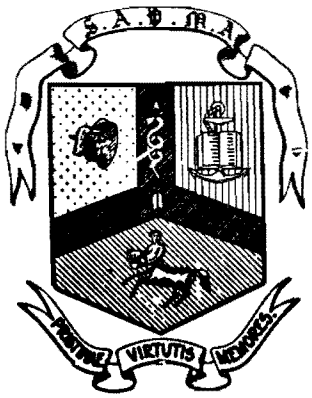
JOURNAL

OF

THE SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

VOLUME
JAARGANG 35

1964



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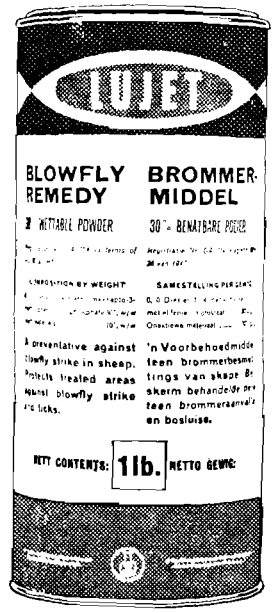

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EDITORIAL

SYSTEMS OF STUDENT EXAMINATION

Examinations have for many years been the subject of much controversy. What is beyond question is the fact that they are necessary and unavoidable in some form or other in order to test the capability of the student to progress to the next phase of his study, or, in the case of the final examinations, to assess his possession of sufficient knowledge to commence its application towards making a living. While one realizes that there is always a very great deal to learn, a certain basic standard has to be met. In veterinary science, as in other disciplines, the learning process must inevitably continue throughout one's entire professional life.

The aspect we wish to examine here is: which form of examination provides the most equitable and efficient assessment of the student's knowledge? The classical or conventional type, where five or six questions have to be answered in a period of say three hours, has the advantage that it at the same time enables the examiner to assess the candidate's ability to marshal his facts, and to present them in logical sequence and in acceptable language. Students vary in their ability to say what they want to say without verbiage, circumlocution and plain muddledness. Practice over a period of years does tend to improve the individual's performance in this respect, and from that point of view is to be commended. On the other hand however, the examiner's evaluation inevitably becomes more or less subjective. At best the correction of papers is an exhausting task, and fatigue, a struggle with spelling, handwriting or syntax and the continuous effort to maintain an even standard, may not lead to a completely fair appraisement of what is being tested. There is moreover quite considerable variability in attitudes of mind of examiners, the emphasis they wish placed on different aspects of the answer, their appreciation of the student's facility of expression, and their degree of irritation with the very real factors of bad spelling and handwriting.

There is another major fault with such conventional examinations, and that is that they test only a small and not very representative sample of the field to be covered. In borderline cases this places too much of a premium on the student's intuition or luck in "spotting" likely questions before the examination.

In the United States, the "objective" or "multiple choice" type of examination is very extensively used in veterinary and medical schools to the point of virtual exclusion of all oral or conventional tests. Questions can be formulated in a number of different ways. A few examples will suffice as an illustration:—

(*a*) Indicate by "T" or "F" whether you regard the following statements as true or false.

(*b*) In such and such a case, which of the following are the most likely laboratory findings?

(*c*) For each item on the left hand list select the most appropriate item on the right hand list.

Since a very wide field in the particular subject can be covered within the available time, a searching test can be provided. It has been suggested that this form of questioning produces students who are better guessers than students, on the evident fact that in a "true or false" type of question he has a 50:50 chance of being right, even if he has no idea of the correct answer. This is easily overcome by penalizing each wrong answer. Also, it is not difficult to formulate questions in such a way that guessing is quite impossible or certainly of no help.

On the debit side is the fact that the ability of the student to collate his thoughts in logical sequence, and thus to give evidence of his ability to present them in an orderly fashion, is not tested at all. This may well be off-set particularly in a final, qualifying examination, by the fact that the questions cover the field

much more adequately and that "spotting" of questions is no longer feasible. In addition much less of a burden is laid on the examiner, and the final marking can be done by several examiners or even by a competent clerical assistant, provided with a key, with no possible variation of standard.

Sir Charles Illingworth, Regius Professor of Surgery at the University of Glasgow, recently published the results of a controlled trial of the "objective" or "multiple choice" type of examination against the conventional type. On the basis of his data he concluded: "it is clear that if the written papers in the final examination were replaced by multiple choice questions the total proportion of passes would not be affected and the fate of only a handful of borderline candidates would be at stake. The question at issue is whether for this handful a more equitable result would be obtained. My own experience suggests that it would". His results showed a good correlation between the "multiple choice" mark in his section and the rest of the Surgery examination, and also between the "multiple choice" mark and those of the entire final examination. Candidates who gain high marks in the "multiple choice" examinations tend to do well in all examinations, and he concluded that there was "a good case for replacing all the written papers in the final examination by 'multiple choice' papers."

At the Onderstepoort Faculty of Veterinary Science the traditional method of final examination in Medicine has been by equal weighting of the "class record", based on conventional tests and marked clinical case reports, and the examination itself consisting of a conventional three hour paper, the presentation of a report on an allocated clinical case, and an oral examination.

Oral examinations have always been found to be an excellent test of a candidate's readiness to go into practice as a veterinarian, since it evaluates both his knowledge and his ability to think under a degree of stress. External examiners are present at these orals and are drawn from the ranks of active practitioners. The only real disadvantage is to the nervous student who tends to "black out" under questioning — but again, it could be argued that students generally tend to be less apprehensive if they really know their subject.

In the final Medicine examination last year it was decided by the head of the department to substitute a comprehensive "multiple choice" paper for the conventional written examination as an experiment. The correlation between the results obtained from this paper and the "class record" was remarkably close when it is considered that the "class record" represented the mean of some eight (mostly conventional) tests of knowledge over two years of study. The class numbered 35 candidates. Of these, four (over 11%) had exactly the same marks; twenty-one (60%) had marks differing by 3% or less, and twenty-five (71%) by 5% or less. Stated otherwise, and using Spearman's formula, the coefficient of rank correlation was calculated as 0.87, indicating a marked relationship between "class record" results and those of "multiple choice" results.

Although only the class of 1963 has so far been involved, the results were considered sufficiently promising to warrant continuation with the "multiple choice" paper in the place of the previously used "essay" or conventional type in the final examination, preserving the latter form in the class tests over the preceding years, and leaving the other parts of the examination unchanged. In this way it is hoped to preserve the good features of the conventional written paper during the tutorial period, while eliminating its disadvantages at the stage of final examination.

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W. D. MALHERBE.

EDITORIAL

THE ROLE OF THE VETERINARIAN IN FOOD PRODUCTION

At the Second World Congress of the International Fertility Association held in Naples in May 1956 the sectional meetings of the medical and veterinary professions were held in two adjacent halls. The chairman of the first veterinary session commenced his opening address with the statement "Our friends next door are planning to increase the human population of the world. It is our responsibility to see that there is sufficient food for the proper nourishment of this increased population".

The fact that the rapid increase in human population is not accompanied by a corresponding increase in the numbers of those species of animals which have to provide the basic human nutritional requirements is a matter of great concern to responsible bodies like W.H.O. and F.A.O.

It is estimated that the world's daily increase in population is about 160,000 or over 50 million per annum. When the 1960 census figures for South Africa showed the population to be 17½ million it was calculated that by the year 2000 this figure will be doubled. The fact that the 1,555,000 head of cattle slaughtered in the Republic in 1962 were 80,000 more than in the previous year illustrates the rapidly increasing demand for beef by our fast growing population.

Notwithstanding the great progress made in controlling infectious epidemic diseases which caused heavy mortality in stock previously, our animal population, particularly that of bovines, has remained static during the past two decades, and we are faced with the definite prospect that human population growth might outstrip food production thus rendering us more and more dependent on the outside world for our most essential foods. It is certainly no compliment to our animal industry that even at this early stage in the development of our vast and relatively sparsely populated agricultural country we should be obliged to import dairy products like butter from one of the smallest and most overpopulated countries in the world, namely Holland.

The function of the veterinarian in arresting this disturbing trend in animal production is perhaps even more important than that of the agriculturist, and entails two fundamental aspects namely:

(i) prevention of mortality in stock, and

(ii) increasing production and reproduction levels of animals.

Phenomenal progress has been made in the prevention and control of epidemic diseases during the past century. In the light of present knowledge it seems quite incredible that only 100 years ago the aetiology and consequently rational treatment of all infectious diseases in both man and animals were unknown and that both curative and preventive treatment was mainly empirical, being based largely on experience, current beliefs and superstition. Many of us for instance still remember the widely held theory that a drench given to a sick horse will only be effective if administered through the left nostril!

The advances made in disease control emanate from the three epoch-making discoveries in both medical and veterinary science that were made within a brief period of 20 years towards the end of the last century. In 1876 Robert Koch proved to the world that microbes were the cause of infectious disease, and he followed up this discovery by developing staining techniques and methods of culturing bacteria artificially. Five years later Louis Pasteur showed that infectious disease can be prevented by inoculation, and developed the technique of vaccination with attenuated virus. A decade later Theobald Smith demonstrated the role played by insect vectors in the transmission of disease when he proved that ticks carried Texas fever.

In the relatively brief period of fifty years the major breakthrough achieved by these three benefactors to mankind has resulted in the elaboration of effective preventive and control measures for nearly all serious epidemic diseases of man and animal, and we no longer live in constant fear that the human or animal population may at any time be decimated by an epidemic disease.

This success does not however imply relaxation of veterinary endeavour in this field. On the contrary modern trends call for greater intensification of veterinary activities in all spheres. Despite the advances made, the majority of epidemic diseases have not been eradicated but merely brought under control and recurrence of any of them at any time is not impossible. Moreover new pathogens will continue to appear periodically thus demanding continuous research in the laboratories and surveillance in the field.

The less spectacular but more sinister erosion diseases are still with us and taking a heavy toll.

Malnutrition in animals is worse in South Africa than in any other civilised country, and it is an oft repeated truism that more animals die from hunger than from disease. Some may contend that this is no concern of the veterinarian, but apart from direct starvation, the profound impact of malnutrition on the health and fertility of animals pitches this problem right into the sphere of the veterinary clinician and research worker.

The pattern of stock farming in South Africa is changing rapidly from natural to artificial pasturing and we witness large tracts of erstwhile good ranching areas being ploughed up and put under cultivation. The soil is being depleted of many of its essential elements and there is increasing evidence of mineral deficiencies in stock in various parts of the country.

Water and soil conservation schemes on an unprecedented scale are being carried out or planned. These obviously progressive measures are not free from danger to animal health and fertility and will add to the veterinarian's problems. They will create ideal conditions for parasitism and for multiplication of insect vectors of disease, while the inevitable depletion of minerals in the soil on the one hand and the fertilizers used to overcome these deficiencies on the other, will increase the incidence of metabolic and deficiency diseases and add to reproductive problems.

When judged by the number of calves born every year, one must conclude that breeding efficiency of our bovines is deplorably low. Spectacular improvement has however taken place during the past decade in those herds where artificial insemination is being applied to the complete exclusion of natural service. The factors militating against the more general application of this method of breeding in this country are gradually being overcome, and this should reduce the incidence of the infectious forms of sterility to a minimum.

The remaining causal factors of low fertility however present a much more formidable and complex problem, and call for fundamental laboratory research, close study in the field, and intensive education and instruction to stock owners on breeding practices.

While basic research on all aspects of reproduction and poor fertility must be conducted on an ever increasing scale in the laboratories, marked success cannot be achieved unless this is supported by thorough investigation and critical observation in the herds. This must be conducted in the widest possible sense and extended far beyond the individual animals concerned. It should embrace every facet of animal breeding such as the aptitude and knowledge displayed by the person responsible for the breeding programme, the stockmanship and management ability of those in direct control of the breeding animals, the breeding practices in the particular herd, the environment in which the animals are kept, the nature of the soil and vegetation in the area concerned, and, most important of all, is the nutritional levels of the breeding animals.

The campaigns that had to be conducted against the epidemic diseases during the major part of the past century and the relatively small number of veterinarians available during that period tended to canalise the veterinarians' approach and to confine it to the animal itself. Breeding problems, with the exception of the

infectious types, however demand a more global outlook.

Observations made in some isolated herds and flocks where the breeding methods cannot be faulted, show that basically the reproductive capacity of the farm animals in this country is as high as in any other, and one must conclude that the average poor performance is due, not so much to inherent defects in the animals, as to the human factor and environmental conditions as a result of which potentially good breeders are frequently just not given the opportunity to produce to the best of their ability.

Unfortunately many South African stock owners have an unjustifiably great faith in drugs and injections. It must be brought home to them that, except in rare individual cases, functional types of infertility simply do not respond to this form of treatment. Actually poor fertility due to adverse extraneous influences can only be remedied by removal of those influences.

Guidance should be given on, and the importance stressed of such matters as proper nutrition, good stockmanship and handling of animals, control of diseases and parasitism which are harmful for reproduction, the numerous ramifications of artificial breeding, the maintainance of proper breeding records, the benefits of periodic veterinary examination for pregnancy and fertility, the elimination of animals showing evidence of inherited poor fertility, and examination of female animals prior to disposal for slaughter.

An inexplicable paradox of beef cattle farming in this country is, that while on the one hand every effort is made to improve the calving rate, stock owners on the other hand slaughter their most fertile cows and heifers in various stages of pregnancy. A survey has revealed that of approximately 600,000 bovine females slaughtered every year, about 70 per cent are from one to nine months pregnant. This implies an annual loss of over 400,000 potential beef producers that are killed before birth.

Stud breeders fortunately are not guilty of this irresponsible destruction of good breeding material. On the contrary there is increasing evidence that many of the breed societies and their members are now realising the valuable aid they can get from the veterinary profession in raising the fertility level of their respective breeds, and the importance of assigning to fertility a high rating among the various attributes of the perfect animal.

While some forms of hereditary infertility are characterized by clearly visible anatomical abnormalities, research work in recent years and progeny testing associated with artificial insemination, have revealed that some of the most serious types of physiological infertility that show no outward manifestations, have a genetic basis. This emphasizes the necessity for consigning to the abattoirs the repeat breeders and non-calvers rather than the pregnant animals.

There are insistent and perhaps justifiable demands from many quarters for more research on infertility; but research will be futile if the results obtained do not receive practical application. If stock owners can only be induced to give serious attention to, and applied the present known facts regarding poor fertility, we shall already have gone a long way towards improving the current poor reproductive performance of our stock and ensuring for future generations an adequate supply of their most valuable nutritive requirements, namely animal products.

S. W. J. van Rensburg.

ON THE OCCURRENCE OF *COOPERIA MCMASTERI* GORDON, 1932 and *C. SPATULATA* BAYLIS, 1938 (NEMATODA) IN BOVINES IN SOUTH AFRICA

R. J. ORTLEPP.

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While this Article was in press Dr. Ortlepp passed away on 12th April, 1964.—Editor.

In his check list of worm parasites of domestic animals in South Africa, Mönnig[1] lists *Cooperia oncophora* (reported by Veglia) from sheep and *C. pectinata* and *C. punctata* from cattle. The areas from which these helminths were recovered is unfortunately not given. During more than 30 years as helminthologist at Onderstepoort the writer has never seen *C. oncophora* from sheep; he did, however, identify this species on two occasions from calves, viz. in 1939 from East London and 1941 from George, both areas situated in the South Western Cape, on the fringe of the winter rainfall area. On the other hand the other two species viz. *C. pectinata* and *C. punctata* are very common parasites of bovines in all areas outside the winter rainfall area; they appear to be relatively scarce in ovines because the writer has only a single record of the presence of these two species from sheep and that from the Pietersburg district, Transvaal.

Dr. G. L. Muller[5], while carrying out a survey of the seasonal incidence of worm parasites of sheep in the winter rainfall area examined helminths from three centres one in each of three districts. In his report he lists the presence of *C. curticei* and *C. oncophora* from sheep but does not state to what extent and whether these parasites were present in all three districts. The writer has since also identified *C. curticei* from sheep from King Williams Town. Recently Dr. A. J. Snijders, veterinarian to the firm Merck, Sharp and Dohme, asked the writer to examine a few hundred male *Cooperia* worms which he had collected from a calf from Stellenbosch; in addition to *C. oncophora* he had noticed that a small number of another species was present which he suspected to be *C. mcmasteri*, a species originally described by Gordon[3] from an Australian calf where it was present in about equal numbers with *C. oncophora* and has since been reported from England, Europe and the United States. Careful examination and comparison with material from New Zealand showed that Dr. Snijders' surmise was correct. Superficially the two species are very similar but they can be distinguished from each other in that the stem of the dorsal ray is much shorter in *C. mcmasteri* than in *C. oncophora* and in that the spicules of the former species are slenderer and each is provided with a dorsal spine. Baylis[2] expressed the opinion that this spine was really a thickened fold or ridge in the delicate membrane; this is not correct because in spicules removed from the body the spine is clearly seen to be a cuticularized process. In the accompanying diagrams (Fig. 1), comparable structures drawn to the same scale, the differences will readily be seen.

During 1962 and 1963 Drs. F. B. W. du Casse and W. B. Hobbs, Senior State Veterinarians, then stationed at Estcourt and Durban respectively, each sent a few male *Cooperia* worms from calves from the Natal midlands to the writer for determination as they appeared to be different to the common *C. pectinata* and *C. punctata* worms from bovines. Unfortunately the worms were much coiled and somewhat shrunken and thus difficult to study; however, by careful dissection under a stereoscopic microscope the spicules and portions of the bursae were freed from a few worms; these structures were found to agree very closely with those of *C. spatulata*, which Baylis[1], described from a calf and a sheep (imported from Australia) from the Federated Malay States and also obtained by him from cattle and sheep from Queensland, Australia. The dorsal ray, spicules and

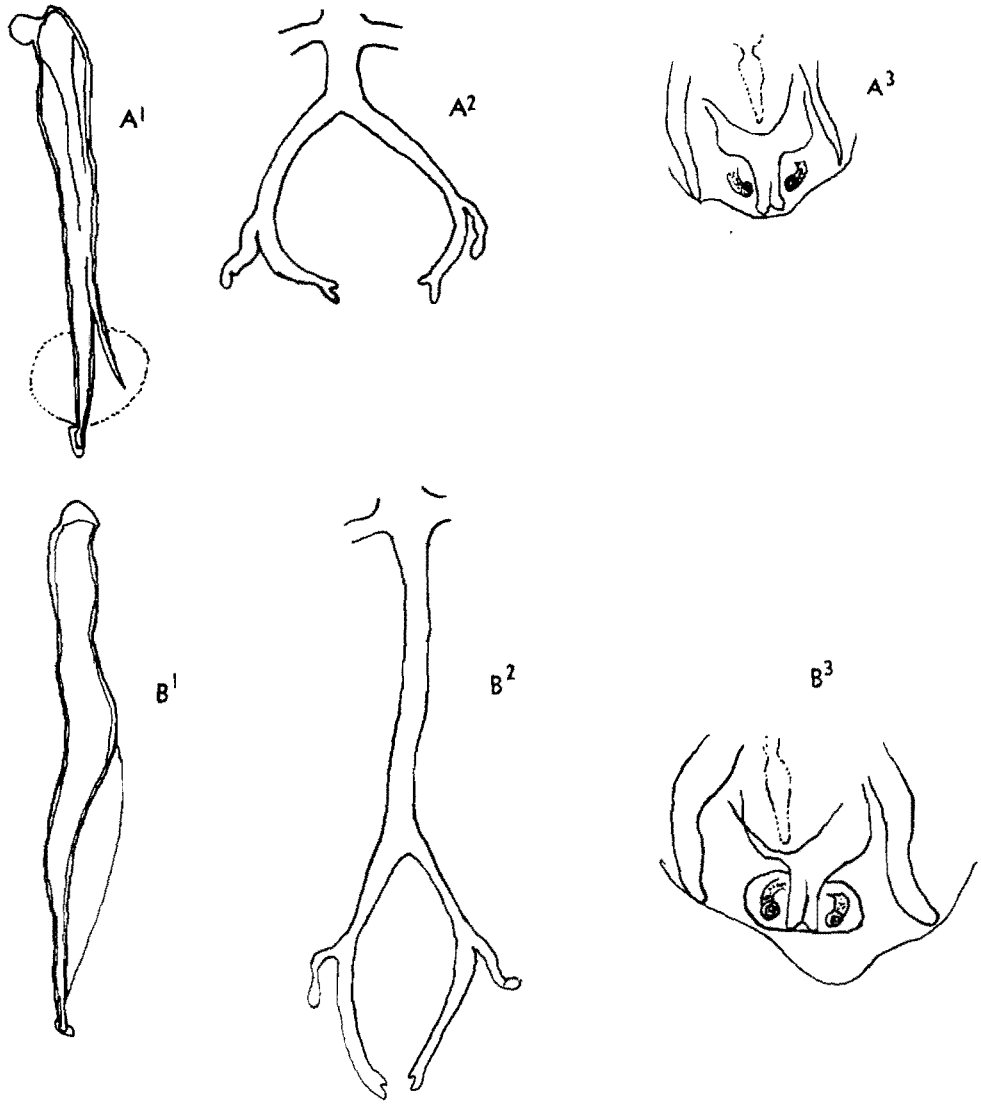

Fig. 1. A = *Cooperia mcmasteri*.

A^1 = Spicule, lateral view.

A^2 = Dorsal ray.

A^3 = Genital cone, ventral view.

B = *Cooperia oncophora*.

B^1 = Spicule, lateral view.

B^2 = Dorsal ray.

B^3 = Genital cone, ventral view.

genital cone of the South African specimens are practically identical with those of *C. spatulata* and the writer is thus satisfied that those from Natal are co-specific with those from Australasia. Fig. 2, drawn from the dissected structures, illustrates the shape of the dorsal ray spicules and genital cone.

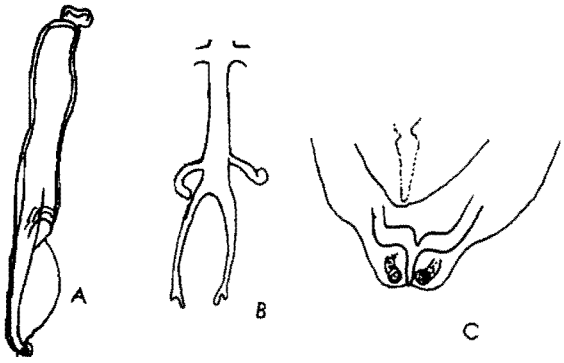

Fig. 2. *Cooperia spatulata.*
A = Spicule, lateral view.
B = Dorsal ray.
C = Genital cone, ventral view.

From the available data it thus appears that six species of *Cooperia* are parasitic in domesticated ruminants in South Africa. All are practically confined to bovines and all with the exception of *C. curticei* only appear exceptionally in ovines. *C. pectinata* and *C. punctata* can be considered to be typically parasites of bovines outside the winter rainfall areas, and *C. oncophora*, *C. mcmasteri* and *C. curticei* to be parasites of the winter rainfall area. Sofar *C. spatulata* has been found only in the midland areas of *Natal*, but its possible presence in adjoining districts cannot as yet be excluded.

KEY TO SPECIES OF *Cooperia* FROM DOMESTIC STOCK IN SOUTH AFRICA.

1. Secondary ventral branches of dorsal ray arise at its bifurcation..... 2
   Secondary ventral branches of dorsal, ray arise from its main branches about midway between their origin and tip... 4
2. Spicules long, over 0.2 mm. long *C. spatulata*
   Spicules short, less than 0.2 mm. long.. 3
3. Main branches of dorsal ray curved to form lyre-shaped structure *C. curticei*
   Main branches of dorsal ray nearly straight and parallel *C. punctata*
4. Stem of dorsal ray much shorter than its main branches, spicules 0.21 to 0.25 mm. long and each provided with dorsal spine *C. mcmasteri*
   Stem of dorsal ray longer than its main branches, spicules nearly 0.3 mm. long and longer..... 5
5. Spicules generally over 0.3 mm. long with middle portion broad and corrugated; tips of branches of dorsal ray rounded and uncleft *C. punctata.*
   Spicules without broad corrugated fangs, tips of main branches of dorsal ray divided *C. oncophora*

ACKNOWLEDGEMENT

The writer wishes to express his thanks to Drs. du Casse, Hobbs and Snijders for placing the above materials at the writer's disposal for study. Credit is due to Drs. Muller and Snijders for being the first to note the presence of *C. curticei* and *C. mcmasteri* respectively in South Africa.

