staining methods. Another extensive classification, (protozoa, helminths and arthropoda) is contained in the chapter on parasitology, and the usual parasitological techniques are also described. A useful store of information, not easily gathered elsewhere, is to be found in the chapter on small animal practise, where brief descriptions of the common ailments and their treatment is supplied in respect of monkeys, rabbits, small rodents, tortoises, tropical fish and cage birds. Normal data, including notes on description and dentition, is fully set out for the various species in chapter 4. The remainder of this handbook comprises chapters on notifiable diseases (including a table of incubation periods), allergic tests, blood and uring (mainly devoted to urinalysis) and a final chapter of miscellaneous information.

This book is well printed, moderately priced and has had an index added to increase its usefulness. Its compact and lucid arrangement makes it especially useful to senior students and the busy practitioner.

R.K.L.

DON. R. ARTHUR. BRITISH TICKS. BUTTERWORTH.

213 pages, numerous line drawings, 9 pages References. Price 55/-

This book is written mainly for the use of zoologists, parasitologists, veterinarians and others in Great Britain whose concern is the study and control of arthropod diseases. A study necessitating a knowledge of the taxonomy and general bionomics of the vectors.

The major portion of the book deals with the identification of 16 *Ixodes* species, 1 *Dermacentor*, 1 *Haemaphysalis*, 2 *Argas* species and 1 *Ornithodoros*; giving in each instance a detailed description, accompanied by original figures of all the known stages (in only a few instances are figures borrowed from other publications), with an analysis of the taxonomic literature and synonymy.

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Assisted by the definition of the morphological terms used, and by the generic and specific keys, workers should have no difficulty in running a species down to its probable identity; which identity can then be checked against the detailed descriptions and excellent figures.

Up till the end of 1961, the synonymy, literature and iconography for the British-Isles have been well scanned, many European publications have been consulted, so that the identifications of the *Ixodes* species are up to date; regrettably, however, some European publications have been overlooked — e.g. those referring to *Ixodes berlesei* Birula 1895, which sink *I. caledonicus* Nuttall 1910 as a synonym thereof.

The biology of the *Ixodes* is well covered; unfortunately, however, somewhat inconsistently in that sometimes reference is made to ecological conditions in European countries and at other times not.

Compared with the almost monographic treatment given to the "Taxonomic section" of the *Ixodes* the "Distribution" is lamentably weak. The British-Isles are given in great detail, but the information for the North African, European and Near East countries is but poorly covered, giving a misleading distributional picture for most species. Some of the main references which have been overlooked are: *Libya* Hoogstraal and Kaiser 1962, Marocco (Tangiers) Charrier 1925; *Algeria* Senevet 1928 Sergent and Poncet 1939; *Spain*, J. de Prado *et al* 1960; *Portugal*, Tendeiro 1962, *France* Lamontellerie 1954; Euzeby 1959, Morel 1959, Morel *et al* 1961, *Italy* Merighi 1959, Battelli 1961; *Czechoslovakia*, Rosicky 1953, Maucha *et al* 1959, Balat 1961; *Germany* Zumpt 1960; *Poland* Kafalski 1956; Zwolski 1960; Lachmajer 1962; Cerny 1959; *Jugoslavia* Mikacic 1949 and 1963; Mekuli 1955, Petrovitch and Simitch 1959; Delic *et al* 1958, Rosicky *et al* 1960; *Hungary* Kotlan 1957, Babos 1958; Janisch 1959; *Turkey*, Parrish 1961; *Iraq*, Patton 1920, *Iran* Rafyi 1958, 1963, Abbassian-Lintzen 1960, 1961; *Israel* and *Sinai* Theodor 1960, Feldman-Musham 1954, 1961; Hadani and Gwilich 1963.

The literature on the revision of the genus *Hyalomma* has been poorly scanned so that the chapter on *H.aegyptium*, the mediterranean Tortoise tick, is both inadequate and inaccurate. The *Argasidae* are treated adequately, but as in the *Ixodes*, the distribution records are incomplete.

A minor though disturbing, ecitorial fault lies in the presentation of the legends to the illustrations, much time is wasted in finding one's way about; this annoyance could have been obviated by italicising the stages *male*, *female*, *nymph* and *larva*. Another slight editorial irritation is the inconsistency in "Distribution". Sometimes the countries are in italics at other times not. A host-parasite list would have been welcome.