The Chief, Veterinary Research Institute, Onderstepoort, is thanked for permission to publish this article.

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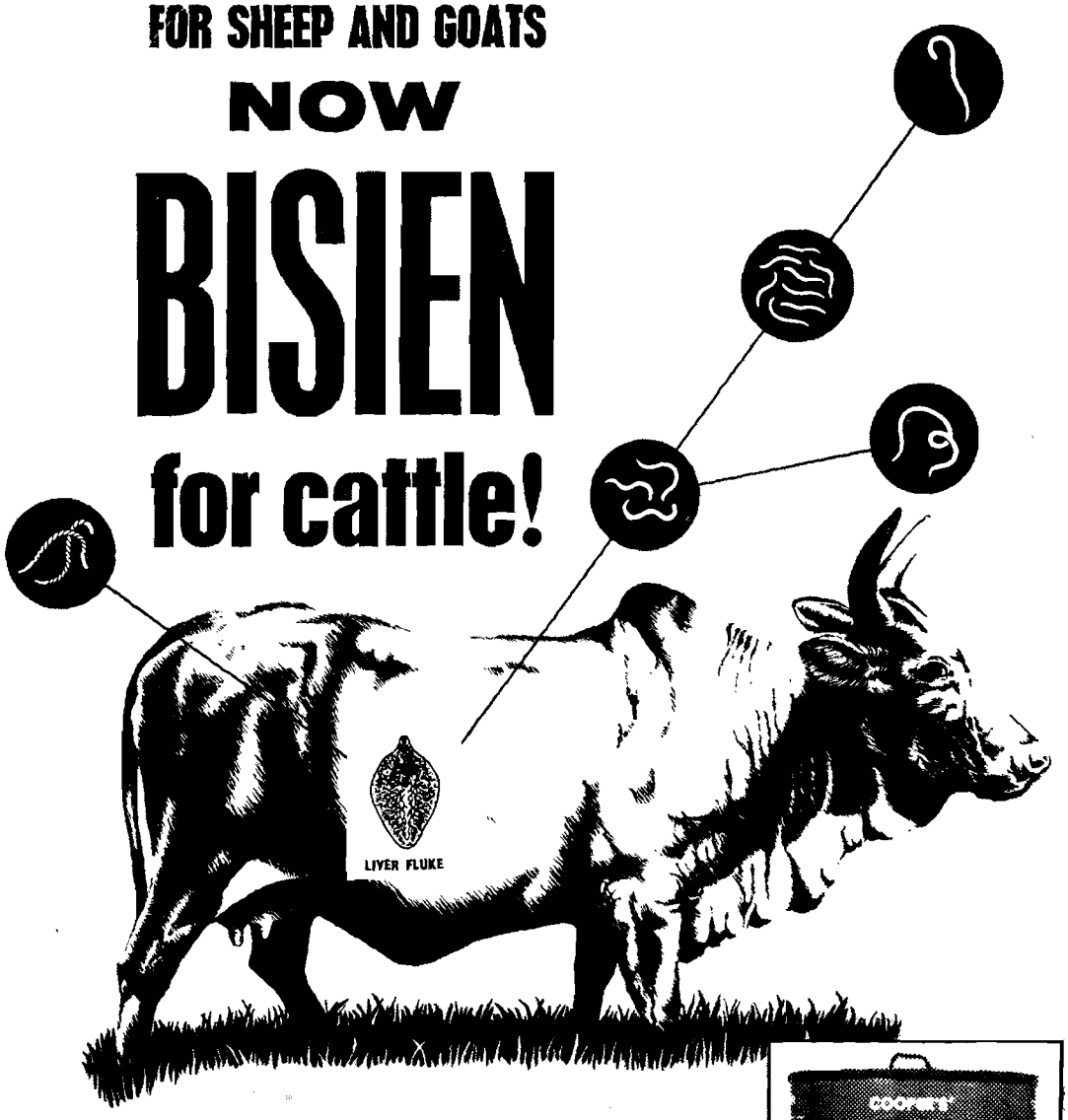

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STUDIES ON PARAMPHISTOMIASIS VI

THE ANTHELMINTIC EFFICACY OF LINTEX AND FREON AGAINST *PARAMPHISTOMUM* SPP. IN SHEEP AND CATTLE

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Received for publication March, 1964.

SUMMARY

1. Freon BU was 99.6 to 100% effective against paramphistomes present in the rumen but erratic against fluke distal to the rumen.
2. Lintex at 50 mg/Kg was highly effective against 7, 14 and 20 day-old paramphistomes in sheep but ineffective against paramphistome metacercariae.
3. Against immature paramphistomes in cattle Lintex at 50 mg/Kg was ineffective and gave variable results at 100 mg/Kg; at 150 mg/Kg it was ineffective against adult fluke.

INTRODUCTION

The efficacy of "Lintex"* (N-(2'chlor 4-nitrophenyl)-5-chlorsalicylamid) against the immature stages of the conical fluke *Paramphistomum microbothrium* was recently demonstrated.[3,4] A critical trial in one sheep using "Freon" (tetrachlorodifluoroethane) was also described[3]; this drug was ineffective against immature conical fluke but inadvertently the inactive symmetric isomer had been used. The test method of choice was the controlled anthelmintic test.

The present paper describes controlled anthelmintic tests with Lintex and Freon.

MATERIALS AND METHODS

1. ANTHELMINTICS.

(*a*) Freon BU* (95% asymmetric isomer of "Freon 112") was mixed with an equal weight of liquid paraffin and dosed at 330 mg/kg.

(*b*) The Lintex used in sheep and on the metacercariae was a commercial product containing 75% of the active ingredient which was only 80% purified. In cattle the highly refined compound containing 75% active ingredient was used. Dosage rates varied between 50 and 150 mg/kg.

2. CONTROLLED ANTHELMINTIC TESTS.

The following modifications to the controlled test described by Horak[3] were adopted:—

(i) In natural and artificial infestations containing worms less than 14 days of age the abomasal and small intestinal ingesta were washed on 300 mesh to the linear inch sieves, to trap these smaller worms.

(ii) In the rumen, the wall only was examined in infestations younger than 20 days; both wall and ingesta were examined in older infestations.

(iii) In cattle infested with adult worms, total counts were carried out.

* Lintex: Farbenfabriken Bayer A. G. Leverkusen.
* Freon BU: E. I. Du Pont De Nemours & Co., Delaware.

The anthelmintic effects were tested on infested sheep, cattle and on metacercariae:

Experiment 1. FREON BU.

(1) Six sheep naturally infested with *Calicophoron calicophorum* and *P. microbothrium* were brought to the laboratory.

(2) Three sheep were injected intra-ruminally with Freon BU at 330 mg/kg. Two sheep acted as undosed controls. One sheep which died immediately after oral dosage of this drug, due to aspiration of part of the drench, was also included as a control. A treated sheep was killed 29 hours after dosage; at 47 and 71 hours respectively one treated and one control sheep were slaughtered at each occasion.

Experiment 2. LINTEX IN SHEEP.

(1) Six adult sheep each received single doses of 71,000 ± 3,000 metacercariae of *P. microbothrium*, encysted on cellulose strips[8].

(2) These sheep were divided into three pairs: one member of each pair was treated with Lintex at 50 mg/kg *per os* on the 7th, 14th and 20th day after infestation respectively; the other member of the pair was kept as an undosed control. The respective pairs were slaughtered seven, six and three days after treatment.

Experiment 3. LINTEX IN CATTLE. Immature *P. microbothrium*.

(1) Four heifers each received 61,000 to 64,000 metacercariae followed by 41,000 to 43,000 metacercariae four days later and a further 65,000 to 66,000 metacercariae seven days later.

(2) Thereafter the procedure with the heifers was:

(i) One was treated with Lintex at 100 mg/kg two days after the last metacercarial infestation and slaughtered six days later.

(ii) One was treated with Lintex at 50 mg/kg and another at 100 mg/kg respectively, seven days after the last metacercarial infestation and slaughtered seven days later.

(iii) The remaining heifer was kept as an untreated control and was slaughtered at the same time as the two heifers in group (ii).

Experiment 4. LINTEX IN CATTLE. Adult *P. microbothrium*.

(1) The presence of adult conical fluke was confirmed by faecal examination of four naturally infested heifers.

(2) These heifers were divided into two pairs.

(i) One heifer was dosed with Lintex at 150 mg/kg. The drug was mixed with liquid paraffin, placed in paper packets and dosed *per os*. Six days later this heifer and an untreated control were slaughtered.

(ii) Another heifer was dosed with Lintex at 150 mg/kg. This was dosed as a dry powder in paper packets. This heifer and the remaining untreated heifer were slaughtered 12 days later.

(3) The paramphistomes recovered at autopsy were found to be *P. microbothrium*.

Experiment 5. LINTEX AGAINST PARAMPHISTOME METACERCARIAE.

(1) Thirty-eight thousand 17 day-old metacercariae of *P. microbothrium* encysted on cellulose strips[8] were placed in a water-permeable nylon gauze bag and immersed for 16 hours in a 0.15% w/w suspension of Lintex and tapwater.

(2) Air was bubbled through this suspension during the period of immersion to keep the Lintex in suspension and to ensure that the metacercariae were bathed in the suspension.

(3) The metacercariae were removed and washed in tapwater until all visible Lintex had disappeared and were then dosed to a sheep.

(4) Thirteen days after infestation this sheep was slaughtered and the immature fluke collected and counted.

Results

Experiment 1. Freon BU.

Table I.—The effect of Freon Bu at 330 mg/kg against Mature and Immature *paramphistomum* SPP.

Sheep No.	Time in hours between treatment and slaughter	Paramphistomes recovered from the rumen	Percentage efficacy	Paramphistomes recovered distal to the rumen	Percentage efficacy
1	29	2	99.6	45	0.0
2	Control	491		13	
3	47	0	100.0	2,754	0.0
4	Control	2,803		101	
5	71	0	100.0	16	98.0
6	Control	3,784		816	

Freon BU was 99.6 to 100% effective against immature and adult conical fluke present in the rumen but erratic against the immature worms distal to the rumen.

Experiment 2. Lintex in Sheep.

Table II.—Controlled Tests on Immature *P. microbothrium* in Sheep using Lintex at 50 mg/kg.

Sheep No.	Number of metracercariae dosed	DAY		Paramphistomes recovered	Percentage efficacy
		Treated	Slaughtered		
7	74,000	7	14	3,738	84.9
8	68,000	Contro	14	24 830	
9	71,000	14	20	15	99.9
10	69,000	Control	20	25,663	
11	72,000	20	23	2,122	96.2
12	72,000	Control	23	56,065	

Lintex was 84.9% and 99.9% and 96.2% effective against 7, 14 and 20 day-old *P. microbothrium* in sheep respectively.

Experiment 3. Lintex in cattle. Immature *P. microbothrium*.

TABLE III.—THE EFFECT OF LINTEX ON IMMATURE *P. microbothrium* IN CATTLE.

Heifer No.	Weight in Kilo.	Dosage level in mg/kg.	Weight of Lintex dosed in gm.	Number of metacercariae dosed	Age of Paramphistomes Day		Paramphistomes recovered	Percentage efficacy
					Treated	Slaughtered		
1	390	100	52.0	169,000	2, 9, 13	8, 15, 19	1,669	96.4
4	224.1	Control		172,000	Control	14, 21, 25	46,310	
2	212.8	100	28.4	171,000	7, 14, 18	14, 21, 25	49,434	0
4	224.1	Control		172,000	Control	14, 21, 25	46,310	
3	249.1	50	16.6	169,000	7, 14, 18	14, 21, 25	95,078	0
4	224.1	Control		172,000	Control	14, 21, 25	46,210	

The efficacy of Lintex at 100 mg/kg against 2, 9 and 13 day-old paramphistomes was 96.4%. At 50 and 100 mg/kg Lintex had no effect on 7, 14 and 18 day-old fluke.

Experiment 4. Lintex in cattle. Adult *P. microbothrium*.

TABLE IV.—THE EFFECT OF LINTEX AT 150 mg/kg AGAINST ADULT *P. microbothrium* IN CATTLE.

Heifer No.	Dosage method	Time in Days between treatment and slaughter	Paramphistomes recovered from the rumen	Percentage efficacy
5	Oily suspension	6	1,789	0
6	Control		242	
7	Dry powder	12	4,699	0
8	Control		787	

Lintex at 150 mg/kg was ineffective against adult *P. microbothrium* present in the rumen.

Experiment 5. Lintex against *P. microbothrium* metacercariae.

TABLE V.—THE EFFECT OF A 0.15% SUSPENSION OF LINTEX ON THE VIABILITY OF PARAMPHISTOME METACERCARIAE.

Sheep No.	Number of metacercariae dosed	Treatment of metacercariae	Day slaughtered	Paramphistomes recovered	Percentage of metacercariae recovered as Paramphistomes
8	68,000	Nil	14	24,830	36.5
10	69,000	Nil	20	25,663	37.2
12	72,000	Nil	23	56,065	77.9
13	38,000	0.15% Lintex	13	19,843	52.2

Lintex had no effect on the viability of paramphistome metacercariae.

Freon BU.

This anthelmintic was highly effective against both adult and immature *C. calicophorum* and *P. microbothrium* present in the rumen. It acts very rapidly; 29 hours after treatment practically all the fluke in the rumen had been removed or digested. In the sheep that died due to some of the drug entering the lungs, an immediate autopsy was performed; 464 of the 491 paramphistomes present in the rumen had already released their hold on the mucosa and were found lying free in the ruminal ingesta.

Boray and Pearson[1] observed the destructive effects of Freon on the cuticle of *Fasciola hepatica.* This was confirmed on *Paramphistomum* spp. Many dead worms recovered showing evidence of cuticular destruction. This compound appears to be a cuticular solvent not only of trematodes but also of the superficial layers of mucosa of the fore-stomach. In sheep recently treated large patches of the superficial mucosa had disappeared; 3 days after treatment the entire superficial mucosa had disappeared, leaving a white surface, however, no macroscopical evidence of inflammation of the underlying layers was seen. Furthermore the ingesta was brown in colour with a putrid smell, compared with the green, normal ingesta of the undosed controls. On microscopical examination of the ruminal ingesta of a sheep treated 71 hours previously, infusoria were few in number and either lethargic or dead.

The numbers of immature fluke found distal to the rumen in the treated and control sheep varied considerably and for this reason no definite conclusion as to the effect on these stages can be drawn. It was effective in one of three sheep treated, and at best can only be considered erratic in its efficacy.

Lintex.

This compound was highly effective against 7, 14 and 20 day-old *P. microbothrium* in sheep. This efficacy against 7 and 14 day-old worms is a distinct advantage when treating cases in a field outbreak of paramphistomiasis where fluke of all ages may be present. It means that with a single drenching the majority of both the pathogenic 20 day-old fluke and the less pathogenic younger stages are removed. It is interesting to note that five of the fifteen immature paramphistomes recovered from Sheep 9 (Table II), were obtained from the gall-bladder, where they were unaffected by the anthelmintic.

In a previous experiment[4] it was noted in one sheep that the majority of immature paramphistomes were excreted on the third day after treatment with Lintex, whereas in all other cases they had been excreted within 24 hours of treatment[3]. A similar phenomenon appears to have occurred in the case of Sheep 11 (Table II), slaughtered three days after treatment, where fluke were still present but found distal to their normal habitat. Because of this delayed action of the drug, it was decided to postpone slaughter till at least six days after treatment; this policy was followed in the anthelmintic tests in cattle.

The variable results, when using Lintex at 100 mg/kg against immature paramphistomes in cattle, are interesting; the negative result probably being due to incorrect dosage level and not to the inefficacy of the anthelmintic.

Strufe and Gönnert[7] demonstrated an inverse ratio between the amount of Yomesan (Lintex) absorbed by cestodes in rats and the volume of ingesta present at the time of treatment. Hecht and Gloxhuber[2] state that very little Yomesan is absorbed from the intestine. In anthelmintic trials on cestodes in lambs[6] a total dose of less than 1 gm. of the active ingredient of Lintex was ineffective in very young lambs; this dose exceeded 50 mg/kg which is the effective dosage level in larger sheep.

The findings of these workers suggest that to be effective this anthelmintic must be present in the intestine at a certain concentration, irrespective of the size of the animal. Should this be the case the empirical dosage rate based on milligrams of anthelmintic per kilogram of live-weight is not valid for this drug or other anthelmintics which act by contact or absorption by helminths. Dosage levels for these anthelmintics should be indicated rather by intestinal volume than by overall bodyweight.

Heifers 1 and 2 in Experiment 3 were approximately three years of age and weighed 390.0

and 212.8 kg. respectively. The volume of small intestine in heifers of this age and size does not vary substantially, the difference in total weight being due to bone and muscle[5]. Although the dosage rate in each of these heifers was 100 mg/kg., Heifer 1 received practically double the amount of Lintex that Heifer 2 was given. Because the drug is not absorbed, it was present in a higher concentration in the intestinal lumen in the former than in the latter. This probably explains the increased efficacy in Heifer 1.

In the trials against adult paramphistomes in cattle Lintex was dosed in paper packets to ensure that it entered the rumen. The anthelmintic was mixed with liquid paraffin in the hope that the oily suspension thus formed would coat the ruminal contents and come into close contact with the paramphistomes. Despite this Lintex was ineffective.

Conclusions.

Freon BU is highly effective in sheep against *Paramphistomum* spp. present in the rumen. Lintex is highly effective in sheep against *P. microbothrium* distal to the rumen.

ACKNOWLEDGEMENTS

The Chief, Veterinary Research Institute is thanked for facilities to carry out these experiments and permission to publish the results; Messrs. L. P. Heitmann, J. H. D. Maré and J. P. Louw for assistance with the autopsies and counting; Dr. R. K. Reinecke for help with the manuscript, and the Section of Reproduction, Onderstepoort for supplying and housing the cattle.

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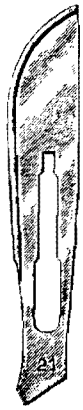

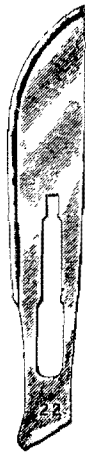

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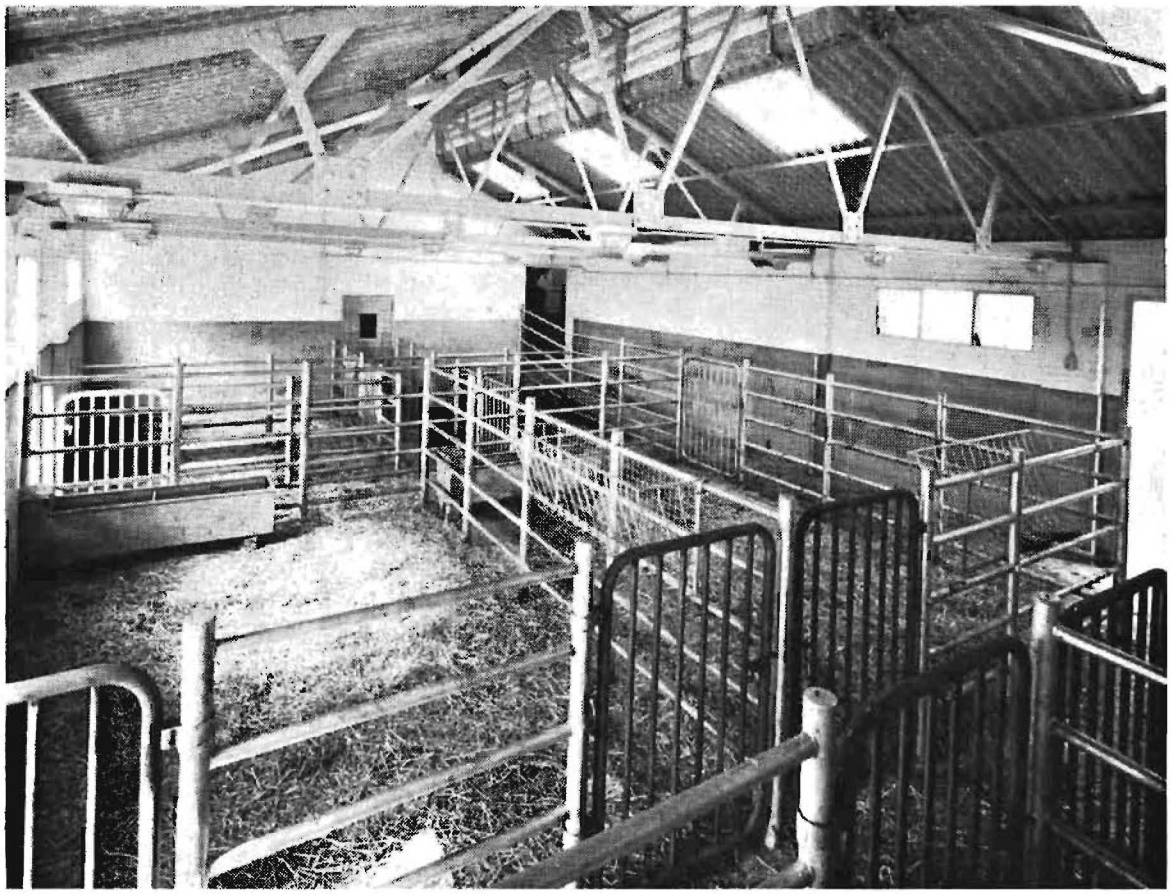

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ADVANCES IN RESEARCH ON ACUTE FROTHY BLOAT IN RUMINANTS*

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INTRODUCTION

Bloat or tympany, to which apparently all ruminants are subject, is a condition where the rumen is distended with gas, formed by fermentation in the forestomachs. Clinically it is recognised by marked bulging of the left flank, weak rapid pulse, respiratory distress, groaning and staggering, frequently followed by death if not relieved.

Gas is normally formed in the forestomachs of ruminants and is expelled by eructation through the oesophagus. Some gas is also absorbed into the bloodstream from the walls of the forestomachs. Only when gas formation exceeds gas elimination does bloat occur.

The condition may be classified as acute or chronic. Acute bloat may again be subdivided into frothy or free-gas bloat. Of these, frothy bloat is encountered more frequently and is by far the most important form of ruminant tympany. Chronic bloat, which may be persistant or occur intermittently, is usually a symptom of some other disorder and is seldom the direct cause of death.

Acute frothy bloat is a condition of major economic importance. It occurs mainly in intensive farming systems where valuable animals are fed on green legumes or where animals are being fattened on high concentrate diets such as the American feedlot systems. American workers thus speak of "pasture bloat," when provoked by green legume pastures, or of "feedlot bloat", when caused by a too high concentrate diet. The extent of the economic losses due to bloat in South Africa is not known but Dougherty[1] estimates the annual loss in the United States as somewhere in the vicinity of forty to fifty million dollars. The countries in which the condition is commonly encountered are Australia, Britain, Canada, Germany, India, New Zealand, South Africa and the United States of America. Most publications on the matter also originate from these countries, especially from the last three mentioned.

Excellent reviews on the problem have been provided by Weiss (1953)[2], Dougherty[3] and Cole and Boda (1960)[4].

ANIMAL SUSCEPTIBILITY

Although cattle, especially dairy cows in milk appear to be the species mainly affected by bloat, there is no direct evidence that this is due to a species difference. In fact bloat is just as common in sheep farming areas if green legumes are fed.[2] Bloat also occurs in wild antelopes. The author has, on a few occasions, seen waterbuck that died of bloat in a lucerne field on the Limpopo River. Various other abundant species, such as kudu, impala, steenbuck, and bushbuck, which also grazed in the same field, were never seen to be affected.

There exists some evidence that susceptibility to bloat is inherited. Knapp, *et al* showed that the progeny of certain beef bulls were more susceptible to bloat than others. The marked similarity in the incidence of bloat amongst identical twins found by Johns[6] confirmed the inheritance of susceptibility to bloat.

GAS FORMATION IN THE RUMEN

Gas is normally formed during fermentation in the rumen. The higher the rate of fermentation, the more is produced. Some feeds produce more gas per unit time than others, eg. lucerne hay produces approximately three times the

* Seminar submitted in partial fulfilment of the degree M.Med.Vet.(Phys.) in the Faculty of Veterinary Science, University of Pretoria.

volume of gas as does Sudan grass, oat hay, teff hay or grass hay.[7,8,9,10]. Green lucerne tops with oat hay produce more gas than lucerne tops alone.[9]

Previously it was thought that the rapid production of gas by the ruminal organisms on certain feeds was alone the cause of bloat and that remedies such as turpentine and coal tar derivatives relieved the condition through reducing gas formation. Quin and Clark[11], however, proved that under normal circumstances a sheep can get rid of two litres of artificially introduced air from the rumen per minute. Only 11 Litres of gas were formed from 4 lbs. of lucerne hay during the first five hours in the rumen of a bovine.[12] Further, it has been shown that ruminal gas production may be as high on a non-bloating as on a bloating ration,[12] and that green lucerne did not stimulate more gas production than lucerne hay[3] or green growing bluegrass.[13] Clark[14] has also shown that turpentine does not relieve bloat through its antifermentative power but rather through its action on the surface tension of the ruminal mass.