In view of the present day accent on ticks as vectors of diseases it seems a pity to the reviewer that the reader has been fobbed off with but introductory comments and a reference to another publication.

However, despite these minor editorial failings, and despite the incomplete coverage of "the extra — Great Britain literature", the book admirably achieves its primary purpose: British species can be readily identified at all stages of their development; their ecological and host preferences, as for Great Britain, established. Veterinarians outside Great Britain can easily gather, according to the locality from which an animal is exported as to what tick(s) it might be carrying upon importation.

G. T.

SMALL ANIMAL ANESTHESIA.

Balliere, Tindal, and Cox, London. 420 pages, 125 illustrations (one in colour). Published in 1963.

Price in London 90/-.

Professor W. V. Lumb of the Colorado State University opens the preface with this paragraph:—

"In the past twenty years veterinary anesthesiology has made great strides. New equipment, new drugs and new techniques have developed

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with amaizng rapidity. While teaching small animal anesthesiology it became apparent to me that although much information on the subject has been published, most of it is quite inaccessible to the student or practitioner. Thus a need existed for a comprehensive text which contained material from widely diverse sources and which integrated this information".

This book bears testimony that he has accomplished this task admirably. From a large number of references all recorded at the end of each chapter research findings are punched into every line, and he has marshalled the facts crisply and clearly, often tabulating them into chronological order or an order of descending importance. It probably is on this account that the book makes easy reading.

Each chapter has a summary of the headings appearing in the chapter, and each heading is boldly defined by a heavier print. All aspects of anaesthesia are dealt with, the physiology of the patient and pharmacology of the drugs receiving special attention, and the factors that must be taken into consideration when anaesthesia is contemplated, the preparation, the anaesthesia itself and the aftercare are fully discussed.

In spite of a very wide field of drugs annotated, it comes as a surprise that diethylthiambutene hydrochoride (Themalon) which is fairly widely used in Britain and this country, is omitted. Also the difficulties experienced with anaesthetic machines using uni-directional valves on small dogs and cats, and vapourisers not equipped with temperature compensatory mechanisms, could have been further elaborated to help the uninitiated, especially now that closed circuits are becoming popular.

The colour chart showing the gas cylinder colour code does not apply to this country or Britain, and students are advised to note the differences.

This book can be recommended confidently as a text book for students, a "brush-up" book for the practising veterinarian, and the "springboard" for the research worker.

J.L.D.

ANIMAL TECHNICIANS ASSOCIATION THE A.T.A. MANUAL OF LABORATORY ANIMAL PRACTICE & TECHNIQUES

Editors

DOUGLAS J. SHORT, M.B.E.
DOROTHY P. WOODNOTT

Foreward by CHARLES HARINGTON, K.B.E., F.R.S.

Medical Research Council

Crosby Lockwood & Son Ltd., London, 1963,

pp. 350, Illustraded W 45/-

For whatever purpose laboratory animals are used, it is essential that they be healthy if the result of an experiment is to be valid. Trite though this statement may be, it is rightly the main, but by no means the only, theme of the A.T.A. Manual.

When a new laboratory or institute is designed, there should be no skimping in space or equipment for small animals and their accommodation should receive just as much careful consideration as the lay-out of the 'show' laboratories. When existing buildings, already overcrowded, must be altered to provide space there is, perhaps, some excuse for compromise, but worry and trouble will surely follow an 'anything-will-do' policy.

The A.T.A. Manual, divided into 24 chapters, each written by an expert, covers the breeding, feeding and housing of small animals, and should be read, in part at least, by every laboratory worker who uses animals. In fact, many chapters would repay study by the practising veterinary surgeon, particularly those on 'Sterilization and Disinfection', 'Common Diseases of Laboratory Animals', 'Pests of the Animal House', 'Techniques and Practice in the Use of Radioisotopes', 'Animal Genetics', 'Mammalian Reproduction', and 'Nutrition'.