The Erectation Reflex

Gas is eliminated from the rumen by eructation. Weiss[2,15] described the eructation reflex, its stimulus and factors that may affect it, in great detail. He proved that the reflex is mainly stimulated by increased gas pressure in the rumen. Dougherty *et al*[16] investigated the innervation of the reflex further and discovered that a small area around the cardiac orifice is particularly sensitive to gas pressure and is probably the site of origin of the nerve impulses governing the eructation reflex. This disproved the theory held by Mead *et al*[17], that the presence of coarse material in the rumen provided the stimulus. Several investigators reported an increase in rate and strength of the eructation contraction during flothy bloat or insufflation of the rumen with various gases [2,9,15,18,19].

The eructation movement of the rumen occurs as a wave-like contraction starting in the region of the posterior dorsal blind sac and moving forward in the dorsal wall of the rumen towards the cardia[15,20,21]. It is innervated by the vagus nerves[15,21,22,23]. These movements usually follow every second or third mixing movement but in cases of higher intraruminal pressures they may even outnumber the mixing movements.[15] The movement forces the gas forward and downward towards the cardia. At this stage, the reticulum contracts twice in succession to free itself from ingesta and then relaxes to clear the cardia. The role of the dilatation of the reticulum in eructation was first advanced by Amadon[24] and was later elucidated by Weiss[2,15] and subsequently confirmed by Dougherty and Meredith[25], who also showed that the movements of the rumino-reticular fold have a very important function in preventing the backflow of ingesta into the reticulum. Another important function of the eructation reflex is the opening of the cardiac orifice. At the moment of eructation the orifice is changed into a funnel-shaped opening by contraction of the medial and lateral pillars of the rumino-reticular fold, allowing the gas to excape through the oesophagus.[2,3,14]. The oesophageal sphincters play an important role in controlling the outflow of gas through the oesophagus,[25] and prevent the eructation of fluid or froth[29].

Today it is generally accepted that bloat is the result of a failure of the eructation reflex to expel gas through the oesophagus, either due to disturbances in the reflex itself or to obstruction. The following factors were proved by Weiss[2,15,28] to influence the efficiency of eructation:—

(*a*) *Overfilling of the rumen*: In greedy feeders or after drinking a great volume of water, the reticulo-rumen may be filled to such an extent that dilatation of the reticulum will not succeed in dropping the level of ingesta below the cardia, thus preventing the escape of gas.

(*b*) *Frothing of ruminal ingesta*: This is the main cause of bloat in ruminants and will be discussed in more detail later. It may cause a purely mechanical obstruction to the escape of gas[2]. Dougherty, Habel and Bond[27], on the other hand, suggest that the stimulation of sensory nerve endings by the foam inhibit the reflex relaxation of the cranial oesophageal sphincter.

(*c*) *Posture of the animal*: Elevating the hindquarters of the animal has the same affect as overfilling of the rumen[18].

(*d*) *Alkalosis*: Efficiency of eructation varies inversely with the degree of alkalosis through its influence on ruminal motility.

(*e*) *Lesions of Vagus nerves*: Branches of the vagi may be damaged by inflammatory or mechanical processes such as peritonitis caused by traumatic reticulitis. Depending on the site of the lesion, chronic bloat may follow.

(*f*) *Reflex inhibition from posterior digestive tract*: Distention of either the abomasum or caecum reduces eructation efficiency by reflex inhibition of the reticulum[2,15].

(*g*) *Toxins.*

(i) *Prussic acid* in small doses inhibits the mixing contractions and the reticular movement. Provided the rumen is not overfilled, eructation is still possible. Larger doses of prussic acid which will inhibit all ruminal movements will also cause other symptoms of acute prussic acid poisoning.

(ii) *Atropine* is found in some plant species. Small doses of atropine, insufficient to cause ruminal paralysis, will completely inhibit the eructation reflex.

(iii) *Histamine* is increased in the ruminal content when the animal is fed a high protein diet[29]. Histaminase in the rumen may, however keep the free histamine at a low level,[30] but may not always be present in sufficient quantity[15].

(iv) *Adrenaline* may inhibit the eructation reflex to a certain extent. Fear and anxiety may therefore be contributory causes of bloat.

Frothing of ruminal ingesta

Normally most of the gas formed in the rumen escapes as free gas above the ingesta. Under certain circumstances, however, the gas may remain trapped in the ingesta giving rise to foam formation. Should such a foam be of high stability, little gas escapes and frothy bloat may develop. According to Nichols[31], the following factors contribute towards a stable foam formation: rapid gas formation; slow solution of gas; a great number of small gas bubbles; a slow rate of coalescence or breaking of bubbles; a high viscosity, density and surface tension of the membrane of the bubbles; a greater number of particles in the medium; a low fluid volume of the ingesta; a higher surface tension, density and viscosity of the ingesta and limited agitation. These conditions are provided in the rumen with the ingestion of fresh bloat-provoking legumes.[31]

It is now generally accepted that frothing of the ruminal ingesta is by far the most important cause of pasture and feedlot bloat[4]. Other factors influencing the efficiency of eructation are only contributory causes. For instance, in a partially paralised rumen the formation of a small amount of froth may give rise to bloat, whereas in an actively contracting rumen with less ingesta, even more severe frothing may have no effects. Frothing depends primarily on rapid gas production in the rumen. As mentioned earlier, large quantities of gas are produced by the fermentation of legumes and, in this respect, they are very suitable substrates for provoking bloat.

Numerous workers have attempted to find the exact cause of sudden frothing of the ruminal ingesta on legume pastures. Pressey, *et al*[32] explain the foaming properties of a plant as the net effect of a delicate balance of foaming agents, foam stabilizers and foam inhibitors. These authors determined the foaming properties of lucerne plants. They found it to vary according to soil type and soil moisture. Foaming ability increased with growth and rapidly decreased before bloom. Optimum foaming appeared at a temperature of 18°C and pH 6.2. The foaming properties were associated primarily with the leaves and could be increased by 50 per cent if the plants were frozen before maceration.

Acute bloat has been produced by the oral or intraruminal administration of pressed juice from freshly cut lucerne[33,34,35,36,37] or clover [38,39]. On the basis of foam stability and pH studies, Johns *et al*[40] and Mangan[41], regarded cytoplasmic proteins as the chief offenders in foam production, a view supported by Cole and Boda[4]. Young succulent grasses also have a high protein content but do not produce foam as readily as legume proteins.[4,41].

At one time saponins were thought to be the most important factor in the frothing of ruminal ingesta[42,43,44,45,46]. Barrentine[47], however, was unable to find any correlation between the saponin content and the bloat-provoking potential of various legumes. Bacteria have been

isolated from the rumen which, when incubated with saponin extracts, produced a copious slime[48,49].

Investigations into the mineral pattern of legumes have been carried out in attempts to correlate their bloat-provoking potentials with certain mineral levels. Jackson, *et al*[50] could not correlate the bloat-producing ability of clover with its nitrogen, saponin, potassium, phosphorus or calcium content. In their present study, Harris and Sebba[51] have been able to demonstrate that lucerne with a high manganese content gives a more stable foam than other lucernes.

Hungate, *et al*[52] suggested that bacterial slime production plays a role in frothing of ruminal ingesta. Gutierrez, *et al*[53] found slime to be increased during bloat. The ethanol precipitated slime fraction isolated from centrifuged rumen fluid contained 61-64 per cent protein, 8-14 per cent carbohydrates and 7-10 per cent ribonucleic acid. (On high grain rations DNA instead of RNA). Rous and Gilchrist[54] showed that slime capsulated organisms and other bacteria producing slime, reached the peak of their activity about half an hour after feeding, a time which corresponds closely to the incidence of bloat on legume pasture. A high correlation was also found between the percentage encapsulated organisms in rumen liquor and the incidence of feedlot bloat[55].

Attempts have also been made to correlate the incidence of bloat with certain ruminal populations. Mah and Hungate[56] found protozoa of the genus *Ophryoscolex* more prevalent in the ingesta of bloating animals than in non-bloaters. On the other hand, no difference could be found between the type or numbers of bacteria cultured from ingesta of bloating and non-bloating animals, by Bryant, *et al*[57]. Rous and Gilchrist[54] proved that bloat can be produced by microflora not adapted to legumes. They adapted the ruminal microflora of sheep to a low protein teff hay diet and suddenly fed the sheep large quantities of succulent green lucerne. Bloat followed, as in lucerne adapted sheep.

Lipid carrying chloroplasts are thought to be important antifoaming substances[58]. Various other anti-foaming agents may be present in the plants consumed. Saliva is now known to possess important antifoaming properties and deserves special attention.

Saliva as an anitfoaming agent

Clark and Weiss[59] first suggested that the salivation reflex stimulated by coarse feed in the rumen might play a role in preventing froth formation and bloat. Weiss[2,60] proved that foaming in the rumen was depressed by increased flow of saliva. He ascribed this effect to dilution of the ingesta by the saliva, changing it from a thick viscid, easily frothing mass to more fluid ingesta which did not foam as readily. Johns, *et al*[61] critisized this dilution hypothesis as they were able to produce bloat by drenching animals with lucerne juice. Bartley[62] *et al*[63,64] and Bartley and Yadava[65] have since proved that the mucin present in the saliva acts as a powerful antifoaming substance when added to ruminal ingesta. It is, therefore, obvious that the amount of saliva secreted plays a very important role in the prevention of bloat.

Ruminant saliva contains several salts amongst which bicarbonates, chlorides and phosphates of sodium and potassium are the most abundant[66]. It also contains approximately 5 to 7 mg. per cent of urea[67] and 250 to 450 mg. of mucin per 100 ml. of saliva collected at the cardia[68]. Phillipson and Mangan[69] indicated that this mucoprotein of saliva is mainly secreted by the submaxillary glands and that it may be increased five times by inflation of the rumen in calves.

The secretion of saliva in ruminants is more or less continuous. The rate of secretion is increased by mechanical stimulation of the cardia eg. by coarse roughages[59,2,60]. The rate of flow is also increased during eating, more so when dry roughages are being consumed than with young green pasture[70]. There is also some evidence that the rate of salivary secretion is increased with higher intraruminal pressures[71,72]. It has been established that non-bloating cows secreted more saliva than bloat-prone cows. During rest a cow secretes from 50-80 ml. of saliva per minute and during feeding between 130 and 540ml. per minute depending on the type of feed [68,70]. For every part of grass eaten, cows secreted 4.5 to 6.1 parts of saliva[70], while

only one part of saliva is required to release trapped gas from 2.5 parts by weight of frothing ruminal contents in vitro[63]. On the other hand, 1 part of saliva to 12 parts of ruminal contents had no influence on surface tension[73], the concentration of saliva probably being too low. The mucin content of the saliva, which may vary, should influence these findings significantly.

It therefore appears that, with the rapid ingestion of young succulent green legumes, too little saliva may be secreted to counteract the foaming of the ingesta with the result that bloat follows. Recently Fina, *et al*[74] isolated five organisms from the rumen with mucinolytic activity. These were capable of breaking down salivary mucin and utilizing the freed sialic acid. Cultures of these organisms injected intraruminally into cows on mature non-bloat-provoking lucerne pasture, resulted in bloat in most instances. In three sets of identical twin cows fed a bloat-provoking ration plus the minimum amount of coarse hay to prevent bloat, marked bloat was induced in one of each of the sets of twins after administration of cultures of these organisms. These authors therefore suggest that bloat is caused by a decreased salivary flow or increased mucinolytic activity.

Prevention of Bloat

Since saliva is apparently the ruminant's natural antifoaming remedy, the maintenance of a sufficient salivary flow should prevent frothy bloat. Secretion of saliva is stimulated by coarse material in the rumen[59] and it has also been proved that the feeding of coarse hay will prevent frothy bloat on legume pastures.[74] Where cows are permitted to graze on legume pastures continuously it is advisable to provide course palatable hay at all times in hay racks in the pasture. Cows which are allowed legume grazing for short periods only, however, will be more greedy and will not be interested in the hay during their short grazing period. In such cases hay should be provided some time before they are taken to the pasture. Because of the danger of overfilling, cows grazing lucerne for short periods should not be allowed to drink water prior to or within one hour after the grazing period.

The successful use of vegetable oils or other anti-foaming agents in the prevention of frothy bloat on legume pasture has been reported by many investigators[14,40,75,76,66,69,79,80,81,82,83,84]. In New Zealand the spraying of pasture strips with oil provided an effective and practical method of control of pasture bloat[52,85,86,87,88].

McDowall, *et al*[84] found that 50 to 100 gm of fat per cow will prevent bloat for approximately 3 hours. This did not adversely affect milk yield or the composition of the milk. These authors found two fluid ounces of crude vegetable oil, fed on the concentrates during each of the three daily milking times, to be effective in the control of bloat in a big dairy establishment using grass clover pastures as the only roughage for the cows. Feedlot bloat, on the other hand, cannot be controlled by vegetable oils, in fact Elam and Davis[90] found a higher incidence of bloat when soya oil at a level of 8 per cent was added to the ration.

Antibiotics have also been found to reduce the incidence of bloat. Mangan, *et al*[58] ascribed the effectivity of penicillin to its inhibition of the bacterial modification of chloroplast lipids which act as antifoaming substances. A single dose of 50 to 100 mg. of procaine penicillin orally prevented bloat in cows for one to three days.[91,92]. The tetracyclines, bacitracin and streptomycin failed to control bloat[91,92]. Unfortunately penicillin is only effective as a bloat preventive for about two weeks[80,81,92]. Penicillin-erythoromycin mixtures may control bloat for three to four weeks,[92,93], while a penicillin, erythromycin, tylosin and streptomycin mixture could be used effectively for about 8 weeks[94]. Although this treatment depressed digestion during the first three days, the daily gains of the experimental animals were 0.19 lb. better than the controls.

Animal mucins given by mouth were found to reduce the incidence of bloat significantly in experiments with identical twins, 75 g. per cow preventing bloat for four hours[65]. An enzyme inhibitor impregnated on a carrier was also found to have bloat preventive properties[95]. It is regarded as being 96% effective.

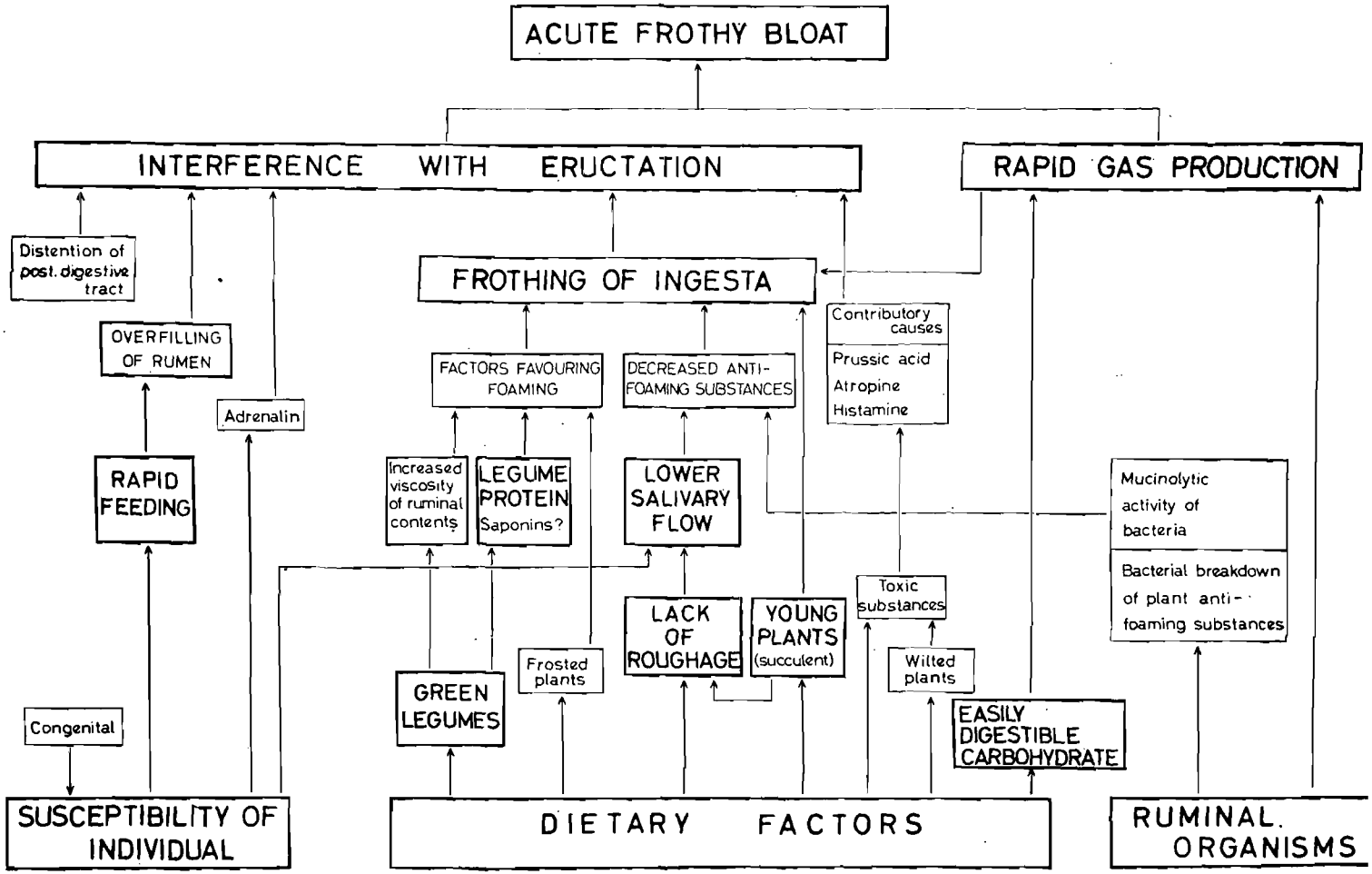

Fig. 1.—Factors responsible for the development of acute frothy bloat.

TREATMENT OF BLOAT

Acute bloat may run a very rapid course and in many cases the animal is simply found dead. Treatment should therefore be commenced as soon as possible after the onset of the first symptoms.

Attempts should first be made to break the froth. This can be done by the oral administration, or better still, injection of antifoaming agents directly into the rumen. Vegetable turpentine has been used empirically for almost 150 years[96] in the treatment of acute bloat. Only in 1948 did Clark[14] prove its action to be due to its surface active properties and not to any antifermentative powers. Various other proprietary surface active agents are today available, most of which are very effective. In fact, any thin oil or other substances which will lower the film strength of the foam can be used against bloat.

The dose of turpentine generally used for injection into the rumen is about two to three fluid ounces for an adult cow. When given by mouth it should be mixed with approximately half a pint of raw linseed oil. Johnson, *et al*[97] found emulsified soya oil a very effective and cheap remedy. Antifoaming agents were found to be unreliable in feedlot bloat[98].

Other measure which will assist to bring relief to the bloated patient should be taken eg. standing the animal against a slope, facing uphill and even inserting a trocar and cannula into the rumen through the left flank. In case of emergency immediate rumenotomy is indicated. In the author's experience, passing of a stomach tube which is sometimes advocated, is not of much avail and it only causes further distress to the animal.

The etiology of bloat, as judged from the literature, may be explained schematically as shown in fig. 1. Investigators agree that frothing of the ingesta which interferes with normal eructation of gas, is the basic cause of bloat. The degree of frothing depends on the balance between factors favouring foaming and antifoaming substances. The main foaming substance is fresh legume cytoplasm when actively attacked by ruminal mico-organisms. Among the antifrothing agents, saliva seems to play a very important role in preventing excessive foam formation. The secretion of saliva is decreased when too little roughage is ingested and also with rapid feeding. The susceptibility of the animal, the physicochemical properties of the diet and the activity of the ruminal micro-organisms therefore all contribute towards the development of bloat.

ACKNOWLEDGEMENT

The Chief, Veterinary Research Institute, Onderstepoort is thanked for his permission to publish this review.

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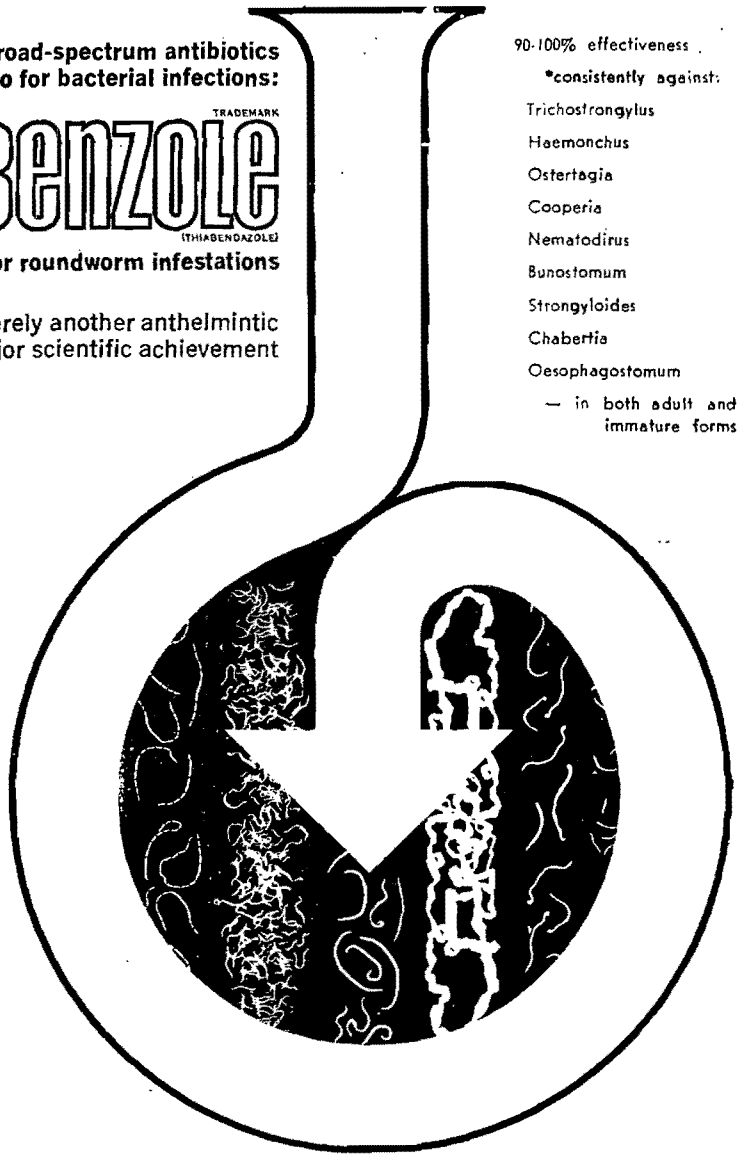

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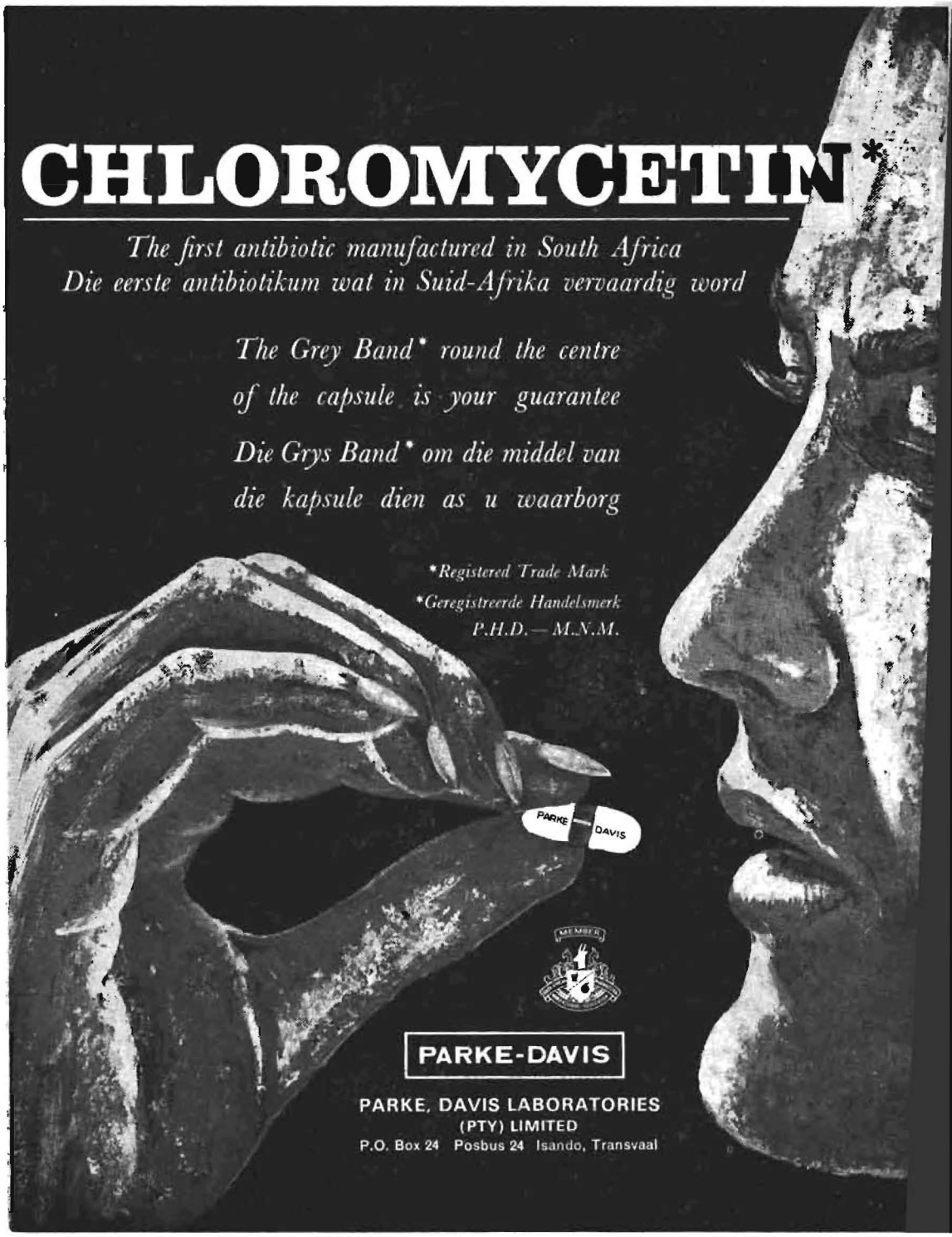

PARAFILARIA BOVICOLA (TUBANGUI 1934) IN CATTLE IN THE REPUBLIC OF SOUTH AFRICA

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Received for publication, March, 1964.

SUMMARY

The presence of *Parafilaria bovicola* is recorded in cattle in the Republic of South Africa for the first time. The literature on this parasite is briefly summarised. A description of the macroscopic and microscopic appearance of the lesions caused by this parasite, in the subcutis of infected animals, is given.

The significance of the parasite in terms of a differential diagnosis of skin lesions, and the evaluation of the carcase from the point of meat inspection, is discussed.

INTRODUCTION

In 1934 de Jesus[1] reported an affection of the skin in bovines in the Philippine Islands characterised by slightly raised nodules from which haemorrhage occurred, which he called haemorrhagic filariasis. Tubangui (1934)[4] described the female parasite of the Parafilaria species responsible for these nodules and named it *Parafilaria bovicola*.

In 1949, female specimens of the parasite were found in cattle in Ruanda Urundi by Fain and Derameé (1949)[2] and in Rumania by Metianu.[5] In 1950 Fain and Herin[3] first described the male of the species.

According to de Jesus[1] slightly raised, tough, non-painful cutaneous nodules 5-7 m.m. high and 12-15 m.m. in diamteer at the base, were present in variable distribution on the body and neck of infected animals. About the beginning of December some of the nodules began to bleed profusely and became enlarged, painful on palpation, attaining a maximum diameter of 40 mm at the base and a maximum thickness of 10mm. At the apex of each bleeding nodule a fistulous tract about 1 mm in diameter, perforating the epidermis was noticed. Incision through the fistulous tracts revealed a thin layer of necrotic material surrounded by acutely inflamed tissue. Symptoms were of variable duration and generally were exhibited by infected animals during the spring and early summer i.e. December to July, after which all nodules disappeared. No parasites were found in non-haemorrhagic nodules, and only females in the haemorrhagic lesions.

HISTORY

While inspecting and grading the carcases of oxen originating from the government experimental farm at Mara, Northern Transvaal in June 1963, it was noticed by one of us (L.W. v.d. H.) that several carcases displayed irregular circumscribed areas of dirty greenish-yellow coloured inflammatory oedema, in the subcutis along the dorsal aspects of the carcase i.e. loins, thorax, hump and neck. Initially they resembled partially healed superficial contusions, but closer examination revealed greenish-yellow to greyish-white opaque areas 4-10 mm in diameter, embedded in the surrounding oedematous tissue, in one of which a whitish thin wormlike structure was found, which later proved to be a partially degenerated filarial worm, which could not be

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identified. Other carcases exhibited small haemorrhagic subcutaneous foci, 1-4mm in diameter, situated in areas of more or less clear, non-inflammatory, oedematous subcutaneous tissue.

During July and October 1963 similar lesions to those described above were seen (J.G.P.) in two cattle autopsied on the farm, "Ameland" approcimately thirty miles west of Mara. From the animal examined during July, two female parasites were collected from the subcutis and from the animal autopsied during October, numerous females and one male parasite were collected. These worms were all identified as *Parafilaria bovicola* (Tubangui, 1934) by Dr. R. J. Ortlepp*.

Fig. 1.—Cross section of *Parafilaria bovicola* in the subcutis. H & E stain. X30.

Materials and Methods

Parasites were carefully removed from the subcutaneous tissue with the aid of dissecting needles and preserved in 10% formalin for identification. Specimens from the affected areas of the subcutis were collected in 10% formalin for histopathological study. Sections were cut 3μ. in thickness and were stained by the haematoxylin-eosin method and Giemsa method and were examined microscopically.

Pathology

(*a*) *Macroscopic.*

The lesions were irregularly distributed in the subcutaneous tissue on the dorsal aspect of the body, over the loins, hump and neck. They were distinctly oedematous in appearance, greenish-yellow in colour, irregularly circumscribed and varied from approximately 7.5—15 cm in diamter. Only the subcutis was involved and the underlying fascia and muscles, and the skin covering the lesions, were not affected. In none of the cases were nodules found in the skin as was described by de Jesus[1], despite a very carefull search for them.

In the first case examined at Ameland two female parasites were collected from the subcutis in the immediate vicinity of lesions, which were themselves free of parasites. From the single lesion encountered in the second carcase, which was situated on the lateral aspect of the hump, a live male was obtained. Numerous females were present, lying coiled up and embedded in the subcutis, all along the dorsal aspect of the carcase.

No inflammatory reaction was present in the vicinity of these females and except for an occasional petechial haemorrhage, the subcutis had a normal appearance. The lesion observed on the hump in this instance had a much lighter yellowish-green colour and was less oedematous, than those seen in the previous cases.

(*b*) *Histopathology.*

Material from lesions present in the Mara cases, containing dead parasites, as well as material from the lesions noticed in the two Ameland cases, were examined histo-pathologically.

A marked, diffuse oedema of the subcutaneous tissues was seen in the Mara cases. The dead parasites were surrounded by a narrow zone of degenerated polymorphonuclear cells. Some

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of these cells were also present within the internal structure of the parasites. This was followed by a zone of macrophages arranged in a pallisade formation (Fig. 2) which again was encircled by a thin layer of young connective tissue consisting of fibroblasts. The area immediately adjacent to this thin connective tissue capsule was densely infiltrated by numerous round cells, predominantly lymphocytes, with a few plasma cells and odd eosinophiles scattered amongst them. No giant cells were seen in any of the cases.

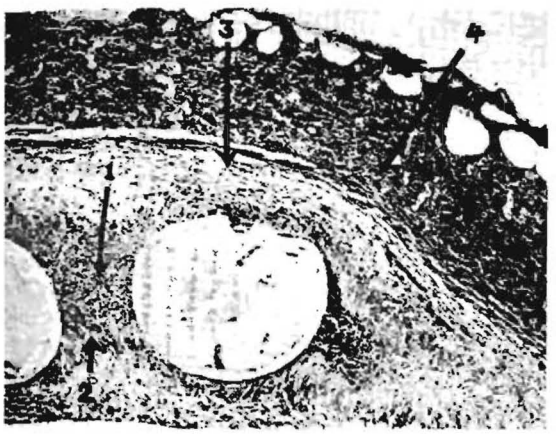

Fig. 2.—The parasite in the subcutis is surrounded by a zone of polymorphonuclear cells (1), followed by macrophages arranged in a pallisade formation (2), connective tissue (3) and lymphocytes (4). Giemsa stain. X190.

Tract-like lesions (Fig. 3) apparently caused by migration of the parasite before dying were also noticed. These consisted of a small central core of necrotic cellular debris and fibrin surrounded by dense infiltrations of eosinophiles. Numerous eosinophiles and macrophages were also present in the oedematous tissue surrounding these tracts.

The microscopic lesions encountered in the first cases examined at Ameland were identical to those seen in the Mara cases with the exception that no parasites were seen in any of the sections.

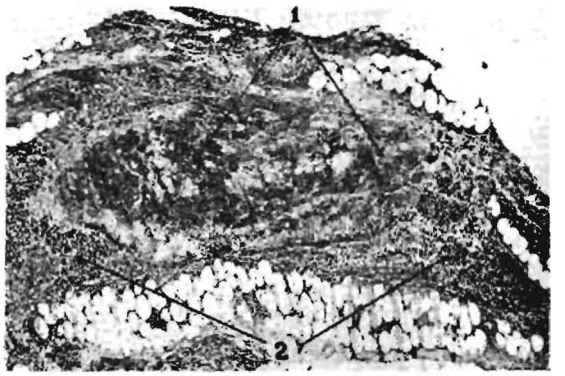

Fig. 3.—Subcutis. Tract-like lesion (1), consisting of necrotic cellular debris surrounded by a dense infiltration of eosinophiles (2). H & E stain. X75.

The single lesion observed in the second case at Ameland which yielded a live male worm, showed, oedema of the subcutis histologically, although not to such a marked extent as in the previous cases. There was in this case only a very scanty infiltration of eosinophiles and macrophages. Small focal haemorrhages scattered in the oedematous tissues were also seen. No pathological changes were observed in specimens taken from the skin covering this lesion.

The subcutis surrounding the live female worms in the Ameland cases was not examined histologically, as no gross abnormalities were seen.

Discussion

Although this is the first report on the occurrence of *Parafilaria bovicola* in the Republic of South Africa, the fact that it was found in two successive autopsies done on cattle on the same farm in the Northern Transvaal and also in several cattle from the Mara farm nearby, suggests that this parasite may be prevalent in that area. It is remarkable that it has not been reported previously in the thousands of cattle originating from that area, which are slaughtered annually in various abattoirs in the Republic. The close resemblance of the lesion evoked by this parasite, to subcutaneous contusion, may account for this.

It is also of interest to note that the marked inflammatory reactions in the subcutis were mainly around dead parasites, with the exception of the reaction surrounding the live male parasite. The possibility that a dead parasite was also present in this lesion cannot be excluded. The inflammatory reaction in this instance was, however, very mild when compared to the other lesions in which dead worms were found. It will seem from these limited observations that the more marked focal inflammatory lesions observed by us in the subcutis, develop only after the parasite had died.

No nodules as described by de Jesus[1], were seen in the skins of any of the cases examined by us. These nodules, or swellings, develop when the adult female worm approaches the superficial layers of the skin for oviposition, and deposits her eggs through an opening to the exterior of the skin. This activity of the worm is accompanied by haemorrhage from the tiny opening at the apex of the nodule. No sexually mature females were present among the worms collected by us, which may explain the absence of the skin nodules.

Cattle in the Northern Transvaal are plagued by a variety of biting flies, and farmers report that drops of blood are frequently seen oozing from the skin. A distinction between haemorrhages caused by biting insects, and by erupting filariae, would have to be made. The skin lesions of parafilariasis might at times, be confused with those of Lumpy Skin Disease, tick bites, urticarial lesions and onchocerciasis. Fain and Herin (1955)[6] showed that the domestic fly, *Musca domestica*, probably acts as the intermediate host in the life cycle of *Parafilaria bovicola*.

Heavy infestations and the resultant skin lesions may produce some damage to the hide. The main significance of this parasite would appear to centre around carcase value, and as such may become important to the country's beef industry. Mild infestations, the presence of small haemorrhages caused by these parasites, or parafilariae in the absence of lesions in the subcutis may readily be overlooked at post mortem meat inspection.

The more obvious and extensive lesions are likely to be taken for localised contusions which are in the process of being resorbed. Carcases showing such obvious lesions would require judicious trimming in order to improve their appearance. This in itself would be the cause of some disfigurement and would lead to early spoilage, particularly where muscle tissue is exposed. Some loss of market value in affected carcases would therefore be inevitable, whilst such carcases would not qualify as being free of blemish for export purposes.

ACKNOWLEDGEMENTS

Acknowledgement is gratefully accorded to: Dr. R. J. Ortlepp for identifying the parasite and for advice and assistance; to Dr. R. C. Tustin for assistance in preparation of the manuscript, Mr. A. M. de Bruyn for the photomicrographs and Miss A. A. Beetge for preparing the histological sections; to the Chief, Veterinary Research Institute, Onderstepoort, for permission to publish this article.

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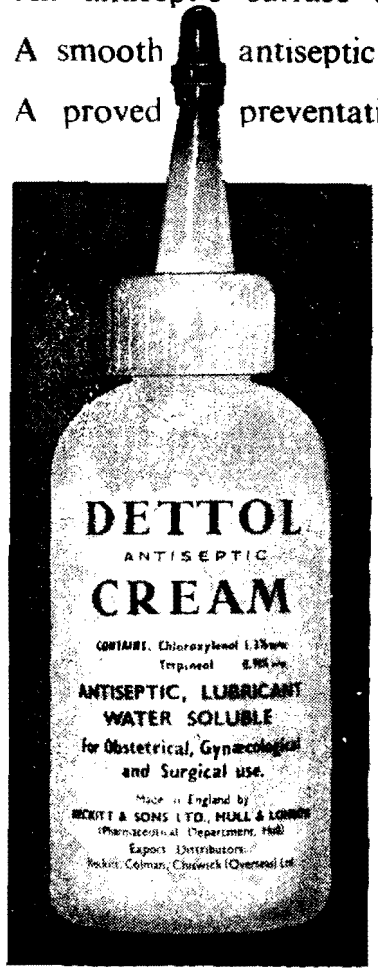

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PROTEUS MIRABILIS AS A CAUSE OF DISEASE IN CALVES

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Veterinary Research Institute, Onderstepoort

Received for publication March 1964

SUMMARY

The results of an investigation in an epidemic affecting calves 3 to 8 days old, suggested the involvement of *P. mirabilis*. This finding was based upon clinical symptoms, post mortems, bacteriological and experimental findings.

INTRODUCTION

Numerous reports have been submitted, describing the occurrence of members of the *Proteus* group in healthy[6] as well as diseased animals. *Proteus* has been associated with castration-introduced funiculitis[8], dysentery in pigs[17], dysentery and nervous conditions in dogs[3] and meningoencephalitis in calves[7].

In the human, various *Proteus* types have also been associated with diarrhoea in both the infant and adult[20]. Brooker[2] claimed that *Proteus vulgaris* was without any doubt the cause of "summer diarrhoea" while Metchnikoff[9] considered the *Proteus* group, as such, as the cause of dairrhoeic conditions. Neter[11], Neter and Bender[12] and Neter and Farrer[13] reported fatal cases of infantile enteritis caused by *P. vulgaris* and *P. morganii*. *Porteus rettgerii* has also been classified as a pathogen by Singer et al[18,19] who stated that the incidence of *Proteus* in healthy babies is very low. His views are consistent with the findings of Snyder[20].

Graber and Lincoln[5] reported the occurrence of *Providencia paracolons* in stools of infants under one year of age and Graber and Dodd[4] concluded that certain strains of *Providencia*, *P. morganii*, *P. vulgaris* and *P. rettgerii* are transient flora which could become "true" pathogens.

Phillips[15] examined 214 *Proteus* strains from animal origin. Of these 126 were isolated from dogs and cats and only 29 from bovine sources. Ninety-five per cent isolates from dogs and cats were *P. mirabilis* while in the bovine *P. vulgaris* and *P. mirabilis* were more or less equally represented. The frequency of *P. mirabilis* in the dog closely resembles its occurrence in the human being, where it was found that 85–90% of all *Proteus* isolates belonged to *P. mirabilis*[8,10,21].

Phillips[16] further recorded marked differences in *Proteus* strains' pathogenicity and in symptoms and lesions produced in mice by varying the dose and route of challenge. Large doses given intravenously produced septicaemia while smaller doses, similarly administered, resulted in localised necrotic renal lesions, only. The distribution of these lesions suggested that *Proteus* favoured spots where urea concentration was the highest i.e. around the renal tubules.

Johannsen[7], examined 575 calves which had died as the result of generalised bacterial infections. Of these 98 showed meningitis and meningo-encephalitis, only detectable histologically. Although the majority of these 98 cases were caused by *E. coli* (67) and *Salmonella* (7), bacteria-like *Proteus*, *Pasteurella*, *pneumococci* and *streptococci* were also incriminated.

PRELIMINARY FINDINGS

During the three year period ending 1963 an epidemic of an obscure illness which affected calves between the ages of 3 to 8 days was experienced by a well established breeding concern. More than 10% of the annual calf

crop, bred by artificial insemination, died, showing various symptoms. Eight-hundred head of cattle were kept on 300 morgen low-laying land under Italian rye and clover, heavily irrigated with municipal sewage water. As the result of this over-irrigation and inadequate drainage, the calves were born in and amongst pools of stagnant sewage water.

At onset the disease was marked by a white-greenish-yellow diarrhoea, followed by dehydration. Typically, the disease appeared between the third and fifth day of life. Occasionally, older than five days were affected. As the disease progressed, usually within two to three days, there were further reactions suggesting nervous involvement. The nervous symptoms included depression, weakness, ataxia, paresis and paralysis accompanied by incessant paddling movements. The calves retained consciousness and seemed to have died as the result of starvation and exhaustion.

In uncomplicated mild cases complete recovery within a matter of a week was the general rule. These calves, which were usually older than one week, showed an elevated temperature only, without undergoing serious motor dysfunction. More severe cases on the other hand, died without showing any signs of gastro-enteric disturbances.

Preliminary diagnosis and treatment

A tentative diagnosis of colibacillosis was made on clinical grounds and the suggested treatment included antibiotic medication in conjunction with creation of better and more hygienic calving conditions. As application of the latter was rather difficult due to the abundance of sewage water that had to be disposed of and the absence of any higher situated land available at the time, antibiotic therapy was resorted to.

The treatment applied was based upon the success obtained by Bortree et al[1], and Pearson[14], i.e. administration of 500 mg Aureomycin or Terramycin to each calf within the first few hours after birth. 500 mg Terramycin was administered for three successive days without any apparent success.

Similar results were also obtained with Furazolidone preparations. A combination of Terramycin and Furazolidone, subsequently used, proved to be more effective although still unsatisfactory.

The pregnant cows were eventually moved to higher situated dry grazing with immediate cessation of calf losses, creating doubt concerning the infectious nature of the disease.

The disease gives every evidence of being non-infectious, as only about 10 per cent of the calves born in a closed community, were affected. Additional support to this point of view is lent by the fact that removal of the pregnant cows to dry lands resulted in immediate cessation of mortalities. Further evidence of the non-communicable nature, of this disease condition was obtained by returning some of the pregnant cows to the original camp after an absence of four months. This change was followed by re-occurrence of cases showing typical symptoms.

Pathological investigation

Post mortem examinations carried out on five calves which had not been treated, revealed gastro-enteritis, enlarged mesenteric lymph glands, tumour hepatitis, congestion, oedema and emphysema of the lungs, enlarged gall and urinary bladders and various degrees of congestion of the meninges.

Bacteriological investigation

While the aetiology of the disease was still unknown specimens of *lung*, *liver*, spleen, lymph glands, gall-bladder contents, urine and various parts of the brain were submitted for bacteriological examination. These specimens were collected under sterile conditions and immediately plated on MacConkey-bile agar and in Selenite-F enrichment media. The latter were plated on MacConkey agar after 24 hours incubation.

From both the original lesions and enrichment media *Proteus mirabilis* was isolated in pure culture. Repeated bacteriological examinations of fresh specimens submitted since, showed similar infections.

The characterization of *P. mirabilis* was based upon its biochemical and morphological properties, viz.:

Phenylalanine	+
Urea	+
H_2S	+
Glucose acid	+
Gas	+
Lactose	−
Mannitol	−
Maltose	−
Inositol	−
Indol	−
Motility	+
Swarming	+

This finding was confirmed by Prof. J. N. Coetzee of the Department Bacteriology, University of Pretoria.

Experimental

The *P. mirabilis* strain obtained in pure culture was used to infect two young calves 5 and 7 days old. Each calf received 1.0 cc of an overnight broth culture given intra-duodenally under local anaesthetic.

Results

Both calves developed severe symptoms including a marked febrile reaction (see Graph. E?) and an acute greenish-white diarrhoea.

Calf 1 showed a sudden rise in temperature, four days after infection. This elevated temperature reaction lasted for 7 days.

Calf 2, on the other hand, developed a gradual increasing swaying temperature, which attained its maximum (104.6°F) nine days after administration.

Discussion

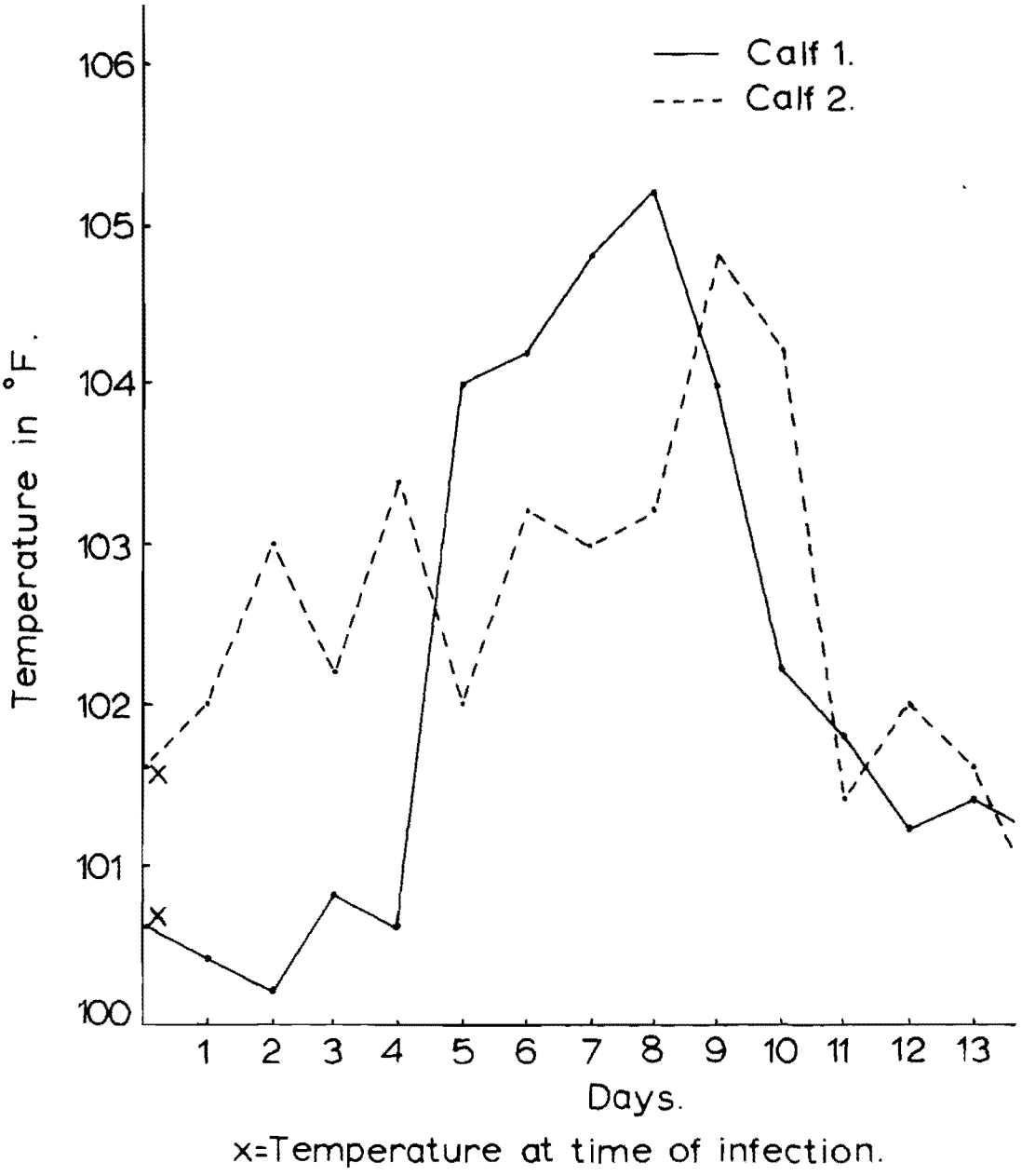
The disease conditions described in the literature were usually attributed to *P. vulgaris* and sometimes to *P. morganii*, *P. rettgerii* and *Providencia*, while *P. mirabilis* was considered of insignificant importance. The frequency of occurrence of *P. mirabilis* in the dog has been attributed to its close association with the human in whom this *Proteus* type is more prevalent.