Among others, the following aspects of breeding, feeding, watering and housing are discussed at some length:

> the health of incoming stock, the design of the animal house, cages, the composition and pests of food, bedding, feeding, hoppers and watering devices, disposal of excreta and soiled bedding, diseases (bacterial, viral, helminthic, parasitic and protozoal) with

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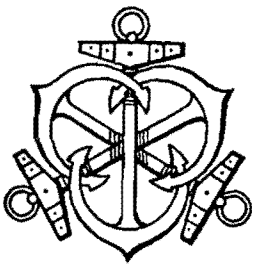
their prevention and control, genetics and reproduction. Although the 'common' laboratory animals (the mouse, rat, guinea-pig and rabbit) come first, the care and management of the cat, dog, hamster, ferret, monkey and fowl are discussed and a chapter is devoted to amphibians, reptiles and fish.

Although each laboratory will use the house, food, cage etc. best suited to its needs and purse, an intelligent reading of this Manual will almost certainly lead to the adoption of something that is cheaper, more labour-saving or better.

The chapter on 'Techniques for Infected Animals' is a very important one for any laboratory working on infectious diseases, particularly if they are easily transmitted and can infect man.

There are some useful tables that list information hard to find when one is in a hurry, for example, those on the control of pests, on reproduction and on diets.

The book is copiously illustrated with clear, understandable photographs, and the printing, paper and binding are of good quality. It can be thoroughly recommended, and should be freely available to all animal attendants and to those laboratory workers who use animals in their work.



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OBITUARY

DOUGLAS DAVID MORTON

DOUGLAS DAVID MORTON, born at Rouxville on 7th April, 1895, passed away in the Voortrekker Hospitaal, Kroonstad, on 12th October, 1963, after a protracted illness.

He went to St. Andrews School, Grahamstown, matriculated in 1913, and attended Rhodes University.

After a course at the Potchefstroom College of Agriculture in 1915 he took his M.R.C.V.S. degree at the Royal Veterinary College Dublin, qualifying during July, 1921.

On his return to South Africa he was, in September of that year, appointed Government Veterinary Officer, Sibasa, where he made a substantial contribution to the final eradication of East Coast Fever from the Northern Transvaal. He was then transferred to Greytown, Natal, for a short period prior to taking charge of Zululand with headquarters at Eshowe.

On 1st October, 1925 he transferred to the South African Police as Veterinary Officer with the rank of Major and was stationed in Pretoria. During this period he suffered a sad bereavement in the loss of his first wife.

On the founding, during 1938, of the Police Remount Depot at Grootdam, Kimberley district he moved down there and when this establishment was dispersed he returned to the service of the Department of Agriculture on 1st November, 1949, as Senior State Veterinarian, Pretoria, but was transferred to Cape Town early in 1950, where he served until December, 1954, when he resigned from Government service to go farming in the Viljoenskroon district, Orange Free State.

He was a rugby enthusiast and played for Rhodes University. During his study period in Dublin he was a distinguished member of the South African team there, and later of the Lansdown Rugby Club. He played rugby for the Barbarians during the 1920 season, and cricket for the Merrion Cricket Club, Dublin. In Pretoria he played rugby for the S.A. Police.

He is survived by his sisters, to whom we offer our deepest sympathy.

C.J.V.H.

GASTON RAMON (1886–1963)

Except to those veterinarians engaged in the production of formol-toxoids and formolized whole cultures, the name 'Gaston Ramon' will probably mean little or nothing; yet the prevention of tetanus, lamb dysentery and enterotoxaemia owes much to the work of this distinguished French veterinary surgeon. The question of the identity of the discoverer of diphtheria formol-toxoid need not be discussed here and certainly need not prevent us paying tribute to Ramon

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who, at least, made the discovery independently and was responsible, in considerable measure, for advocating its use in the immunization of man against diphtheria. The conversion to formol-toxoid of *Clostridium tetani* toxin and later of the toxins of other pathogenic clostridia followed as an obvious sequel.

Ramon's discovery of the flocculation method of titrating both the toxin and antitoxin of *Corynebacterium diptheriae* has proved a boon to those laboratory workers who have to prepare them and led to the working out of a similar method for the titration of the toxins, formol-toxoids and antitoxins of *Cl. tetani* and *Cl. welchii*, Types A.B.C. and D.

Ramon received his veterinary training at the world famous Alfort Veterinary School near Paris. For 37 years he was Director of the Annexe de Garches, the Serum Production Department of the Pasteur Institute where, in addition to carrying out a vast amount of research, he was responsible for the production of toxins, formol-toxoids and antitoxins.

In 1949, he was appointed Director of l' Office International des Epizooties and from there he continued his campaign against infectious diseases, particularly against foot and mouth disease. He retired in 1959, to enjoy a well earned rest.

We veterinarians should be proud that Ramon was a member of our profession to which he brought lustre and renown.

J.H.M.

BOOK NEWS

The latest new publications added to our stock include:

Principles of Veterinary Radiography; Douglas & Williamson. The purpose of this work is to provide veterinary students and practitioners with the necessary information to equip and operate a unit for radiographic diagnosis; 243 pages; numerous illustrations; R4.95.

Small Animal Anaesthesia; W. V. Lumb. Although planned principally for use by students and veterinarians this book covers a much wider field than usual, being not confined to small domestic animals but including fishes, amphibia, reptiles and small wild mammals like mice; 420 pages; I25 illustrations; 60 tables; R9.35.

Feline Medicine and Surgery: 32 authors; published by American Veterinary Publications; the first comprehensive text and reference book devoted exclusively to feline medicine and surgery; 512 pages; 286 illustrations; R15.30.

Clinical Biochemistry of Domestic Animals; Cornelius and Kaneko; this work covers comparative clinical pathology for research workers and veterinary clinicians; extensive references are given; 678 pages; R15.00.

Pathology of Domestic Animals; Jubb & Kennedy; A most unique and comprehensive work in two volumes. Vol. I deals with bones and joints and the circulatory, respiratory and haemopoietic systems; 477 pages; R14.45. Vol. II covers all the other systems and provides a wealth of material particularly on the endocrine and genital systems; 613 pages; R17.85.

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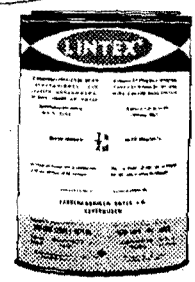

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LETTERS TO THE EDITOR

Being an expression of views by contributors to promote the dissemination of information and seek the opinion of others.

The Editor J.S. Afr. vet. med. Ass.

Dear Editor.

A NOTE ON ASCORBIC ACID IN THE HORSE

For a good many years the horse has been regarded as an animal capable of producing all its ascorbic acid requirements. However, it would appear that deficiencies can develop in the young thoroughbred.

The thorcughbred breeder is not uncommonly plagued with epiphysitis above the knees of well kept and certainly very well fed animals. This condition has been spoken of by many names such as lumps, knee bumps, sore knees, sore joints, ricketts and most commonly "bone disease".

Radiographic and blood serum analysis tend to show that this condition is not rachitic in origin. The normal healthy animal for various reasons appears suddenly to begin draining the epiphyses of calcium, although normal growth processes continue. With concussion, haemorrhages take place in these softened tissues under the periosteum resulting in an extremely painful swelling. It was pointed out to me that the nature of the swelling on x-Ray closely resembled Möller-Barlow's disease in the human child which is ascorbutic in origin.

Trials were carried out with yearlings, and although the ascorbic acid can obviously have no effect in preventing softening of the new bone of the epiphyses, it appears to have considerably reduced the clinically visible incidence of the condition, and one animal which developed a slight tenderness above one knee, was perfectly normal after one week of application of the usual treatment of this condition, which sometimes can stretch into months, and the animal is usually left with the visible signs of having had the condition i.e. a distortion of the medial aspect of the epiphysis above the knee joint. No visible signs remain on the above mentioned animal.

It would seem that the additional ascorbic acid helped in some way to reduce capillary permeability in the softened epiphysis and the inflammatory swelling was therefore considerably prevented.

T. Toms.
Mauritzfontein Stud,
Kimberley C.P.
12th Dec. 1963.

The Editor

J.S. Afr. vet. med. Ass.

Dear Editor

MALIGNANT ABDOMINAL ADIPOSITY

The Subject was a highly pedigreed 4 year old Guersney cow. Her dam was artificially inseminated with deep frozen semen from the United States of America. The owner is a most knowledgeable stockman. She was now 8½ months in calf, artificially, again with deep frozen semen ex United States of America.

On the 7th of August 1963 she became suddenly ill with all the symptoms of dry gallsickness. A proprietry dry gallsickness remedy was administered. There was no response to the first treatment, and two days later the dry gallsickness remedy was repeated. Her condition had been progressively deteriorating. After the second dose she passed some soft faeces. She then went down and could not rise.