The same is also true as far as the present specific epidemic in calves is concerned. Here the calves were born in lush grazing, flooded with sewage water from human origin, creating ideal conditions for multiplication of bacteria including *P. mirabilis*.

There is no doubt that *P. mirabilis* was responsible for the cases encountered. This finding is primarily based upon the isolation of *P. mirabilis* as the sole possible aetiological agent in twenty out of the twenty-eight specimens examined. The incrimination of *P. mirabilis* as the causative agent is secondary based upon the experimental findings. Although neither of the two calves infected died, the severe reactions showed by both are indicative of the virulent nature of the infective agent. These results are consistent with observations made in some of the calves naturally infected, viz. an elevated temperature as the only symptom.

From the reported results it would appear as if this *P. mirabilis* epidemic was brought about by circumstances. In lesser numbers and in older calves, *P. mirabilis* most probably would not be pathogenic. This is well illustrated in our experimental results where seven day old calves showed an elevated temperature reaction only, as well as by the fact that only very young calves were naturally affected. Calves older than 8 days, kept under the same conditions, were either not affected or showed mild symptoms only.

Proteus has generally been regarded as a secondary contaminant. This view should be reconsidered in accordance with results reported in the literature, the present epidemic and results obtained from some routine bacteriological examination of pathological material:— From 5–10% of all material submitted to the section Enterobacteria, *Proteus* was isolated either in pure culture or as a contaminant of other bacterial cultures.



ACKNOWLEDGEMENT

The author is indebted to the Chief, Veterinary Research Institute, for permission granted to publish this article.

I am also grateful to Prof. G. C. van Drimmelen for his advice and critisms and to Prof. J. N. Coetzee for typing of the *Proteus mirabilis* strains in question.

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THE ABSORPTION AND EXCRETION OF HETEROLOGOUS ANTITOXIN IN THE SHEEP AND DOG

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J. C. AUSTIN

Sandown Veterinary Hospital, Johannesburg

Received for publication March 1964

SUMMARY

Enzyme-purified antitoxins of equine origin, injected intramuscularly into sheep and dogs, do not reach their maximum concentration in the blood until about 10–24 hours later.

It may be an advantage to inject antitoxin intravenously into a sick animal because the maximum circulating titre is reached immediately.

Antitoxin is eliminated from the blood of the sheep and the dog in 30–50 days and not, as in the rabbit, in 9–21 days.

INTRODUCTION

The duration of passive immunity conferred by heterologous antitoxin is commonly said to be 14–21 days, but this period depends, in some measure at least, on the zoological natural order of the recipient and on the number of units injected.

Possibly the statement has its origin in the animal, the rabbit, commonly used in this type of work. Smith[1] found that an *Escherichia coli* antiserum of caprine origin was eliminated by the rabbit in 6–9 days, and Glenny and Hopkins[2], Christensen[3], Prudovsky and Turner[4], Suri and Rubbo[5] and Mason and Robinson (unpublished) showed that antitoxin of equine origin was undetectable in the sera of rabbits 9–21 days after its injection. On the other hand, when man is the recipient, antitoxin may be detected in his serum for a much longer time. Cooke and Jones[6] found that, after the injection of 100,000—200,000 units of tetanus antitoxin of equine origin, 0.1 unit per ml serum was detectable after four to eight weeks and 0.01 unit after eight to ten weeks; Veronesi[7], also working with tetanus antitoxin, detected 0.01–0.1 unit 15 days after injecting 1500 units and 0.5–1.0 unit 28 days after giving 100,000 units; Smolens, Vogt, Crawford and Stokes[8] found 0.0025–0.005 unit six weeks after the injection of 1,500 units, and Mason and Robinson (unpublished), in collaboration with Dr Arnold Jackson, one-time Superintendent of the Fever Hospital Johannesburg found that enzyme-purified diphtheria antitoxin was not completely eliminated from the sera of eight children, aged 11–15 years, until about the 76th day after the injection of 40,000 units into them. After 14 days, 0.5–2.0 units per ml serum were present, after 21 days, 0.2–0.5 unit and after 50 days 0.004–0.02 unit.

In this paper, we shall give the results of titrating the sera of sheep and dogs which received enzyme-purified antitoxin of equine origin. We have been unable to find references to experiments in these animals and the tests in the dogs were carried out to fill a gap in a review article written by one of us, Mason[9]. Diphtheria antitoxin only was used in the dogs because it is economically and easily titrated but the results apply to any antitoxin made in the same way.

MATERIALS AND METHODS

Antitoxins. All, of equine origin, were purified with pepsin and concentrated with ammonium sulphate. Their main constituent was γ globulin. Diphtheria antitoxin was titrated at the

$L_+/1000$ level intradermally in guinea-pigs using a stable toxin of known value. Tetanus antitoxin was titrated at the $L_+/10$ or $L_+/100$ level in mice weighing 16–18 g with a dry, stable toxin and *Clostridium welchii* antitoxin was titrated by the haemolytic method using a dry stable toxin and sheep erythrocytes.

Sheep. These were young castrated Merinos. Each antitoxin injected into them was diluted in 0.85% NaCl solution so as to contain 12.5 g protein per 100 ml.

Dogs. Four males and two females of different breeds, and aged between 1 and 7 years, were used. Each received the same batch of diphtheria antitoxin, which contained 14.5 g of protein per 100 ml, in a dose of 220 units per kg body weight.

Results

Sheep. Three kinds of antitoxin were used—diphtheria, tetanus and *Cl. welchii*. Each sheep received all three, by the intravenous and intramuscular routes and by the intramuscular route when the inoculum was antitoxin mixed with hyaluronidase. This extra injection was made to find if the spreading factor hastened absorption. The results are summarized in table I.

Table I.—Absorption and Excretion of Antitoxin in the Sheep.

Sheep	AT Units injected	Route	UNITS A T/ml SERUM AFTER HOURS 1	2	4	6	10	16	24	34	48	DAYS 21	35	56
1	Anti-	i.v.	2.8	2.0	2.0	2.0	0.8	0.8	0.8	0.8	0.8	0.1	0.06	< .0025
2	Welch	i.m.	0.05	0.2	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.2	0.25	< .0025
3	7,500	i.m.h.	0.05	0.25	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.2	0.06	< .0025
3	Anti-	i.v.	14.0	10.0	10.0	7.0	7	7	7	7	5	0.5	0.07	ND
1	Tetanus	i.m.	0.15	0.4	0.7	1.5	3	3	5	5	4	0.3	0.07	ND
2	20,000	i.m.h.	0.3	0.7	3.0	6.0	10	10	10	7	7	0.7	0.15	ND
2	Anti-	i.v.	17	17	15	15	15	12	10	8	5	0.5	0.15	0.01
3	Dip.	i.m.	0.5	1	2	3	5	7	7	5	5	0.5	0.15	0.01
1	14,000	i.m.h.	0.5	1	3	5	7	7	7	7	5	0.5	0.1	0.004

AT = Antitoxin; Welch = *Cl. welchii*; Dip. = diphtheria; i.v. = intravenous; i.m. = intramuscular; i.m.h. = intramuscular + hyaluronidase; ND = Not done
The pre-injection titres (units antitoxin per ml serum) were:— *Cl. welchii* — all . . 0.0025; tetanus — all . . 0.01; diphtheria — all . . 0.001
Weights of sheep = No. 1 — 43.5 kg, No. 2 — 45 kg, No. 3 — 45 kg

Naturally, the intravenous injection brought about the maximum serum antitoxin concentration in the shortest time. When *Cl. welchii* antitoxin was used, about two thirds of it had disappeared from the circulation in 10 hours, with tetanus antitoxin half in 6 hours and with diphtheria antitoxin half in 34 hours. Passage into tissue spaces is almost certainly the reason for this.

The concentration of antitoxin after intramuscular injection was, at the one-hour period, between 1/30 and 1/90 of that reached after intravenous injection. The maximum concentration, reached between the sixth and the twenty fourth hour, was never as high as the highest obtained by the intravenous route.

Hyaluronidase did not increase the rate of absorption of *Cl. welchii* antitoxin and very doubtfully that of diphtheria antitoxin, but did appear to have an effect with tetanus antitoxin. Probably this was a chance occurrence, possibly brought about by the rupture of a blood vessel. There is no reason to believe that one enzyme-purified ammonium sulphate-precipitated antitoxin will act differently from another with respect to rate of absorption.

After 21 days the titres had fallen. Compared with the 24-hour value, the *Cl. welchii* antitoxin titre had fallen to 1/8–¼, that of tetanus antitoxin to about 1/15, and that of diphtheria antitoxin to between 1/14 and 1/20. We cannot give a reason for the smaller fall with *Cl. welchii* antitoxin.

After 35 days, the titres were still smaller. At the 56th day no *Cl. welchii* antitoxin was detectable: tetanus antitoxin assays were not carried out but between 0.004 and 0.01 unit of diphtheria antitoxin was still present.

Dogs. Three dogs received the antitoxin intravenously and three, intramuscularly, and blood samples were taken at intervals thereafter.

The high circulating titre obtained immediately after an intravenous injection of antiserum would be of great benefit to an animal bitten by a snake and could not fail to be of help to one

TABLE 2.—ABSORPTION AND EXCRETION OF ANTITOXIN IN THE DOG.

Dog	Wght kg	Route	UNITS AT/ml SERUM AFTER																
			MINUTES		HOURS								DAYS						
			0*	2	1	2	3	6	12	24	48	72	7	14	21	28	35	42	49
1	20.4	i.v.	ND	ND	3.5	3.5	3.5	3.0	2.5	2.5	ND	1.5	0.65	0.14	0.04	.005	.001	ND	ND
2	20.0		ND	ND	3.5	2.0	3.0	3.5	2.5	2.0	ND	1.5	0.65	0.2	0.08	.04	.01	.0035	< .001
3	24.0		ND	5	2.5	3.5	3.5	3.0	3.5	2.5	ND	2.0	0.6	0.16	0.07	.03	.005	.003	< .001
4	20.4	i.m.	< .001	ND	0.1	0.3	0.5	0.8	2.0	2.0	1.5	1.5	0.3	0.1	0.02	.005	.003	.003	< .001
5	28.0		< .001	ND	0.06	0.12	0.15	0.4	0.5	1.5	1.5	1.5	1.0	0.15	0.03	.01	.004	.004	< .001
6	9.0		.002	ND	0.2	0.35	0.3	0.8	1.0	2.0	2.0	1.5	0.5	0.12	0.03	.003	.003	.002	.002

AT = antitoxin; i.v. = intravenous; i.m. = intramuscular; ND = Not done
0* = blood sample taken immediately before injecting antitoxin
Each dog received 220 units of diphtheria antitoxin per kg body weight

Intravenous injection. One dog, No. 3, bled immediately after the intravenous injection, had a serum titre of 5 units per ml, and one hour later of 2.5 units per ml. This considerable fall was almost certainly due to the passage of some of the injected serum into the tissue spaces. After 72 hours, the titres were half or more of those found after one hour, and after 14 days, the tritres were between 1/10 and 1/20 of those got at 24 hours. Even after 42 days, two of three dogs still had circulating antitoxin which did not disappear completely until the 49th day.

Intramuscular injection. The rate of absorption of antitoxin into the circulation after intramuscular injection was similar to that obtained in the sheep, and maximum titres were not reached until the 12th–24th hour. But even after 14 days, between 1/10 and 1/20 of the highest titre was found. The injected antitoxin was not completely eliminated until sometime between the 35th and the 49th day.

DISCUSSION

The results of the experiments summarized in this paper have more than academic interest because they show the advantage of injecting antitoxin intravenously and the futility of a second dose if the initial one was adequate.

suffering from tetanus. The intravenous route is, unfortunately, the most dangerous one, but if steps are taken to test the recipient for serum sensitivity, it can be used with reasonable safety.

If an animal is acutely intoxicated with snake venom and is in imminent danger of dying, a sensitivity test should be omitted. The chance of causing shock is certainly less than that of the animal's death while the result of the test is awaited and is a calculated risk that may reasonably be taken. If an animal is not in immediate danger of dying, a small dose of serum, 0.1 ml, should be injected subcutaneously and if no symptoms of shock appear in half an hour, the bulk should be given **very slowly** by the intravenous route. Adrenaline and a cortico-steroid should be available immediately in case of necessity.

The results given in tables 1 and 2 show that if an adequate dose of an antiserum is given initially, there is no need for a second one. The circulating serum titres did not fall markedly between the 24th and the 72nd hours and even at the 14th day there was still a considerable amount of antitoxin present. On no account should a further injection, by any route, be given after the 6th day unless a small trial dose of serum, injected subcutaneously, is tolerated because, at about this time, antibodies to

foreign protein are beginning to form. A note should be kept of any animal that has received heterologous serum so that proper steps may be taken if another injection has to be given months or years later.

The rate of excretion of heterologous antitoxin in the sheep and dog is similar to that in man, rather than to that in the rabbit. The size of the subject is not the only reason for this because Mason and Robinson (unpublished) have shown that the guinea-pig eliminates diphtheria antitoxin somewhat more slowly than the rabbit.

ACKNOWLEDEGMENTS

We have pleasure in thanking Dr. J. G. Boswell for placing his kennels at our disposal and Dr. E. M. Hearn for her interest and for obtaining the dogs.

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A DIAGNOSIS OF PRUSSIC-ACID POISONING IN CATTLE MADE FROM A SAMPLE OF MUSCULAR-TISSUE

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Received for publication March 1964

HISTORY

Twelve dairy dattle had been put into a camp, which had not been in use for at least a month, at about 10 o'clock one October morning. It was a hot day and the humidity was high. At noon one cow was found dead and two others were down, showing spasms and biting the ground. On our arrival later that afternoon the two cows had completely recovered. Only the ruminal contents of the dead cow was available. This was examined for remnants of Gifblaar (*Dichapetalum cymosum*) leaves, with negative results. The camp was then thoroughly searched for Gifblaar plants, again with no result.

DIAGNOSIS

A tentative diagnosis of prussic-acid poisoning was made. No parenchymatous organ of the dead cow could be traced, but a piece of muscular tissue was recovered and a specimen placed in 1% mercuric chloride solution. From the time of death until the muscular tissue was preserved, 8 hours had elapsed.

The picric-acid-test[1] was performed on the stomach contents that evening with negative results. However, after incubation at 35°C overnight the paper strips were brick red. This reaction was highly suspicious. The muscular tissue was then tested by the more specific method of Gettler & Goldbaum[2]. A distinct positive reaction was found in three successive tests.

On the following day the farm was visited again and 25 different plant species collected, identified and tested for prussic acid. All proved negative.

DISCUSSION

S. J. van der Walt[3] found the liver to be the best organ for diagnostic analyses in cases of prussic-acid poisoning. However, he also found that putrefaction could destroy all significant amounts of HCN within 24 hours. Specimens should not be taken later than 5 hours after death. Fulfilment of this requirement constitutes a practical field problem.

In the detoxification of cyanide in the body (CN + S+rhodenase = CNS) adequate sulphur and rhodenase are necessary. This enzyme occurs abundantly in the liver but is absent in muscular tissue[4]. It thas herefore been suggested[5] that, during putrefaction, the disappearance of HCN from muscular-tissue will not be as rapid as from liver.

This case report has been submitted to illustrate why specimens of both the right lobe of the liver[3] and muscular tissue should be taken separately in 1% mercuric chloride for the detection for HCN in carcases dead for some time.

ACKNOWLEDGEMENT

The Chief of the Veterinary Research Institute, Onderstepoort is thanked for permission to publish this report.

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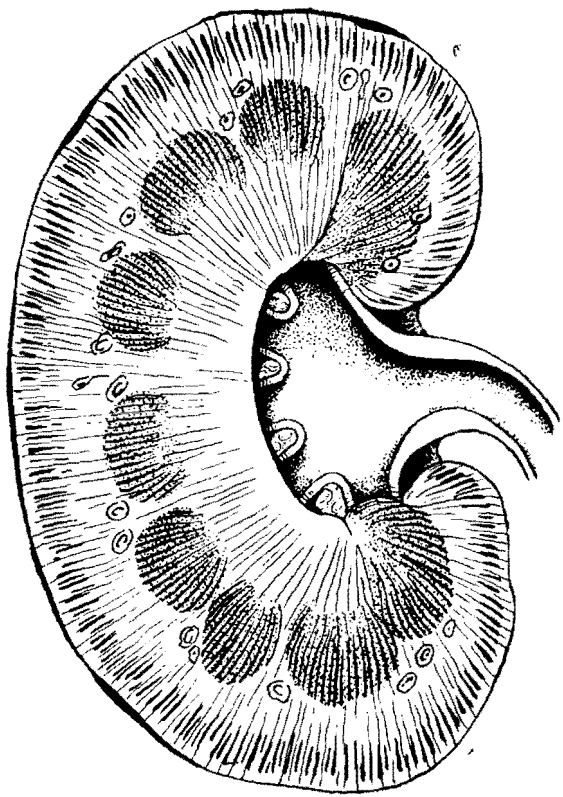

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OBSERVATIONS ON CYANURIC ACID AS A SOURCE OF NON-PROTEIN NITROGEN FOR SHEEP

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Received for publication April 1964

SUMMARY

Acute and cumulative toxicity tests and a feeding trial indicate that cyanuric acid is non-toxic and can be utilized by sheep as a source of non-protein nitrogen when fed with maize meal as a supplement to low quality bulk roughage.

INTRODUCTION

Urea has been fed to ruminants for many years as a source of non-protein nitrogen and although this compound has limitations in livestock nutrition due mainly to the rapid hydrolysis and release of ammonia from it in the rumen, only limited research has been carried out on alternative sources of non-protein nitrogen. The *in vitro* studies of Belasco[1] indicated that a number of compounds were active in promoting cellulose digestion and bacterial growth. Further investigations were conducted on several ammoniated products, biuret and diammonium phosphate[2,3,4,5], but to date none of these has been widely accepted as a protein replacement in the rations of cattle and sheep.

Cyanuric acid which can be derived from urea and is present as a contaminant in crude biuret contains approximately 32% nitrogen. Investigations were initiated to attempt to assess the potentialities of this compound as an alternative to urea.

TOXICITY TESTS

The material used throughout the investigations contained 98% cyanuric acid and had a total nitrogen content of 34.6%.

TRIAL 1—ACUTE TOXICITY

Methods

Cyanuric acid was introduced via a fistula to the rumen of a sheep. An initial 12 grams was followed 5 days later with 24 grams, then 8 days later with 48 grams and finally 7 days later by a dose of 96 grams. The sheep showed no ill effects at any time. Rumen fluid was tested for pH before and after the administration of the 48 gram dose.

RESULTS

TABLE 1 pH OF RUMEN FLUID FROM A SHEEP DOSED 48 G CYANURIC ACID

Sample No.	*Time*	*pH reading*
1	45 min. before treatment.....	5.59
2	5 min. before treatment.....	5.33
3	1 hour after treatment.....	5.35
4	2 hours after treatment.....	5.19
5	5 hours after treatment.....	5.31

TRIAL 2—ACUTE TOXICITY

Methods

Four maiden ewes in poor condition on a diet of low quality hay *ad libitum* and 4 oz. maize meal per head per day were drenched *per os* with cyanuric acid and water in the shortest possible time.

TABLE 2—LIVEWEIGHT OF EWES AND DOSAGE OF CYANURIC ACID DRENCHES

Sheep No.	*Liveweight lb*	*Dosage of drench (g. cyanuric acid: ml water)*
9	63	30 : 100
28	74	60 : 200
45	74	90 : 300
84	85	120 : 400

Results

The sheep were watched for 1 hour after drenching and no signs of abnormal behaviour were observed. Hay was offered during this period and it was readily consumed. Subsequent observations over 2 weeks showed that the sheep were unaffected by the drench.

TRIAL 3—CUMULATIVE TOXICITY

Methods

Three groups, each containing 12 German Merino ewes, were grazed on *Eragrostis curvula* pastures which had received a dressing of nitrogenous fertilizer at the rate of 46 lb. nitrogen per morgen. The sheep had free access to salt and bonemeal.

GROUP 1. received a total of 39 oz. cyanuric acid mixed in 39 lb. molasses per group per week fed as a lick in three equal portions.

GROUP 2. received 39 lb. molasses per group per week in three equal portions.

GROUP 3. received no lick.

The sheep were on the pasture for 157 days. During this period treatments were stopped for 23 days when the ewes were mated. At the end of the pasture season all groups were penned and fed hay. Groups 2 and 3 were combined and fed molasses at the rate of 78 lb. per week and Group 1 received the same cyanuric acid and molasses lick as was fed on the pasture. These treatments continued until the first lamb was born. The sheep were weighed monthly until one month before lambing and each ewe was weighed within 12 hours of the birth of her lamb.

DISCUSSION

Drenching tests indicated that cyanuric acid had no toxic effect on sheep even at a rate of $1\frac{1}{2}$ g cyanuric acid per lb. bodyweight.

The cumulative toxicity tests in which ewes consumed an average of $\frac{1}{2}$ oz. cyanuric acid per day for 286 days failed to show adverse effects of cyanuric acid on the bodyweight of ewes, birth weight of lambs and on the fertility of the ewes. There was a liveweight response to molasses by the ewes on the pasture.

TRIAL 4—FEEDING TRIAL

Methods

Eight pairs of maiden ewes aged 18 months were selected on liveweight from a group which had received crude biuret, maize meal and low quality hay, for 7 weeks prior to the commencement of the trial.

The sheep were weighed weekly and initial and final weights were calculated from the average of 2 starved weights taken over 3 days.

The basal ration was veld hay (4.1% C.P. and 39.1% C.F.) and a lick (30 lb. dicalcium phosphate: 30 lb. salt and $\frac{3}{4}$ lb. trace element concentrate) *ad libitum*.

Results

TABLE 3.—AVERAGE LIVEWEIGHTS OF EWES AND LAMBS AND LAMBING RECORD OF EWES IN LB.

	Group 1	*Group 2*	*Group 3*	*Period*
Weight at start of pasture	80.9	79.5	78.6	157 days
Weight at end of pasture	130.6	126.7	113.1	129 days
Weight 1 month before lambing	118.3	122.0	113.2	
Weight after lambing	110.6	112.8	105.4	
Birthweight of lambs	10.5	10.5	10.6	
No. of ewes mated	12	12	12	
Nos. of ewes lambed	11	10	11	
Nos. of lambs born	12	11	11	

TABLE 4: COMPOSITION OF SUPPLEMENTS

GROUP 1. 4 oz. yellow maize meal per head per day.

GROUP 2. 4 oz. yellow maize meal and 21.5 g cyanuric acid per head per day. Liveweight changes and the consumption of the lick and water were recorded.

NOTE

The cyanuric acid was omitted from the Group 2 ration for 3 days before the final weights were recorded to eliminate bias due to the higher salt intake of this group[6].

Group 2 was significantly (P=0.01) heavier than Group 1 after the test period.

DISCUSSION AND CONCLUSIONS

The results of the tests show that cyanuric acid is neither acutely nor cumulatively toxic to sheep and when fed in combination with maize meal as a supplement to low quality roughage it can be utilized by sheep as a source of non-protein nitrogen.