The next step in her treatment was terramycin soluable animal formula intravenously. She then rose with much difficulty; with much coaxing walked ¾ of a mile and went down again in a most unusual position i.e. fore limbs normally folded but the hind limbs extended behind her. This was now on the fourth day since becoming sick.

Up to now the owner did all the treatment and observed all the symptoms.

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On Sunday evening the 11th August she was injected with 10 c.c. of Benapen.

I was now consulted telephonically and the above symptoms were described to me.

I could not make a conslusive diagnosis, but considered the possibility of an injured ricked back, hypo-magnesaemia or acetonaemia.

On Tuesday morning the 13th instant I was formally requested to come and see the cow, as her condition was deteriorating.

Upon arrival there it was obvious that the cow was dying, recumbant as described above. It was immediately decided to try and salvage the calf. A Caeserian operation was performed and the calf—a bull—was extracted, but dead.

At the post mortem there was an adhesion the size of an orange between the reticulum and sternum; no foreign body could be found. The fore-stomachs were full of ingesta of normal consistancy, in spite of not having eaten for six days.

The mesentery and omentum were solid sheets of fat more or less an inch in thickness throughout. The fat looked forced up against the intestines. The intestines were empty. The caecum and spiral colon was one solid ball of fat. The spirals could not be seen. The contents of the caecum was bone dry and looked like dried lucerne leaves, so also was a part of the colon contents. There was nothing unusual about the rest of the abdominal and thoracic organs.

Cause of death, ileus due to malignant abdominal adiposity.

T. C. Wessels.
Tweespruit,
O.F.S.

The Editor

J.S. Afr. vet. med. Ass.

Dear Editor

Penicillin Allergy

On the 1st July 1963 a farmer, a knowledgeable stockman, requested me to examine and operate on a mature Friesland cow for wire. Upon examination of the subject I diagnosed a subacute diffuse pneumonia.

I injected 3 m.u. each of Procaine and Benethamine Penicillin in one syringe. As I was preparing to inject Streptomycin the cow became extremely nervous, and foamed from the mouth, in less than one minute after the first injection.

I realized immediately that this was a case of allergy.

The way she performed and jumped about, it was impossible to give her an intravenous injection of calcium gluconate in spite of being held by the nose. Fortunately the cowtie did not break. It also seemed as if she was seeing ghosts.

She was then injected with Vecortenol (Ciba) and Anthisan (Maybaker) intramuscularly.

In this subject perspiration started around the sight of the Penicillin injection and by the time I injected the Vercortenol and Anthisan intramuscularly the area of perspiration was the size of a soup plate.

Five minutes after this last injection she became more subdued but was still trembling violently.

Fifteen minutes later she was quiet but looked extremely tired. She was then given the Streptomycin and recovered satisfactorily and completely.

Conclusion

It seems rather strange that I should come across two cases of Procaine Penicillin allergy within 2 months, after having injected hundreds of bovines over a period of 15 years in bovine practice. Subject had not received antibiotics before.

I can find no explanation for this phenomenon.

T. C. Wessels
Tweespruit,
O.F.S.

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The Editor

J.S. Afr. vet. med. Ass.

Dear Editor

A TREATMENT FOR COCCIDIOSIS IN RABBITS

Initially a hutch of twenty five pet rabbits were involved.

The symptoms, present for three or four days before death, were listlessness, emaciation, diarrhoea, and a milky naso-ocular discharge. Appetite was only affected in that the affected rabbits ate slower than the others. Twenty three showed symptoms before treatment was begun. These comprised two adult does, showing no sympt(ms, and three kindles numbering 8, 8 and 7, aged three, two and a half, and two and a half months respectively. Of these, six had died over a period of one week, five being three months old and one two and a half months old. Two of these were presented for *post mortem*.

The only macroscopic lesions were multiple focal abscesses of the liver, up to 1 cm. in diameter, and focal enteritis in the small intestine and caecum appearing as white spots up to 0.5 cm. in diameter.

Scrapings of the mucosa of the small intestine and caecum, and smears of the liver abscess material revealed oocysts, in both cases. A tentative identification was made of *Eimeria stiedae* in both liver and intestine, and of *E. perforans* in the intestine only.

On the recommendation of the Poultry Department, Onderstepoort, the survivors were treated with furazolidone ("Neftin" S.K.F.). This was in tablet form, 0.5 gm. containing 61 per cent furazolidone. The dosage used was 10 mgm. of tablet per lb. bodyweight per day.

One tablet was crushed to a fine powder on a sheet of paper and the powder divided as accurately as possible into ten equal parts. A rabbit weighing five pounds received one such portion, and others received proportionately more or less, depending on their weight, again as accurately as could be estimated.

Each rabbit was dosed individually per os. Direct administration was chosen in preference to dosing in the food or water because firstly the rabbits were unwilling to eat the treated food, and secondly the amount of water consumed by rabbits is minimal, and by either method they did not receive a therapeutic dose.

The day after treatment was initiated two more of the worse infected rabbits died, but thereafter, recovery ensued in even the worst cases.

The hutch had a grassed run, on which disinfection was ineffective. Adjacent to this hutch, and separated from it by wire netting only, was another hutch containing an adult doe and a kindle of eight, six weeks old. These remained unaffected until placed in the infected hutch, on the ninth day of treatment, and after three days all the young rabbits developed symptoms. They then received 10 mgm./lb./day for five days. The doe received treatment as well, but remained unaffected. There was no mortality in this group.

The only toxic effects of this dosage rate observed was a loss of hair from the back of the neck in two cases. When treatment was discontinued the hair loss ceased within two days.

Three weeks after treatment, no further cases or toxic effects had been noted.

A. F. J. Cross.
Hermitage Terrace,
Richmond,
JOHANNESBURG

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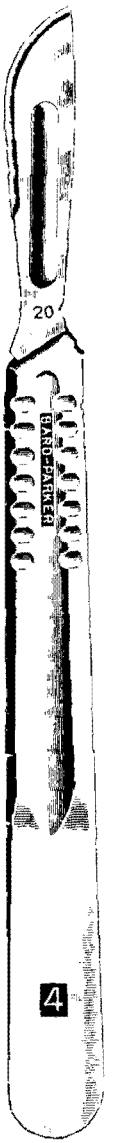

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FOURTH SYMPOSIUM OF THE WORLD ASSOCIATION OF VETERINARY FOOD HYGIENISTS

The 4th Symposium of the W.A.V.F.H. will be held from *July* 27 *till* 30, 1965 *at Lincoln, Nebraska, U.S.A.*

Further information about program and organization will be furnished later and will be available from Dr. L. W. van den Heever, Veterinary Research Institute, Onderstepoort.

FIFTY-NINTH A.G.M. AND SCIENTIFIC CONGRESS OF S.A.V.M.A.

The Fifty-Ninth Annual Meeting and Scientific Congress of the Association will take place from 27th September to 3rd October, 1964, at the Arthurs Seat Hotel, Sea Point, Cape Town. Members proposing to attend should make early booking either to the Management direct or to the Secretary who will undertake to approach the management on receipt of requests stating the accommodation required.

JOURNÉES INTERNATIONALES DES APPLICATIONS DU COBALT

C.N.R.M. and C.I.C. will organize on 9th, 10th and 11th June 1964 the "Journées Internationales des Applications du Cobalt".

The official languages will be French, English and German, and simultaneous translation facilities will be provided in these three languages. The texts of the various papers will be printed and distributed to registrants in advance of the meeting. A special programme of visits will be drawn up for the ladies who will accompany the participants.

If you are interested in the meeting and wish to receive further relevant documents, full particulars together with the final registration documents can be obtained from:

The Secretariat of the "Journées Internationales des Applications du Cobalt" 35 Rue des Colonies, Brussels 1. Belgium.

RAAD VIR DIE KUNSMATIGE INSEMINNERING VAN DIERE

Die heraanstelling van Dr. S. W. J. van Rensburg is bekragtig.

Die volgende besonderhede word vir maklike naslaandoeleindes verstrek:

Die Voorsitter van die Raad is:

Dr. F. N. Bonsma, Hoof: Navorsingsinstituut vir Veeteelt en Suiwel, Privaatsak 117, Pretoria.

Die Registrateur, K. I. Wet is:

Dr. G. B. Laurence, Asst.-Hoof: Navorsingsinstituut vir Veeteelt en Suiwel, Privaatsak 177, Pretoria.