Results

TABLE 5.—AVERAGE LIVEWEIGHT, AVERAGE LIVEWEIGHT LOSS AND AVERAGE LICK AND WATER CONSUMPTION (63 DAYS).

	Group 1	*Group* 2
Initial weight (lb.)	82.9	82.9
Final weight (lb.)	74.4	80.6
Weight loss (lb.)	—8.5	—2.3
Lick consumption (oz. per head per day)	0.53	1.99
Water consumption (gallons per head per day)	0.36	0.60
No. of animals	8	8

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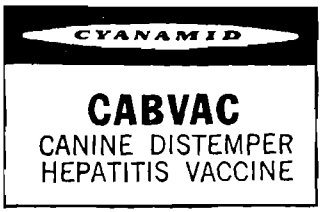

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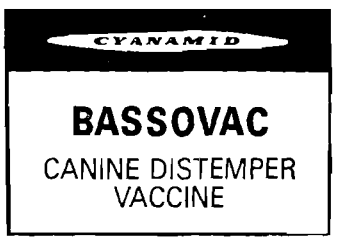

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TETANUS IN THE DOG AND CAT

A review with comments

J. H. MASON

The South African Institute for Medical Research, Johannesburg

INTRODUCTION

Tetanus is uncommon in the dog and rare in the cat. Of the well-known British veterinary practitioners of the 19th century, Blaine[1] saw only three cases in the dog and Youatt[2] but four (quoted by Moss and McGaughey[3]). Loeffler, Hensel and Ehrlein[4] found 117 references to the disease in the dog and only eight articles recording it in the cat. However, although tetanus is undoubtedly uncommon in these animals it is probably not quite so rare as the paucity of reports would suggest, because not every practitioner publishes his clinical findings.

Shumacker, Lamont and Firor[5] showed that when tetanus toxin is injected by either the intravenous, subcutaneous or intramuscular route into the monkey, dog or cat, the lethal doses, in terms of the guinea-pig LD_{50}, are:— monkey, 4, dog, 480, cat, 960, whereas they die from about the same dose per unit body weight when the toxin is injected into the lumbar portion of the spinal cord. In other words, when the toxin reaches the central nervous system, the resistant dog or cat is just as susceptible as the monkey.

Abel, Evans and Hampil[6] showed that, when a supralethal dose of toxin is injected by a non-neural route, the rapidity and completeness with which it disappears from the blood-lymph system differ with the zoological natural order to which the recipient belongs. When 25–70 guinea-pig LD_{50} of toxin is injected into sheep, about 90% of it can be detected in the blood and lymph for several days, and a large percentage can be accounted for in the blood and lymph of guinea-pigs which receive a supralethal dose. In contrast, toxin disappears rapidly from the blood of the dog. These results support the hypothesis that natural resistance depends in some measure on the ability of an animal to fix toxin in tissues that are not sufficiently injured by it to cause the death of the recipient.

TETANUS IN THE DOG

Although Loeffler *et al*[4] give 117 references to the disease in the dog, only fifty five articles were available to me in South Africa. I found it rather difficult to make a fully satisfactory summary because some authors merely said that their patients suffered from tetanus or that the disease was typical. Further, it was obvious that the shorter articles omitted mention of many symptoms because, for example, in a dog that was 'as stiff as a board' the head and neck would almost certainly be stretched out and the jaws locked.

Sex did not appear to play a part. Fifteen of the dogs were males and twelve were females and in twenty eight the sex was not given. (It is assumed that the word 'dog', unqualified, does not necessarily mean a male animal). A wound was found in 42 animals and was not found or was not mentioned in the remaining thirteen.

In table 1, the symptoms mentioned in the articles are listed.

Antitoxin

This was injected in amounts ranging from 220,000 to 100 units into 34 dogs; twenty three recovered, ten died and the fate of one was not given. Twenty one dogs did not receive antitoxin; seven recovered, twelve died and the fate of two was not recorded. It is not unreasonable to suggest that the antitoxin had a beneficial effect.

TABLE I

SYMPTOMS	NO. OF TIMES MENTIONED
Stiffness or rigidity or difficulty in bending legs	43
Ears erect and approximated, skin of forehead wrinkled	32
Trismus (all degrees)	30
Difficulty in walking	16
Risus sardonicus	15
Tail stretched out or bent	15
Reflex excitability	13
Spasms	13
Membrana nictitans prominent	12
Difficulty in standing	11
'Stiff as a board'	8
Neck stretched out or bent	7
Died or killed	23
Recovered	29
Outcome not given	3
Clostridium tetani demonstrated	5

Interval from injury to first symptom—

Days	3-6	7-10	>10
Cases	8	13	5

The information given in this table was obtained from 55 case histories.

The effectiveness of antitoxin in the treatment of tetanus has been a subject of discussion for many years and only recently has a *controlled* experiment been carried out in man (Brown, Mohamed, Montgomery, Armitage and Laurence[7]). They say 'The mortality rate was 49% among patients receiving 200,000 i.u. (international units) of antitoxin and 76% in those not receiving antitoxin'. Tetanus antitoxin is a valuable remedy in clinical tetanus'.

The consensus of opinion is that antitoxin should be injected at the earliest moment after a diagnosis has been made. The intravenous route is recommended by some workers (Turner, Velasco-Joven and Prudovsky[8]) because it brings about the maximum concentration of antitoxin in the blood stream immediately, but steps must be taken to ensure that the patient is not sensitive to horse serum before using this, the 'most dangerous', route. On *a priori* grounds, the use of antitoxin is justified in that it will neutralize toxin unbound to cells and any that may be formed subsequently.

Free or unbound toxin is not only that present in and around the lesion and in the circulation, but also that passing up the neurilemma of nerves and as yet unfixed to nerve cells. Webster and Laurence[9] injected toxin into the muscles of rabbits and 48 hours later administered antitoxin. Symptoms did not progress beyond their stage 2, i.e. a distinct bending of the toxin-injected leg. The antitoxin limited the spread of symptoms presumably by stopping the passage of toxin up the spinal cord.

Dose of Antitoxin

This varied greatly, from 220,000 to 100 units, and not infrequently antitoxin was given daily or every other day for a week or more. Spaeth[10] goes into the question of dosage as it concerns man and feels that between 30,000 and 50,000 units are adequate. Pratt[11] found no evidence showing that 80,000 units gave better results than 30,000 units. Patel and Joag[12] investigated the effect of dosage in man and obtained these results:—

No. of patients	*Units antitoxin injected*	*% mortality*
816	240,000	40.44
243	120,000	34.57
243	60,000	39.92

The outcome was not influenced by the number of units of antitoxin injected.

On the assumption that a dose of 100,000 units is sufficient for a human patient weighing 60–80 kg, the dose for the dog should be about 3,000 units for one weighing between 2–3 kg and about 30,000 units for one of 27–30 kg.

Number of injections of antitoxin

Many of the authors injected antitoxin on more than one occasion, probably because heterologous antitoxin is rapidly excreted from the body. But if a large enough initial dose is given there would appear to be no need for a further injection. Mason, Robinson and Austin[13] (this Journal p193) showed that when dogs received 220 units of enzyme-purified diphtheria antitoxin per kg body weight (100 units per lb), the highest titre obtained was between 2 and 4 units per ml serum and that after 14 days, the titre was between 0.1 and 0.2 unit per ml. The heterologous antitoxin did not disappear completely until after 42 days. Thus, as an adequate amount of antitoxin persisted in the body for at least 14 days, by which time the sick animal should be cured, obviously recovering or dying or dead, the injection of more antitoxin would not appear to be necessary.

The intravenous route is that of choice because a maximum concentration of circulating antitoxin will be produced immediately. It would be advisable, however, to inject a small amount, 0.1 ml to 0.2 ml, of antitoxin subcutaneously and to wait for half an hour. If no untoward symptoms appear, the bulk of the serum should be injected very slowly by the intravenous route.

Sedation

Before the advent of the phenothiazine derivatives, relaxation was produced by bromides, chloral hydrate, barbiturates or morphine. But a considerable number of dogs was merely kept in a darkened kennel free from noise and disturbance. Sedation by one or other drug is not only logical but essential if exhaustion of the patient is to be prevented. The degree of severity of the symptoms will dictate the dose and its frequency of administration but, if practicable, the animal should be given the chance of urinating and defaecating during a non-sedation period.

Except in a thoroughly equipped veterinary hospital staffed by fully trained personnel, on duty day and night, the complete immobilization of a dog for days on end with a curare derivative, necessitating intubation and the use of a 'breathing machine', is not possible although such a method is being increasingly employed to treat the human patient.

Surgery

If a wound was found, it was cleaned and treated with an antiseptic, often hydrogen peroxide because *Cl. tetani* is an anaerobe. I personally feel that a wound should be dealt with thoroughly—opened to its depth, all necrotic tissue removed and debridement carried out. Adequate surgery is almost certainly of more importance than the kind of antiseptic used because pathogenic anaerobes thrive in a devitalized, necrotic locus.

Antibiotics

Penicillin was the antibiotic of choice and was given daily or at least frequently until recovery was obviously taking place. It is a logical method of treatment.

Interval between time of injury and onset of symptoms

In man, it is generally accepted that the shorter the incubation period, the greater is the chance of death occurring. Possibly this holds for the dog but I can draw no conclusions from the case reports because the interval was not given often enough.

Duration of illness and outcome

In man, most but by no means all deaths occur in the first ten days of the illness. In the series of 117 cases reviewed by Loeffler *et al.*[4] and which includes the fifty five on which this summary is based, this finding is, in the main, confirmed. In those dogs that survived, the disease lasted for an average of sixteen days and in those that died for an average of five days.

General

The animal should be housed in a comfortable, darkened kennel, free from noise and disturbance. The bedding should be soft and changed as it becomes soiled and, as the dog will be recumbent for some time, measures to prevent

the development of bed sores must be taken. It may be necessary to administer enemas and to pass the catheter, probably best done when the animal is tranquilized.

The dog should be coaxed to eat and drink and, when trismus is present, an attempt should be made to administer broth by dropper. If nourishment cannot be taken by mouth, glucose-saline or another suitable solution should be injected intravenously.

TETANUS IN THE CAT

I was able to read eight articles from which the information listed in table 2 was culled.

A wound was found in every cat, stiffness or rigidity, attaining the 'stiff as a board' stage in some, was always seen, the membrana symptom was common, trismus was uncommon, *Cl. tetani* was demonstrated in wounds of four of the patients and six out of eight died or were killed.

TETANUS IN THE CAT.

The author was able to read eight articles from which the information listed in table 2 was culled.

TABLE 2.

Cat / Symptoms etc.	1	2	3	4	5	6	7	8
Sex	M	M	M		M		M	M
Age (years)	2.5	0.5	2.0		1.0		1.5	1.0
Wound	+	+	+	+	+	+	+	+
Stiffness or rigidity	+	+	+	+	+	+	+	+
Reflex excitability	+	+						+
Tail erect or drawn over back		+		+		+		+
Spasms			+		+	+	+	+
Mim. nict. prominent	+	+	+	+			+	+
Trismus	O	+	O	O			O	+
Ears approximated							+	
Tetanus AT (units)	10,000			30,000		+		35,000
Tranquilizer	+						+	+
Antibiotic	+						+	+
Outcome	D	K	K	L	D	D	D	L
Cl. tet. demonstrated in wound	+		+		+		+	

M = male;
\+ = present or given;
O = not present;
D = died;
K = killed;
L = lived;
blank space = no information given;
AT = antitoxin;
Mem. nict. = membrana nictitans;
Cl. tet. = *Clostridium tetani*.

ACKNOWLEDGEMENTS

I have pleasure in thanking the library staffs of The South African Institute for Medical Research and of the Veterinary Research Institute, Onderstepoort for their co-operation.

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SOME OBSERVATIONS AND DATA IN THOROUGHBRED BREEDING

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Received for publication March 1964

SUMMARY

The incidence of certain reproductive phenomena and disorders in 336 breeding cycles in 182 thoroughbred mares, during two successive seasons, are recorded. An average overall conception rate of 72% was recorded. Sixty per cent of 178 foaling mares demonstrated foaling heat. Anoestrus, as a manifestation of four forms of ovarian dysfunction, was responsible for 27 per cent of all reproductive disorders; aerovagina with or without uterine infection for 40 per cent, abortion for 14 per cent, and other forms of ovarian dysfunction not associated with anoestrus, for nineteen per cent.

INTRODUCTION

The purpose of this paper is firstly to record certain observations and data, with regard to a number of breeding problems in 182 thoroughbred mares on four farms in the Eastern Cape, during the breeding seasons of 1960 and 1961, and secondly, to make a minor contribution to a better understanding and handling of these problems. Records of foaling, heat-periods, duration of heat and findings at rectal examination of each mare, were kept. Mares in oestrum were examined daily, in order to allow service on the most appropriate day.

FOALING HEAT

This is the first oestrum that occurs within a particular period after foaling. There appears to be considerable discrepancy in the literature about the meaning of the term "foaling heat". Thus Roberts[1], quoting Dukes states that mares come into their first oestrum between four to 14 days after foaling, and stay in oestrum for 11 to 20 days. Yet Andrews and McKenzie[2] recorded foalheat in six mares, 21 to 30 days after foaling. The question arises whether an oestrum at this latter period can still be termed a foaling heat. Since the period during which relatively few foaling mares show their first oestrum after foaling lies between the 14th and 24th day, it is proposed that the term foaling heat be confined to the 14 days following parturition.

More important is the question whether the foaling heat should be utilized or not. Although Jennings[3] and Trum[4] report a conception-rate of only 43 per cent during this oestrum, a higher abortion rate and a greater percentage of dead, diseased and non-viable foals, it is generally considered that in thoroughbred breeding, the foaling heat should be utilized because of the time factor, it being important that foals should be dropped as early in the season as possible.

In the mares under discussion, 106 (60 per cent) out of 178 foaling mares during two foaling seasons, showed foaling heat. Of these, 49 (46 per cent) mares conceived. Of the 57 mares that did not conceive during foaling heat, 35 were successfully mated during successive heat periods; 22 mares remained barren. If it is considered that causes of sterility, other than the foaling heat factor, probably were responsible for infertility in these 22 cases, and if these are subtracted from the original 106, a conception rate of 58 per cent is arrived at.

Of the 72 mares that did not show foaling heat, 57 showed oestrus within 20 to 30 days after parturition, while 15 developed anoestrus.

The average first day of heat was the 8.8th day and the earliest day after parturition, the fourth. The average duration of the foaling heat was 3.8 days, with two days duration the most common, and 13 days as the longest single foaling heat recorded. The latter was a fertile

oestrus that resulted in pregnancy and that commenced 12 days after parturition.

Out of the 106 mares served during foaling heat, four aborted, i.e. 8 per cent of the 49 fertile foaling heats. This figure compares favourably with the overall abortion rate of 14 per cent discussed further on and does not support the views of Jennings[3] and Trum[4] that a higher abortion rate results from foaling heat pregnancies.

An additional factor in support of service with foaling heat, is the greater tendency for mares with a foal at foot, to develop anoestrus. Of the 57 mares that did not conceive during their foaling heats, 12 (21 per cent) developed anoestrus. Had the foaling heat therefore not been utilized, a greater number of anoestrus cases would in all probability have been encountered, with consequent late foals or barrenness.

Anoestrus

The term anoestrus in the general sense of the word, refers to the total absence for a specific length of time after the previous oestrus period or throughout an entire breeding season, of the usual manifestations of oestrus behaviour in the non-pregnant mare, teased in the accepted manner.

Rectal examination of the ovaries of the anoestrus mare reveals two distinct different states in which the ovaries may be found. There is the small, contracted and hard or involuted ovary, with no palpable graafian follicle. With speculum examination of the vagina at intervals over a considerable length of time, the usual signs of oestrus are absent. This condition is found chiefly in maiden mares and occasionally in multiparous mares, in both cases particularly early in the season. This, the involuted ovary, is associated with true anoestrus.

Seven mares (11 per cent of a total of 63 that evidenced anoestrus) demonstrated true anoestrus. With each of these an attempt was made to induce oestrus. This object was achieved in four cases but conception failed to take place in all of these. Rectal palpation of the ovaries in these cases, without exception revealed very little if any activity and no follicular development. The signs of oestrus in these cases can justly therefore be signified as purely psychological in nature. Five of these seven mares were maiden, three of which persisted with anoestrus throughout the season. It is the opinion of the author that, with rare exceptions, the mare with involuted ovaries in true anoestrus should not be forced into oestrus, and should not be served without further investigation if signs of oestrus are shown, as this heat would in all probability be merely a psychological oestrus.

A second type of anoestrus is evidenced by the mare with ovaries which vary in size from medium to large, are soft to moderately soft but not hard and firm in consistency, and harbour clearly palpable graafian follicles, varying in size from one to several centimetres in one, or less often in both ovaries. Rectal palpation of the ovaries at regular intervals reveals no significant change, development or maturation of the follicles. The ovaries are therefore anatomically and physiologically static. The anoestrus associated with static ovaries was found to be one of the most common forms of anoestrus.

Twenty mares or 32 per cent presented anoestrus in association with static ovaries. Of these, 12 mares had a foal at foot and with one exception only, not one of these 12 had showed a foaling heat. Treatment was instituted in each case, from 30 to 103 days after foaling, with oestrus following in 15 cases. Conception resulted in 11 cases (55 per cent), but pregnancy was terminated by abortion in four of these, at 40–50 days, 50–60 days (2 mares) and five to seven months gestation. Three mares out of this group of 20 had aborted during the previous season. Of the 11 mares that conceived, 9 had one oestrus period following the period of anoestrum, while in two cases the second heat period was successful.

As the regular appearance of oestrus is the only indication to the breeder when to allow service, and as its absence for a period longer than three weeks after service is an indication that pregnancy may have resulted, it is understandable how anoestrus can interfere with the successful breeding programme. The fact that a mare does not return to service within 40 days

after the last service, does not therefore mean that conception has taken place.

In the studs under discussion, 24 mares (38 per cent), three of which during the two successive seasons, showed anoestrus after what appeared to be a successful last service. With pregnancy examination at approximately 40 days after service, they proved to be barren. Of these, 15 mares had a foal at foot, of which eight had shown a foaling heat. Treatment was attempted in 16 cases, seven of which became pregnant. Two of these pregnancies were terminated by abortion at five and seven months gestation.

The cause of anoestrus was associated with static ovaries in ten of these cases, whereas one mare demonstrated what appeared to be the one case of true cystic degeneration of the ovary, encountered during the two seasons. Two mares, both with a foal at foot, were "silent heat" types, and both conceived after service on a day determined by repeated rectal examinations of the ovaries.

A fourth group of mares evidenced anoestrus in association with the condition where ovarian processes of follicular maturation and ovulation actually take place, without the clinical and externally detectable signs of oestrus being demonstrated. In this so-called "silent-heat" mare, ovulation occurs as already stated, but the mare's behaviour when teased, may be anything from a state of acquiescense to violent resentment of the teaser's presence.

Twelve mares (19 per cent) demonstrated "silent heat", ten of which had a foal at foot. Two of these failed to show oestrus during both seasons, but nevertheless proved to have normal follicular maturation and ovulation, and both came into heat and conceived both seasons after induction of oestrus.

The total of 63 cases of anoestrus (19 per cent of 336 breeding cycles) was made up by 38 mares (60 per cent) with a foal at foot and 25 (40 per cent) dry mares. The higher percentage of mares with a foal at foot is significant and suggests that anoestrus is more common amongst foaling mares. Fourteen of the 38 foaling mares demonstrated a foaling heat; this fact supports the view that, when possible, mares should be served during foaling heat, as it might be the only naturally occurring oestrus during a season.

Out of the total of 63, 23 or 37 per cent conceived, six of which subsequently aborted. This high percentage (26 per cent) of abortions lends support to the belief entertained by more than one breeder, that anoestrus is nature's indication that a particular mare is not in a suitable state of health to produce another foal, and should not be forced into heat.

The treatment of choice instituted in 45 of these cases, was that advocated by Proctor, cited by Roberts[1], namely the infusion of 500 c.c. warm, sterile, physiological saline by means of a suitable catheter into the uterus. Oestrus followed within one to six days in 25 cases. The fourth day proved to be the day on which most cases showed oestrus. In eight cases that did not respond to saline infusion, 10 mgm. stilboestral was administered subcutaneously, with consequent oestrus in three mares; two of these presented a psychological heat only; conception did not take place in any of these three mares.

Chorionic gonadotropin in doses from 2,000 to 3,000 I.U. was employed alone or in conjunction with saline, in those cases where a static ovary prevailed. The procedure was the administration of chorionic gonadotropin immediately before or after the intra-uterine saline and repeated during the ensueing oestrus, in those cases where ovulation was delayed.

The so-called "cystic ovaries" is a concept that calls for clarification and more discretion, in its use. It is held responsible for certain cases of anoestrus and is used too loosely in many instances. It is a confusing term, as the "cysts", which are so readily palpable in mares showing anoestrus, were found, during rectal examinations at regular intervals, to be nothing but static graafian follicles in a static ovary. True cystic degeneration of the ovary was found to be rare in the mares under discussion. Only one such case was encountered in 336 breeding cycles of 182 mares. This mare was barren for three consecutive years and had a right ovary measuring 9 by 7 by 5 cm. with a cyst $\pm$ 5 cm. in diameter, which persisted throughout two breeding seasons.

It must be emphasized that sound rational treatment of anoestrus depends on a critical consideration of the particular mare's breeding history, in combination with a careful rectal examination of the genital organs, not only on one occasion but in many cases at regular intervals, in order to determine the nature of functional disorders existing in the ovaries. Only after determining the type and degree of anoestrus after repeated examinations at specific intervals, should the line of treatment be decided on. The ability to detect pregnancy by rectal examination with as much certainty as is practically possible, as early as 40 days after the last service, is a necessity in this particular aspect of breeding, and without any doubt, forms the basis of the veterinarian's approach to the breeding problems in any stud.

Aerovagina and Caslick's Operation

Since the vital importance of the act of wind-sucking in the mare and its surgical correction was first described by Caslick[5], every veterinarian engaged in equine sterility work, has indeed come to realise the important relationship between the ability of the volvo-vaginal orifice to prevent or limit the entrance of air into the genital tract on the one hand, and the health of the reproductive tract and the pathogenicity of infective organisms, on the other. Gaslicks' statement that, although most veterinarians are familiar with the act of wind-sucking, few realise its importance in conjunction with genital infections and allied diseases, such as barrenness, abortion and infections of the new-born foal, still holds good to-day.

The necessity of correcting aero-vagina by means of Caslick's operation, played an important role in the 336 breeding cycles of the 182 mares dealt with in this paper. This is borne out by the fact that during two seasons a total of 117 Caslick's operations were performed on 93 mares; 24 mares therefore had the operation during both seasons. This total of 117 cases consisted of the following:—

Thirty-seven mares conceived after a barren preceding season, followed by a routine treatment during the following June, consisting of an intra-uterine administration of four ounces of propamidine and one million units of crystalline penicillin, followed immediately by Caslick's operation.

In 53 cases the operation was performed from one to 98 days after the last service, conception having taken place in each case. Further reference to these cases are made below.

Caslick's operation was performed on eight mares, where in actual fact there were no signs of aerovagina and there were none of the usual abnormalities of the vulva, vagina and perineum that would necessitate the operation. These mares all had two or more normal oestrus periods in which ovulation took place, but without conception. These mares all conceived during the first oestrus after the operation. Three other mares with a similar sexual behaviour were treated likewise, but remained barren.

Sixteen additional mares remained barren after Caslick's operation. Factors other than aerovagina, could be ascertained as a cause of sterility in ten of these. A total of 98 Caslick's operations or 84 per cent were followed by conception.

The question as to when the operation should be performed brings certain difficulties to the fore. It is generally agreed that in dry mares the winter months are appropriate. In foaling mares however, the time factor complicates the matter. Early in the season, in mares that have been "Caslicked" (if this word may be coined) once or more during previous seasons and that rupture the upper vulvar commissure during parturition, the raw edges should be closed as soon after foaling as possible, before swelling occurs, i.e. within one to two hours after parturition. Caslick's operation at this time usually, but not in all cases, precludes service during foaling heat. As it is a primary object in thoroughbred breeding to get a foal dropped as early as possible, the procedure towards the middle or end of the season was to allow service first, either during foaling heat, or in its absence, during the oestrus that usually follows parturition within 25 to 30 days, and to perform Caslick's operation within one to five days after the last service. This was done in the case of 28 mares, in 22 or 79 per cent of which conception took place.

It is often stated by breeders that if a mare has been subjected to this operation once, it has to be repeated during each successive year. This was proved not to be the case in eight mares, which were "Caslicked" the previous season, conceived, foaled and subsequently conceived without any further surgical interference. Although it was the experience in a small percentage of mares that had been operated on before conception, that the raw edges of the vulva which are separated during parturition, spontaneously knit, the majority of "Caslicked" mares that tear during parturition, require surgical attention before conceiving again. It must therefore be assumed that in the case of these eight mares no injury had taken place where the vulva had been united surgically.

Another noteworthy feature was the relationship between Caslick's operation and the occurrence of anoestrus in seven mares. These mares demonstrated anoestrus associated with static ovaries throughout the previous season, received Caslick's operation the following winter, and without exception conceived with the first oestrus period. It must be added that all these mares were examined by speculum during their anoestrum periods and that not one case showed the usual clinical signs of aerovagina and/or bacterial infection. It would therefore appear that a sub-clinical aerovagina with probably a concommitant mild bacterial endometritis has an inhibitory effect on the normally functioning ovaries.

The probable link between abortion and clinical or sub-clinical aerovagina was suggested by Caslick[4]. With this possibility in mind an attempt was made during two seasons to decrease the incidence of abortion by subjecting every pregnant mare that presented mild to moderate abnormalities of the vulva, vagina and perineum, to Caslick's operation. In no instance was examination by speculum carried out. In 31 mares, from 13 to 98 days pregnant, an examination of the vulva, vagina and perineum was carried out with the above possibility in mind.

The criteria by which it was decided whether or not to do the operation were the following: A loss of tone of the constrictor vulvae muscles, an angle of the vulva of less than 85°, a sunken anus and a distance of more than one half inch between a horizontal forefinger placed on the pubis and the upper commissure of the vulva. If one or more of these aberrations prevailed, Caslick's operation was performed.

The results recorded were that three of these 31 mares, "Caslicked" respectively, 26, 40 and 84 days after the last service, aborted at 60-80 days, 100-150 days and 290 days gestation respectively. This abortion rate of 10% appears to indicate that sub-clinical aerovagina is not a cause of abortion after the second month of pregnancy, and that if the state of the vulva, vagina and perineum was such that pregnancy could be carried over the second month, it was also capable of maintaining full-term pregnancy.

In support of the above finding it must be added that abortion occurred in five mares that had been "Caslicked" after a preceding barren season. It is significant to state that three abortions took place in the seventh and two in the ninth month of pregnancy.

On the other hand, eight instances can be quoted where abortion occurred at 40 to 60 days pregnancy. Subsequent to the negative pregnancy examination, Caslick's operation was performed and no other treatment applied. Conception promptly took place during the next season.

On the strength of the relationship between these 16 abortions and the stage of pregnancy at which it occurred, it would appear that a certain percentage of early abortions (40-60 days pregnancy) can be attributed to aero-vagina, whereas abortions after the second month of pregnancy apparently are not due to one or more of the factors mentioned as criteria for ascertaining the necessity of Caslick's operation.

Abortion.

Out of a total of 241 conceptions, 34 abortions were recorded, i.e. 14%. The stages of gestation at which these abortions occurred were: 16 (or 47% of the total of 34) at 35 to 100 days pregnancy; two (6%) at 100 to 150 days pregnancy; 16 (47%) at 150 to 300 days pregnancy. In the case of 13 mares conception took place the following season; the treatment administered in these mares was the intra-uterine peni-

cillin and propamidine already mentioned and Caslick's operation in eight cases.

The history of mares responsible for the first group of abortions at 35 to 100 days is in accordance with that mentioned by Jennings[3] and Cole and Hart[5]. These mares were found pregnant by rectal examination 40 to 45 days after service, but proved to be barren at subsequent examinations carried out 80 to 100 days after the last service, or suddenly came on heat 70 to 80 days after the last service. The expression that a certain mare has "broken" is common amongst breeders. The latter usually state that such a mare had shown the usual signs of pregnancy, a shining haircoat, docility, increased flesh and fullness in the flank, before showing the unexpected heat.

The possibility that a considerable percentage of early foetal death are attributable to the presence of aerovagina has already been mentioned. This suspicion however requires confirmation.

Knowledge of the aetiology of abortion in mares after the fifth month of pregnancy, is incomplete. In the group of mares under discussion, the cause of the high incidence of abortion during the second half of the gestation period, could not be ascertained. Material from three, six to seven month aborted foetuses, was submitted for bacteriological and virological examination; the results in each case were negative.

Acting partly on empirical grounds through personal experience, and the history from breeders that many abortions occur in the region of the seventh month of pregnancy, a trial by means of progesterone implantations was carried out. This experiment was also prompted by the theory that abortion at this stage is attributable to a deficiency of progesterone, associated with the transition of progesterone production from the ovaries to the placenta, which occurs from the 100th day of pregnancy onwards and is practically complete by the 5th month.

After confirming pregnancy by rectal examination, each of 95 mares received three 100 mgm. progesterone implants subcutaneously. The implantation was carried out as close to the sixth month of pregnancy as possible.

The results obtained were that 87 mares gave birth to live healthy foals, two mares aborted four and seven weeks after the implantation, two mares aborted twins five and seven weeks after the implantation, one mare had a premature dead foal, (this mare had another premature dead foal the following season) and three mares had dead foals at full term. One of the latter aborted both the following seasons at seven and eight months pregnancy.

It must be admitted that the progesterone dosage might not have been adequate and should have been repeated a month later, but it is difficult to ascribe the two abortions at four and seven weeks after implantation, to a lack of progesterone. The aborted twins cannot be counted against a beneficial effect of the progesterone implants, as twins in thoroughbreds are rarely carried to term.

Another aspect of this experiment complicated the interpretation of the results. It was noticed during the next breeding season that certain mares retained a small circumscribed nodule at the sight of implantation. This finding raised the possiblility that part of the implant may have become encapsulated in fibrous tissue, preventing the steady release of progesterone. Such an encapsulation was probably due to local infection at the time of implantation. The majority of these implantations were done in the veld, where aseptic measures are often impossible.

It is difficult to ascertain the relationship, if any, between the implantations and the one premature and three full-term dead foals. The latter were born after 330, 338 and 332 days gestation periods. None of the mares therefore had exceptionally prolonged gestation periods. It is improbable that the progesterone implants could have interfered with normal parturition.

Although with certain reservations, there was justification to believe that a deficiency of progesterone was not responsible for the late-gestation abortions reported in this paper.

Although no laboratory confirmation was done, it is suspected that a considerable percentage of these abortions were due to equine viral rhino-pneumonitis. Erasmus[7] states that the existence of this disease in the Republic of South Africa has been confirmed by means of

the demonstration of compliment-fixing and virus-neutralizing antibodies in the sera of horses as well as by virus isolation. The incidence of the respiratory form of this disease was high amongst yearlings in these studs during the autumn months; it is stated by Doll and Bryans[8] that these cases with clinical rhino-pneumonitis serve as a source of infection for older horses and pregnant mares.

Further investigation into the role that viral rhino-pneumonitis plays as etiological factor of abortion not only in these studs, but throughout the Republic, are necessary; the probability that this viral agent is responsible for a major percentage of these abortions and full-term dead foals, is entertained by the author.

In conclusion the proportional incidence of the following reproductive disorders are presented as follows:—

The four forms of anoestrus:	63 cases (27%)
Aerovagina with or without uterine infection.....	98 cases (40%)
Abortion (including early foetal death).....	34 cases (14%)
Other forms of ovarian dysfunction not included under the above.....	43 cases (19%)

Out of a total of 336 breeding cycles in 182 mares, a total of 241 conceptions were recorded. This represents a overall conception rate of 72%.

ACKNOWLEDGEMENT

The Chief, Veterinary Research Institute, Onderstepoort, is thanked for his permission to publish this article.

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SOME REFLECTIONS ON EMBRYOTOMY IN THE BOVINE UNDER FIELD CONDITIONS

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SUMMARY

The Albrecht-Lindhorst method of embryotomy in the bovine modified by G. Reetz, and its advantages, are discussed. Owing to the more simple operation and less strenuous work, preference is given to it under field conditions.

INTRODUCTION

With the appearance of Thygesens embryotome in 1920 a new era in embryotomy had obviously begun. Classical and proved methods as Albrecht-Lindhorst (1912) were abandoned and unjustifiably forgotten.

On the continent it was R. Götze[3], at Hanover who, after having unnecessarily modified the head of the Thygesen embryotome, willingly adopted the new ideas which he taught in an orthodox manner tolerating no other method whatsoever. For young and inexperienced veterinarians however, the new method remained cumbersome and often led to early exhaustion and failure. Unnecessary and numerous transverse cuts, leaving sharp bone ends, had to be made, and short-armed obstetricians were handicapped.

Subsequently W. Becker, Hagemeister and G. Reetz[6, 7, 8, 9, 10], and other veterinary surgeons of good standing and many years of obstetrical experience, went on adhering to the proved method of Albrecht-Lindhorst which led to the publication of "Taschenbuch der Geburtshilfe fur Tieraerzte" (1937 and 1953)[1].

It was Reetz who modified in 1930 the Swiss Glattli spirals (1923) by constructing elastic spirals and perfecting the old method which has the following advantages over the Thygesen method as taught at Hanover:—

1. Due to the elasticity of the spirals they can be easily adapted to the foetus. No injuries to the parturient animal can happen when it suddenly goes down and no sharp bone ends will inflict traumas to the uterus or vagina.
2. They are of light weight, easy to handle, easy to introduce into the pelvis, easy to transport and to clean.
3. The spirals do not become hot by friction with the wire saw, and the saw cannot jam in the spirals.
4. Short-armed obstetricians can work better with them.
5. Far less cuts, usually three in anterior presentation and two in posterior presentation, are necessary, and the operation is shortened considerably and is less strenuous.

The principal aim of any foetotomy should be:—

(*a*) To finish the operation within as little time and with as few cuts as possible.

(*b*) To protect the parturient animal and the surgeon against injuries and to avoid unnecessary strain.

TECHNIQUE

Anterior Presentation.

If the animal is standing, inject 6-8 ml 1 per cent to 2 per cent solution of a local anaesthetic into the epidural space, and keep the animal standing. If the animal cannot get up, place two sacks tightly filled with teff grass, straw or grass, under the pelvis. Inject 10 ml two per cent Planocaine or Lignocaine into the epidural

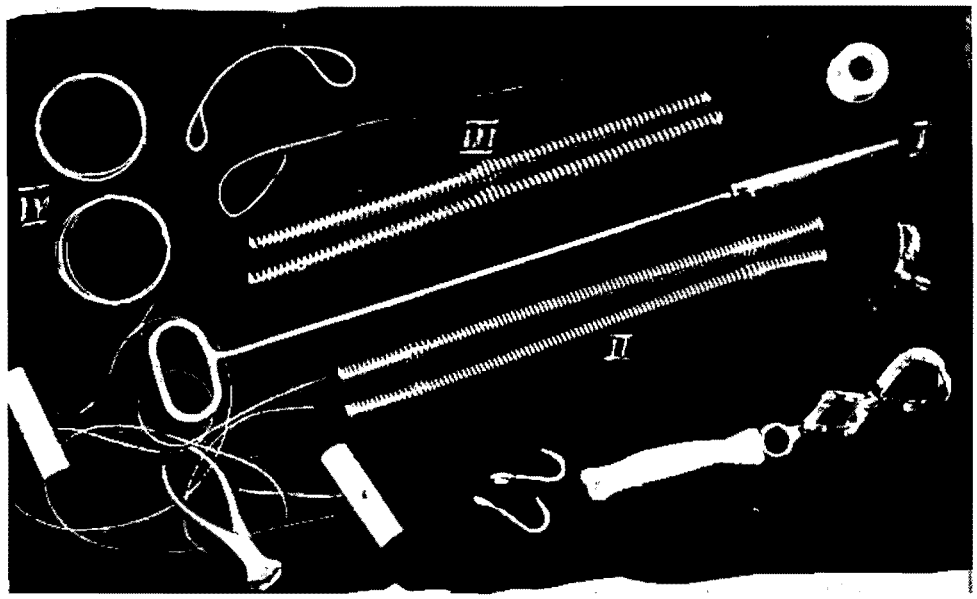
space to avoid strain and labour. The first big obstacle being the head of the calf, this must be cut off first.

Direct both spirals with the wire saw over the head, lead one round to left of jaw and one to the right. Join them under the larynx by pressing the extended ends together. The wire saw is now firmly placed behind the ears. Fix the wooden handles.

One strong person will have to do the sawing, standing firmly or kneeling, bent backwards, and maintaining long, steady and even movements with arms and shoulders. During pauses the saw wire should not be loosened, thus avoiding curling of the wire. This is very important because the saw needs a fixation point. The head can be sawn off within a short time.

vertical position and thus come 10 inches nearer and within the reach of any short armed surgeon. Make two deep longitudinal cuts with the finger knife into the skin above the shoulder cartilage. Remove the borer. Direct the rope carrier with saw round the elbow. Slip one spiral over each end of the saw. After having fixed the wooden handles, hook the saw wire over the shoulder cartilage so that it is placed between the thorax and the shoulder of the calf. Press the extended ends of the spirals together. The foreleg can be cut off easily. In many cases the calf can be pulled out after having brought the other leg into the normal position. If not, the same method has to be applied to the other leg.

Having removed both fore-legs the borer must be screwed firmly into the vertebral channel.



I.—LOWEG'S Borer—Length 30".
II.—REETZ Elastic spirals for anterior presentation—Length 20".
III.—REETZ Semi-elastic spirals for posterior presentation—Length 20".
IV.—Simple 2-wired saw (any wire saw can be used.).

The next phase is to screw the Loweg borer firmly into the vertebral channel of the neck. By pushing it and the calf forward both fore-legs can be bent in the carpal joints and placed back into the uterus. By vigorously pulling the borer and calf back, the shoulders will be placed in a

The thorax can only be pulled out when the parturient animal is in a right lateral recumbent position. This can be achieved by bending the animal's head to the left and by placing a sack under the abdomen which should be lifted strongly by two persons. To prevent the stem-

ming of the sternum against the bottom of the pelvis and the folding of the neck skin, the borer has to be moved to and fro in an horizontal direction. With some patience the thorax can be extracted.

If the remaining hind quarters cannot be pulled out they can be divided by directing the wire saw over the regio ischiadica parallel to the spine between the hind legs after having cut off the thorax behind the xiphoid cartilage; the normal procedure to be followed with any embryotomy.

Posterior Presentation

Direct both spirals with the wire saw as far forward as possible over the croup of the calf. Fix the handles, lead the right spiral and wire in front of and round the right hip joint and round the right knee till it reaches the regio pubica of the calf. Direct the left spiral likewise round the regio pubica. The spirals are now between the hind legs. Cross both extended ends and press them together. Now sawing can begin. After more or less 30-40 cuts, the position of the left or right spiral has to be changed by taking it back over the regio ischiadica and by joining it to the right or left one which is left in its position. Thus one hind leg and half of the pelvis can be cut out by changing over the cuts from a more or less oblique to a longitudinal axis, which is of importance.

If the remaining part cannot be extracted, cut the posterior part off in the xiphoid region. Screw the Loweg borer into the vertebral channel if necessary[5]. Direct the wire saw forward, over and round the right or left shoulder of the calf. Slip the sprials over the wire saw and lead them round and over to the opposite side of the thorax. Press the ends together, fix the handles and start sawing.

Discussion

This embryotomy is based on an entirely different conception.[5] It is not a mere modification of the Thygesen method. It needs anatomical and technical reflections whereas the Thygesen method is a more or less schematic one. No strictly transversal cuts however, are possible, and consequently sharp bone ends will be avoided.

The head being the biggest obstacle, must be decapitated first in anterior presentation. By placing both forelegs back into the uterus by means of the Loweg borer the shoulders will be placed in an upright (vertical) position. Thus they will come approximately 10 inches nearer, within the reach of a short armed veterinarian, which is definitely an advantage. Even in posterior presentation a short armed obstetrician will be able to place the spirals forward over the croup of the calf when he can only reach the tuberi ischii and tail insertion.

The wire saw will last longer because it is not exposed to intense friction on the metal head of an embryotome. A cheaper one can be used. Due to the elastic ends of the sprirals a bigger bending radius of the wire saw will result which helps to again lengthen the wire saw.

The greatest advantage, however, over the Thygesen method is the less strenuous work involved. Secondly the wire saw can be fairly easily placed over and round the obstacle by directing it in the sprials. The stripping of the wire saw over the obstacle, according to Professor F. Benesch,[2] is one of the most difficult manipulations in an embryotomy. He further stresses that any embryotomy can be technically achieved more conveniently and more hygienically when the animal is standing.

If no fruitless attempts have been made by laymen to extract the foetus by force causing injuries, jamming and thus preventing the exhausted mother from rising to her feet, most cases can be dealt with when the animal is standing. In unsuccessfully broken off cases of the Thygesen method, after the thorax has been partly sawn, and in delayed cases when the uterus firmly encloses the foetus, it cannot be applied.

In recent years, according to Reets[6,7,8,9,10], the caesarean section has been strongly propagated by the veterinary colleges which can well be understood when comparing it with the schematic and strenuous delivery by means of a total embryotomy. The younger generation does not appear to think that an embryotomy has much advantage over a caesarean.

According to Professor J. Andres, veterinary college Zurich, the caesarean section remains

in spite of chemotherapeutics and modern antibiotic treatment, a less sparing operation than an embryotomy. In poorly conditioned animals with living foetusses the embryotomy can be indicated for economic reasons. In breeding areas laparotomized animals will not be sold.

The younger practitioner lacking experience will decide more easily on the caesarean operation because it is straightforward, a more elegant operation, more impressive to the layman, and definitely less strenuous and more time saving than a total embryotomy.

Reetz[6,7,8,9,10], proves the contrary by quoting a case of posterior presentation of a cow in her third or fourth pregnancy. At the age of 65, he embryotomized the calf without any assistance whatsoever. The calf weighed 156 lbs. This conclusively proves the superiority of his method.

The author gives preference to the caesarean operation in the following cases:—

In juvenile heifers which were served too early and in some cases of a too narrow or abnormal pelvis and narrow vagina; in malformations viz. schistosoma reflexum etc., in certain cases of delayed and incomplete opening of the cervix uteri, and in delayed cases with emphysematous calves, provided they are not septic[4].

The author has met many a veterinarian who has never made use of a Thygesen or similar embryotome, and who has performed many successful embryotomies under difficult conditions. Others do not apply the Thygesen method any more. Owing to the advantages of the Albrecht-Lindhorst-Reetz method it should not be abandoned or just ignored for mere prestige.

This article is an attempt to point out the great advantages of this method and thus to bring recognition to the life work of Dr Reetz.

ACKNOWLEDGEMENT

The Chief, Veterinary Services, is thanked for permission to publish this article, and to Dr. Reetz the author is indebted for his invaluable advice.

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LACTATIONAL FAILURE IN THE SOW

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SUMMARY

Current views regarding the causation and classification of lactational failure in the sow are discussed. An account is given of the salient features of an outbreak of post-partum illness in sows associated with hypogalactia, and reasons are advanced to try and explain the comparatively widespread incidence of this syndrome among South African sows.

INTRODUCTION

Dramatic and economically serious piglet mortality is a common sequel to early lactational failure in the sow. The occurrence of this disaster has so increased in recent years with the intensification of pig production methods in South Africa that it today constitutes one of the most serious problems facing both clinician and producer alike. Diagnostic problems are intensified by the notoriously diverse clinical manifestations of post-partum disease accompanied by agalactia or hypogalactia. These range from a peracute, septicaemic crisis with prostration and agalactia to a subclinical hypogalactia, reflected only in the unthriftiness of the litter. Between these extremes occur a number of unlike syndromes, varying from udder hypoplasia or milk ejection failure to a variety of febrile illnesses, distringuished by the involvement of one or more different organs such as udder, uterus, gastrointestinal tract, skeletal musculature and skin.

A valuable study of this last syndrome in Sweden has been published by Ringarp[1], who has also surveyed the literature up to 1960. He points out that "current knowledge of post parturient disorders with agalactia in sows is very incomplete and is mainly based on clinical studies. The aetiological and the pathogenic interrelationships have not been clarified". The literature places great emphasis on the role of infection in the causation of post-parturient disease but pays scant attention to the impact of management on the incidence of this disease.

Ringarp has classified the various types of agalactia post-partum in the sow into five main groups as follows:—

1. Eclampsia with or without hypocalcaemia.
2. Milk ejection failure of gilts, which is due to neurohypophyseal failure and responds to oxytocin administration.
3. Udder hypoplasia, occuring mainly in fat, overfed gilts.
4. Hormonal or symptom-free agalactia, with no other outstanding symptom other than agalactia or hypogalactia; many of these cases turning into the type classified under group 5 if not treated with an antibacterial drug.
5. By far the largest group, provisionally named "agalactia toxaemica"; this group is characterised by lactational failure some 12-48 hours post partum, and is, therefore not a primary disturbance of milk secretion or ejection. Symptoms noted are usually fever, inappetance, often udder swelling, coprostasis, occasionally increased lochial discharge and sometimes a stiff or tense staggering gait. He places no less than 88.56 per cent of his 1,180 cases in this last group and concludes that "agalactia toxaemica" is a syndrome in which agalactia constitutes just one of the many symptoms which may occur. The aetiology and pathogenesis include metabolic and endocrine components as well as intoxications and/or infections of gastrointestinal origin.

Very similar cases of agalactia are described throughout the literature with an amazing

similarity of symptoms, under such names as post-parturient or pueperal fever, pueperal septicaemia, milk-fever syndrome, hypopituitarism, *E. coli* infection, mastitis, metritis and agalactia[1]. A similar condition has been named "febrile agalactia" in Southern Rhodesia. In the past eight years the writer has investigated an extensive series of outbreaks of post partum illness in sows with agalactia (or more usually hypogalactia) as the principal symptom. The great majority of these cases could be classified as the "agalactia toxaemica" of Ringarp and were generally associated with husbandry errors such as overfeeding and prolonged pre-partum confinement. Affected animals usually exhibited hyperpyrexia up to 107°F, marked udder swelling, constipation and often prostration. Mortality in treated cases has been slight, but many of these sows have not returned to milk and have either lost their litters or neccesitated the piglets being fostered or handreared. Very little material has become available for pathological study. Bacteriological examination of milk and vaginal swabs from such sows has repeatedly shown the presence of non-haemolytic strains of *E. coli*, either in pure culture (milk) or associated with a mixed flora. Treatment has usually consisted of the administration of a tetracycline or streptomycin, pituitrin and a corticosteroid. Recumbent sows have often been given calcium borogluconate in addition. Return of a satisfactory milk flow has generally only followed early treatment. The disease has been far more prevalent in summer and has often tended to occur in a number of consecutive farrowings on the same farm, creating the impression of an infectious disease. Very few instances of primary lactational failure from udder hypoplasia or milk ejection failure have been encountered. Nothing resembling the udder hypoplasia, described in Southern Rhodesia[2], and resulting from the feeding of ergot-infected bulrush millet, has been recognised nor has a condition considered to be attributable to hypocalcaemia yet been observed.

Recently, a large outbreak of post-parturient disease in sows with hypogalactia has been investigated which has lacked many of the typical features of "agalactia toxaemica". This outbreak will be briefly described in an attempt to illustrate some of the factors which may influence the incidence, clinical features and course of such disease.

History

The pig herd in question is one of the largest and best-managed in the country. The housing, feeding and management of pregnant and farrowing sows has remained largely unchanged for several years. Two changes, however, occurred, and both are believed to have predisposed towards this outbreak. The brooder house was enlarged and totally enclosed about a year earlier and some groundnut cake meal containing aflatoxin was inadvertently introduced into the home-mixed ration for a while.

Exceptionally hot weather set in during the early part of September 1963, and shortly afterwards signs of inappetance and hypogalactia became apparent in a large proportion of the newly-farrowed sows in the brooder house. No other classes of pig on the farm manifested any evidence of illhealth during the same period. The position deteriorated still further during the following month, but slowly improved in November, following certain changes in management. An examination of the excellent herd records showed that a post-farrowing syndrome requiring antibacterial treatment had occurred on a small scale towards the end of summer earlier in the year, and that the incidence of these disorders showed a definite positive correlation with the warmer months of the year (Table 1).

TABLE I.—SEASONAL OCCURRENCE OF POST-PARTUM HYPOGALACTIA.