Die samestelling van die Raad vanaf Januarie 1964 is soos volg:

1. Dr. F. N. Bonsma, Privaatsak 177, Pretoria (Voorsitter).
2. Dr. M. C. Lambrechts, Privaatsak 138, Pretoria.
3. Dr. W. A. Verbeek, Privaatsak 116, Pretoria.
4. Mnr. D. Beal Preston, Exwell Park, Pk. Waku, Cathcart.
5. Mnr. R. J. Theunissen, Posbus 1, Theunissen, O.V.S.
6. Mnr. A. L. Doidge, Posbus 381, Ladysmith, Natal.
7. Mnr. T. van Heerden, Posbus 225, Cradock.
8. Mnr. C. R. F. Arnold, Edenfield, Pk. Baroda, Cradock.
9. Dr. G. J. L. Volk, Posbus 186, Upington.
10. Dr. D. J. le Roux, Posbus 604, Pietermaritzburg.
11. Mnr. J. C. Landman, Mooivlei, Pk. Lehmansdrift, Queenstown.
12. Mnr. W. J. van Niekerk, Mosselbank, Pk. Durbanville, K.P.
13. Dr. A. B. la Grange, Privaatsak 5, Irene, Transvaal.
14. Mnr. J. S. van der Spuy, Adderley, Pk. Philadelphia, K.P.
15. Mnr. S. J. H. Brits, Posbus 310, Vanderbylpark.
16. Dr. S. W. J. van Rensburg, Pk. Onderstepoort, Transvaal.

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PROFESSIONAL PROVIDENT SOCIETY OF SOUTH AFRICA RETIREMENT ANNUITY (PENSION) FUND

Yet again the Professional Provident Society has announced an increase in benefits for its members, making the third such increase in twelve months. Earlier in the year a waiver of subscriptions was granted to members in receipt of the permanent disability benefit under the Society's sickness insurance scheme. Now, following closely on the announcement of an increase in their Hospital Scheme benefits, comes news of an improvement in the benefits under the Society's Retirement Annuity (Pension) Fund. The estimated bonus rate has been increased from R2.50 per cent to R2.75 per cent per annum, compounded annually, which will mean a substantial increase in the pension benefit.

As the facilities under the Pension Fund have also been extended, the Society is now able to offer the following policies underwritten by Sanlam at preferential rates:

(1) *Pure Pension Scheme* (*Existing Scheme*): This scheme provides a pension on reaching the pension date. In the event of death before the pension date there will be a refund of contributions actually paid plus 4 per cent compound interest to the date of death.

(2) *Endowment Assurance Pension Schemes*: While the pension benefits under this scheme will be less than under the existing scheme, the life assurance cover included provides a substantially higher death benefit in the event of death before the pension date.

(3) *Reinforced Endowment Assurance Pension Scheme*; This scheme provides a considerably higher death benefit than the endowment assurance scheme, particularly in the earlier years. The cost of this increased death cover is met by an appropriate reduction in the pension benefits.

Anyone requiring further information should write to the Professional Provident Society of South Africa, P.O. Box 6268, Johannesburg, stating age, type of policy required, and if possible, the amount of intended contribution.

III INTERNATIONAL MEETING ON DISEASES OF CATTLE

III International Meeting of Diseases of Cattle is to be held on the 20th–22nd August, 1964, in Copenhagen.

The following principal topics will be dealt with at the meeting.

(1) Virus diseases of the air passages and the digestive organs in cattle.

(2) Hypomagnesemia in cattle.

(3) Lameness in cattle.

Time has been set aside for lectures dealing with topics other than the above mentioned.

Languages of the meeting: English, German, French (simultaneous translation).

Notification of Contributions.

The Organization Committee will designate certain specialists for first speakers on the main topics.

Minor contributions concerning these three topics as well as information regarding other problems of cattle-diseases will be accepted to the extent time will permit.

Such contributions, which should not exceed 1600 words (4 standard printed pages including tables and illustrations and a summary of 5–10 %, should be announced at the earliest possible date, and the paper, written in English, German, or French, should be submitted to the Secretariat by the 1st March 1964.

Projectors for showing diapositives of the current sizes as well as 8 and 16 mm films will be available.

The Report of the Meeting will appear as a Supplement to Nordisk Veterinaermedicin and will be sent to all participants.

The address of the Secretariat is:

III International Meeting on Diseases of Cattle, Bvlowsvej 13, Copenhagen V, from whom further particulars may be obtained from the secretary.

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UNIVERSITY OF EDINBURGH

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Classes are held at the Veterinary School, Veterinary Field Station and in appropriate Departments of the University. Written, oral and practical examinations qualifying for the diploma are held in March for Part I and in June for Part II. Re-sit examinations are held in September.

Candidates desirous of taking the Course must have a veterinary qualification registrable with the Royal College of Veterinary Surgeons or such other veterinary qualification as may be recognised for the purpose by the University Court.

Applications for admission should be lodged with the Director Royal (Dick School of Veterinary Studies, Summerhall, Edinburgh, 9, on or before 30th March of the year in which the applicant desires admission.

December, 1963.

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BACK NUMBERS OF J.S. AFR. VET. MED. ASS.

The Association has for sale back numbers containing articles on many veterinary subjects.

The Association will pay 50c. per copy for back numbers in good condition.

The following numbers are particularly required:—

1943—March, September, December.
1944—March.
1946—September, December.
1947—March.
1948—March, June, September, December.
1949—March, June.
1950—March, June.
1950—March, June.
1951—March, June.
1954—June.
1955—December.
1956—June, September.
1957—March, June, September.
1958—March.
1959—June, December.
1960—March.
1961—March, June.
1962—March.
1963—June.

VETERINARY HEALTH CERTIFICATES

Printed and offered for sale by the Association in both languages and obtainable from the Secretary, P.O. Box 2460, Pretoria.

Books of 50 Veterinary Health Certificates bearing the crest of the South African Veterinary Medical Association and printed in Afrikaans and English are available at the following prices.

Members desiring these books of certificates should remit the necessary amount to the Secretary, P.O. Box 2460, Pretoria.

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LIST OF VETERINARIANS

The S.A.V.M.A. compiles and offers for sale the following list of Veterinarians residing within and beyond the Republic.

1. FULL LIST of Members of the S.A.V.M.A. indicating their places of residence. R3.10 *per list.*
2. PROVINCIAL LIST of Members of the S.A.V.M.A. indicating their places of residence. R1.50 *per Provincial list.*
3. CITY LIST of Members of the S.A.V.M.A. indicating the Veterinarians residing in the cities of Johannesburg, Pretoria, Cape Town, Port Elizabeth, East London, Durban, Pietermaritzburg, Bloemfontein, Windhoek.

For an extra 50c the list will be classified to indicate the type of veterinary duty undertaken.

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UNIVERSITY OF MELBOURNE

DEPARTMENT OF VETERINARY PARACLINICAL SCIENCES

1. Senior Lecturer or Lecturer in Veterinary Pathology

Applications are invited for the position of Senior Lecturer or Lecturer in Veterinary Pathology. The appointee will be expected to conduct teaching and research in the subject of veterinary pathology.

The salary range is from –A2,700 to –A3,250 per annum for a Senior Lecturer and –A1,850 to –A2,600 for a Lecturer. Initial salary will be determined according to qualifications and experience. Superannuation similar to F.S.S.U. in Great Britain will be provided.

This is a new position and further information and the conditions of appointment should be obtained from the Registrar, University of Melbourne, Parkville N.2., Victoria, Australia, and applications should reach him by May 1st, 1964.

2. Senior Lecturer or Lecturer in Parasitology

Applications are invited for the position of Senior Lecturer or Lecturer in Parasitology.

The appointee will be expected to conduct teaching and research in the subject of veterinary parasitology. Preference will be given to applicants with a degree in veterinary science, but applications will be accepted from persons with a basic degree in zoology and post-graduate experience in veterinary parasitology.

The salary range is from –A2,700 to –A3,250 per annum for a Senior Lecturer and –A1,850 to –A2,600 for a Lecturer. Initial salary will be determined according to qualifications and experience. Superannuation similar to F.S.S.U. in Great Britain will be provided.

This is a new position and further information and the conditions of appointment should be obtained from the Registrar, University of Melbourne, Parkville N.2.. Victoria, Australia, and applications should reach him by May 1st ,1964.

F. H. JOHNSTON,
Registrar.

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