Month of Year	*Percentage of newly-farrowed sows treated*
January	15.5
February	8.2
March	12.5
April	7.0
May	3.5
June	3.5
July	1.4
August	4.4
September	21.5
October	44.1
November (1-18)	20.1

Sows were noted as sick when they failed to eat their first feed after farrowing had been completed. Affected animals were in reasonable, but not overfat condition, and had been carefully fed during pregnancy on not more than four pounds per day per sow of a high-class, maize-based, 18 per cent crude protein ration, containing a sufficient proportion of animal protein and fortified with vitamins and trace elements. This ration also contained about two per cent of the aflatoxin-containing groundnut oilcake meal. Following the onset of hot weather, it became rapidly evident that the ventilation of the brooder house left much to be desired, and the ambient temperature in the farrowing sties was found to rise to between 85° and 95°F at 3 p.m., in the afternoon. At the height of the outbreak four unbred, mature gilts were introduced into the farrowing house as "sentinels" and fed on the sow meal. These animals did not develop clinical disease during the period of several weeks they were under observation.

Clinical Findings

The chief symptom noted was lack of appetite after farrowing, either a complete anorexia for one or more feeds or a much diminished appetite for the same period. No evidence of emesis, diarrhoea or constipation was noted in these sows, except in one gilt with a temperature of 106.4°F, which vomited several times at the height of the temperature reaction. Rectal temperatures were recorded in 50 sows and gilts, not all of which were clinically sick, and in 16 of these animals temperatures of more than 103° were found, the highest temperature being that of the gilt mentioned above. Most of these 16 animals had temperatures ranging from 103.2° to 104°. Except for one animal with slight oedema, no reddening, hardness or swelling of the udders was observed. The lochial discharge in affected sows was considered to be of normal quantity, colour and consistence, a very few animals only having a slightly increased amount of white, creamy vaginal discharge. No cyanosis, skin discolouration or muscular stiffness was observed in the affected animals.

While most affected animals showed inappetance within 24 hours of farrowing, a few went off their feed for a day or two as long as eight to nine days post-partum. During these periods the sows drank water normally and did not generally appear reluctant to move about. The hypogalactia was, however, soon reflected in the behaviour of the piglets, which became restless and thirsty, even sucking up the sow's urine from the floor. Many of the piglets developed a white creamy diarrhoea and lost condition rapidly. A number of these litters were seen at three to five weeks of age to be pale, hairy and uneven as a result of the earlier setback.

Sows were treated by intramuscular injection of chlortetracycline and pituitrin and a few were also given prednisolone. Generally, the appetite returned after one or two tetracycline injections, with concurrent restoration of milk flow and immediate improvement in the litter. Small dishes of glucose water were made available for the piglets during the period of hypogalactia and this was readily consumed.

Haematology and Bacteriology

Examination of blood samples from four clinically affected animals showing hyperpyrexia, hypogalactia and a scouring litter was made (Table II).

A normal total and differential white cell count for the sow has been given as WCC/10^3/mm^3. 15,900 with 35 per cent polymorphs, 63 per cent lymphocytes and two per cent eosinophiles[3]. The same author[4] has described the stress pattern displayed by the differential leucocyte count at parturition, where a "change-over" in the ratio between neutrophiles and lymphocytes occurs six to 30 hours prior to parturition. A post-farrowing reduction in the red cell count has been described[5], as also a leucopenia[1]. No explanation of the eosinophilia observed in three of these animals can be advanced. It may possibly represent an allergic reaction to absorbed *E. coli* mucopolysaccharide, since such a hypersensitivity has been shown to exist in pigs.[6] The aflatoxin in these pig's meal may have reduced the detoxicating powers of their livers to allow such an allergy to occur.

TABLE II.—HAEMATOLOGICAL RESULTS.

Animal No.	RCC $10^3/mm^3$	Hb. g%	WCC. $10^6/mm^3$	PCV. %	Neutrophiles %	Lymphocytes %	Eosinophiles %	Monocytes %
Gilt 1.....	—	—	7.1	—	84	13	0.5	2.5
Gilt 2.....	4.43	13.3	12.4	37	34	50	15	1
Gilt 3.....	4.44	13.3	10.8	38	20	64	15	1
Sow 1.....	4.31	14.0	13.5	35	49	40	10	1

Vaginal swabs from 15 animals were examined bacteriologically with the following results:—

No growth obtained: one swab.
E. coli in pure culture: two swabs.
E. coli and *Staphylococcus* Species: three swabs.
E. coli and *Staphylococcus* Species and *Streptococcus pyogenes*: one swab.
Streptococcus pyogenes: one swab.
Streptococcus pyogenes and *Staphylococcus aureus*: three swabs.
Streptococcus pyogenes and *Staphylococcus Species*: one swab.
Aerobacter aerogenes: one swab.
Proteus: two swabs.

These results agree reasonably well with those obtained by Ringarp[1]. Two rectal swabs from scouring piglets were also examined, but yielded only non-haemolytic, non-enteropathogenic strains of *E. coli*. The beta-haemolytic streptococci isolated from the vaginal swabs were characterised as Streptococcus pyogenes on the biochemical reactions described in Bergey's Manual of Determinative Bacteriology, 7th. Edition.

DISCUSSION

Many sows appear to be precariously balanced between normality and disease after parturition. In this dangerous state, a moderate amount of additional stress may provoke endocrine disturbance and sufficient infection/intoxication to cause lactational failure. This increased susceptiblity to stress was beautifully demonstrated by Ringarp's experiments[1]. He was able to produce agalactia toxaemica by four different methods which disturbed the intestinal flora during the final week of gestation, but none of these four methods had any ill-effects when applied to sows five to 12 days post-partum.

He also showed that agalactia toxaemica could be provoked by hypothyroidism, when he caused thyroid depression by means of dosing with methyl thiouracil. Decreased bowel motility and milk formation are common sequelae to thyroid hypofunction. It is believed that exposure of farrowing sows with their thick, subcutaneous fat layers, to high ambient temperatures will oftern produce a measure of thyroid inhibition and favour the production of lactational disturbance. This and the other effects of heat fatigue would provide a dangerous amont of additional stress to these animals, and would help to explain the increased incidence of lactational disorders in the hotter months.

During pregnancy the increase in weight of the uterus is compensated by a diminution in size of all digestive organs. It is believed by some workers[7] that this may partly explain the difficulties encountered with digestive upset and particularly constipation at term in the sow. These same workers have demonstrated the remarkable ability of the pregnant sow to gain weight during pregnancy, even when fed on a maintenance ration of one pound per day per 100 pounds liveweight, an allowance which does not allow of weight gain in the non gravid female. This improved nitrogen and fluid retention they call "pregnancy anabolism" and point out that it is greatest where high-energy diets are fed. Failure to appreciate this concept with the maize-based rations fed here to sows, has led to much overfeeding and overfatness of sows at partus. It is well established that many overfat animals have unduly long farrowing times, with consequent exhaustion and proneness to agalactia. The value of individual feeding stalls for pregnant sows cannot be overemphasised as a means of controlling feed intake more accurately.

With the adrenal exhaustion occasioned by excessive stress there exists the danger of in-

creased invasion of the circulation by bacteria and toxins from the gut. Under these circumstances, factors which promote bowel stasis or changes in the flora (sudden changes of feed; protein overfeeding) are particularly dangerous in promoting intoxication or infection of intestinal origin. The consistent indentification of *E. coli* organisms in animals with agalactia toxaemica supports this view.

Ringarp has shown[1] that many animals with agalactia toxaemica are suffering from hepatic degeneration and also exhibit an increased bromsulphalein retention. Aflatoxin is a potent hepatotoxin and has been reported to cause inappetance and agalactia in nursing sows[8], when infected groundnut cake meal composed some eight per cent of their ration. In the outbreak reported here, the aflatoxin-containing groundnut cake-meal constituted only two per cent of the ration, and can thus hardly have been the sole factor in the causation of illness. It did, however, constitute yet a further stress factor. The brooder house was eventually depopulated, disinfected and fitted with a new and higher roof, which allowed of adequate air movement through a central ventilation vent. Thereafter, the brooder house air temperature did not rise to dangerous levels.

In this outbreak, it is important to note that because of the careful observation of each sow, it was possible to identify sick animals at a very early stage and to obtain rapid and satisfactory results from the resulting early treatment. This factor, together with the careful pre-natal management and feeding, was responsible for minimising the clinical expression and economic losses of the outbreak.

ACKNOWLEDGEMENTS

I wish to thank Dr. C. Cameron for the examination of the vaginal swabs, Dr. H. Botes for the examination of the rectal swabs and Miss. B. M. Evans for the haematological examinations. My thanks are also due to Prof. J. S. van Heerden for assistance with the investigations and to the Chief, Veterinary Research Institute, Onderstepoort for permission to publish.

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DIE EOSINOFILIESE INDEKS AS DIAGNOSTIESE HULPMIDDEL IN VOORTPLANTINGSPROBLEME VAN TEWE

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Ontvang vir publikasie April 1964

RESUMÉ

'n Kliniese geval van vermeende onvrugbaarheid in 'n teef word beskrywe as voorbeeld van die waarde van die eosinofiliese indeks van die vaginale selsitologie as diagnostiese hulpmiddel by die bewerkstelling van optimale bevrugtingsresultate. Met hierdie indeks kon nie alleen die optimum paringstyd vasgestel word nie, maar ook paslike hormonale terapie aangewend word. Die betrokke gegewens gedurende die vierde en vyfde siklus is grafies geïllustreer.

INLEIDING

Sedert die klassieke werk van Allen en Doisy[1] wat die uitwerking van estrogene op die vaginale slymhuid van rotte aangetoon het is al verskeie tegnieke ontwikkel om van hierdie bevinding as aanduiding van estrogene werking gebruik te maak.

In die mens het veral Papanicolaou[8] rigting aangegee eerstens om deur middel van vaginale smere nie alleen hormonale afwykings te demonstreer nie, maar later ook om die aanwesigheid van sekere kwaadaardige baarmoederhalsgewasse aan te toon.

Sekere indekse, ten opsigte van vaginale sitologie is uitgewerk waarvogens die hormonale status in die mens vasgestel kan word. Die belangrikste hiervan is die Kariopiknotiese indeks[10, 11] en die eosinofiliese indeks[3].

Daar is al gepoog om die verskillende fases van estrus in die teef aan te stip deur bepaling van die teenwoordigheid van sekere bloed- en selelemente[5,7]. Hierdie bepalings is egter nie so betroubaar nie omdat, die teelsiklus van tewe geweldig kan variëer[29].

My waarnemings op 31 tewe—die onderwerp van 'n meer uitgebreide verhandeling—dui daarop dat die eosinofiliese indeks (EI) ook in honde estrogene stimulasie aantoon. Dit blyk dat die EI veral aangewend kan word om—

(i) die korrekte tyd van paring te bepaal en

(ii) hormonale afwykings gedurende die siklus op te wys, wat dan terapeuties herstel kan word. Albei hierdie fasette sord deur die onderstaande geval geillustreer.

GEVALVERSLAG

Anamnese:

Die betrokke teef, gebore op 7/4/61 is uit Engeland ingevoer nadat sy haar eerste teelsiklus aldaar sonder enige dekking ondergaan het. Nadat die teef in Suid-Afrika aangeland het, het sy nog twee skynbaar normale bronstigheidsperiodes deurgemaak. Dekking is in beide gevalle op die 11de en 12de dag na aanvang van proestrum toegelaat maar selfs tenspyte van hormonale behandeling gedurende die derde siklus het bevrugting nie plaasgevind nie. Met aanvang van die vierde siklus is die geval na my verwys. (Sien tabel).

Skraapselsmere van die vulva-slymvlies is met 48-uur-tussenposes gemaak en volgens Shorr se tirchroommetode gekleur. Die eosinofiliese indeks is uitgewerk, d.w.s., die persentasie gekeratiniseerde oppvervlakkige epiteelselle wat 'n rooi kleur aanneem is bereken in terme van die niegekeratiniseerde oppervlakkige epiteelselle wat groen kleur. Die intermediêre en parabasale selle is buite rekening gelaat.

In die tabel word die volledige teelgeskiedenis van die teef weergegee asook die behandeling

LEGEND TO GRAPH

GRAFIEK WAT SKOMMELING IN EI MET VERLOOP VAN BRONSTIGHEID AANTOON
GRAPH SHOWING FLUCTUATION OF EI DURING COURSE OF OESTRUS

A. 200 E DMS S/K +50 IE LH I/M
B. 250 IE LH I/V
C. 20 mgm Progesteroon I/M
C¹. 20 mgm Progesteroon I/M
D. Dekdatum, Siklus 5
D¹. Dekdatum, Siklus 4

A. 200 U PMS S/C +50 IU LH I/M
B. 250 IU LH I/V
C. 20 mgm Progesterone I/M
C¹. 20 mgm Progesterone I/M
D. Date of coitus, Cycle 5
D¹. Date of coitus, Cycle 4

Dag 1 is eerste dag waarop bloederige skedeuitvloeisel klinies bespeur is.
Day 1 is first day on which bloody vaginal discharge is detectable clinically.

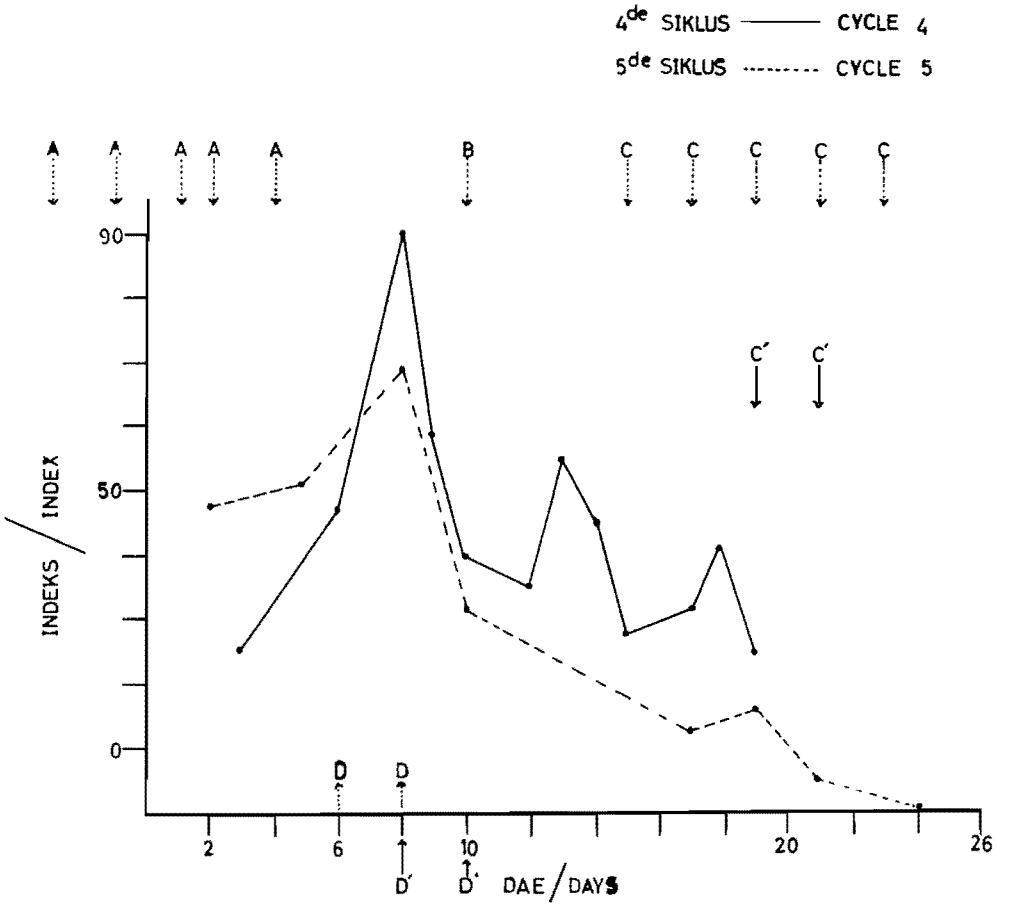
wat toegepas is. Die resultate wat verkry is, is in bygaande tabel opgesom en duidelikshalwe ook grafies voorgetsel.

Kortliks kom dit daarop neer dat geen welslae behaal is met dekking op die agste en tiende dag van siklus vier en laat nabehandeling van

SIKLUS	AANVANG VAN SIKLUS	DEKDATUM	TYDPERK TUSSEN BRONSPERIODES	BEHANDELING TOEGEPAS	RESULTAAT
1	12.1.62	Nie gedek		Geen	—
			6 Maande		
2	9.7.62	11de dag 12de dag		Geen	Nie bevrug.
			5 Maande		
3	2.1.63	11de dag 12de dag		11de dag 500 IE Lutëiniserende-Hormoon I/V	Nie bevrug.
			5 Maande		
4	9.6.63	8ste dag 10de dag		18de & 20ste dag. 20 mgm Progesteroon I/M	Fetale resorpsie?
			7 Maande		
5	13.1.64	6de dag 8ste dag		10de dag 250 IE Lutëiniserende Hormoon. I/V 15de dag 20 mgm Progesteroon I/M 17de dag 20 mgm Progesteroon I/M 19de dag 20 mgm Progesteroon I/M 21ste dag 20 mgm Progesteroon I/M 22ste dag 20 mgm Progesteroon I/M	6 Kleintjies (5♀ + ♂

Dag 1 van siklus word weergee as die eerste dag waarop 'n bloederige vaginale uitloopsel klinies bespeur is.

vermeende progesterooninhibisie — aangedui deur EI pieke op die 13de en 18de dag van die siklus — deur middel van 20 mgm progesteroon nie. Daarenteen was dekking op die sesde en agste dag van siklus vyf en vroeë behandeling van verwagte progesterooninhibisie d.m.v. 250 EI LH op die tiende dag en 20 mgm progesteroon op dae 15, 17, 19, 21 en 22 wel suksesvol. In albei siklusse is die teef op die tydstip van die hoogste EI en twee dae daarna gedek, terwyl in siklus vyf sy ook nog twee dae tevore gedek is. Opvallend is die feit dat die EI-piek in albei gevalle vroeg in die siklus, en wel op dag agt plaasgevind het.



Bespreking

Uit voorafgaande grafiek blyk dit dat die estrogene piek soos deur die EI aangedui in beide die vierde en vyfde siklus reeds op die agste dag voorgekom het. Daar is nog geen sekerheid dat ovulasie presies samehangend met die eosinofiliese indekspiek saamval nie. Verdere studie kan hierdie aspek ophelder. Dit kan redelikerwyse aanvaar word dat daar wel 'n betreklik noue verband tussen die twee verskynsels bestaan. Die aanname word versterk deur die suksesvolle eindresultaat wat verkry is deur dekking net voor of gedurende die piek te laat plaasvind.

Nieteenstaande die feit dat die lewensduurte van spermatozoa van die hond op 48 $\pm$ 12 uur gestel word[2,6], is dit aan te beveel dat kopulasie nogtans so nou as moontlik met ovulasie gesinkroniseer word om optimale fekunditeit te verseker, want, net soos met ander politokiese species, word al die ova nie tegelyk vrygestel nie. Hancock en Rowlands[4] gee aan dat hulle die

hoogste konsepsiesyfer verkry het deur dekking toe te laat gedurende die eerste vier dae van werklike estrum gevolg deur 'n tweede dekking 48 uur later. (Ware estrum word aangedui as die periode vandat die teef die reun vir die eerste maal toelaat om haar te dek).

In hierdie geval is die uiterse kort pro-estrum, wat nie klinies waarneembaar was nie, eers met die EI aangetoon. Die moontlikheid is dus nie uitgesluit dat bevrugting wel sou kan plaasgevind het gedurende die tweede en derde siklus indien dekking op 'n vroeëre stadium toegelaat was nie.

'n Verdere belangrike aspek in hierdie geval is dat die EI gedurende die vierde siklus 'n duidelike styging op die 13de en 18de dag van die siklus getoon het. Dit is geïnterpreteer as aanduiding van onvoldoende progesterooninhibisie. Om hierdie verskynsel met die vyfde siklus te voorkom, is op 'n vroeëre stadium progesteroonterapie met hoër dosisse toegepas. Aangesien daar nie 'n soortgelyke styging gedurende die vyfde siklus voorgekom het nie, word aangeneem dat die diagnose en daaruit voorspruitende terapie geregtig was.

Gedurende die anestrumperiode voor aanvang van die vyfde siklus is daar gepoog om estrus te verwek deur die toediening van FSH en LH. Omdat daar nie 'n noemenswaardige verskil tussen die lengte van anestrum tussen die vierde en vyfde siklus en die van vorige siklusse was nie, word hierdie poging—in ander gevalle geslaagd—nie as suksesvol beskou nie.

Summary

The value of the eosinophilic index—determined on vaginal smears prepared according to Shorr's method—as a diagnostic aid in reproductive failure in the bitch, is exemptified by a case report on a bitch observed during her fourth and fifth oestrous cycles, after unsuccessful service on the 11th and the 12th day of the second and third oestrus.

The EI peak occurred on day eight of both the fourth and fifth oestrous periods. Service on days eight and 10 of the fourth cycle was unsuccessful, presumably due to insufficient or incomplete progesterone inhibition, reflected by two subsequent rises in the eosinophilic index. Hormonal treatment was instituted in the fifth cycle to circumvent this and service was allowed to take place on days six, and eight, with successful results. The appended graph (with legend also in English) gives full details of treatment and observations.

It is doubtful whether in this particular case the use of FSH and LH materially assisted in bringing on oestrus.

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VETERINARY NON-PROPRIETARY NAMES

LIST No. 1.

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The following is a list of non-proprietary names which have been adopted for seven substances used in veterinary medicine:—

Non-proprietary name	*Other names*
Coumaphos.....	3-chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl diethyl phosphorothionate; Asuntol; Bayer 21/199
Cyacetazide.....	cyanoacethydrazide
Diaveridine.....	2,4-diamino-5-(3,4-dimethoxybenzyl)-pyrimidine; Darvisul
Dioxathion.....	a mixture consisting essentially of *cis*- and *trans-SS'*-1,4-dioxane-2,3-diylbis (00-diethyl phosphorothiolothionate); Delnav
Methyridine.....	2-(2-methoxyethyl)pyridine; Promintic
Piperonyl Butoxide	1-[2-(2-butoxyethoxy)ethoxymethyl]-4,5-methylenedioxy-2-propylbenzene
Thiabendazole.....	2-(thiazol-4-yl) benzimidazole; Thibenzole

These names have been adopted by the Committee set up by the Pharmaceutical Society of Great Britain to revise the British Veterinary Codex 1953. If the Substances named are included in the forthcoming edition of the British Veterinary Codex the names chosen will be the titles of the new monographs in the Codex.

The non-proprietary names are reported to be free from conflict with trade marks registered in Great Britain and Northern Ireland, and these names, or names resembling these names, will not be registered as trade marks for pharmaceutical products or drugs in those countries. Some of the names, other than the chemical names, appearing in the second column above are registered trade marks.

By publishing these, the first list of non-proprietary names for veterinary medicines, the Society emphasises the importance of veterinary medicines, and the value of ensuring that these products, like human medicines, can be prescribed under free names as well as under trade names.

Requests from manufacturers and other interested persons for the provision of non-proprietary names for veterinary medicines should be addressed to:— The Secretary, British Veterinary Codex Revision Committee, The Pharmaceutical Society of Great Britain, 17 Bloomsbury Square, London, W.C.1.

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The basic research, which began in a small back room in Fulham, London, in the autumn of 1957, was carried out by the Plantmilk Society (a charitable organisation formed a year earlier) and has been directed by Dr. H. B. Franklin, Ph.D., A.R.I.C., a research biochemist who is now the technical director of Plantmilk Ltd. This Company, formed in 1961 to carry forward the commercial applications of the Society's work, is building a small pilot-scale factory in the village of Langley, Bucks.

The research was initiated in an effort to meet the need for a satisfactory alternative to animal milk. For example, a number of children and some adults suffer in varying degrees from milk allergy, and would benefit from such an alternative. There are also undernourished areas of the world in which dairy farming is either impossible or uneconomic. By building Plantmilk factories in these areas and using local vegetation not suitable for direct human consumption, a valuable contribution could be made toward solving the world protein shortage.

The Plantmilk process is capable of a high protein extraction rate, about 80 per cent of the protein in green leaves being extracted for use in the making of the product. It is hoped to begin producing Plantmilk for sale in small quantities in the London area during the early months of 1964.

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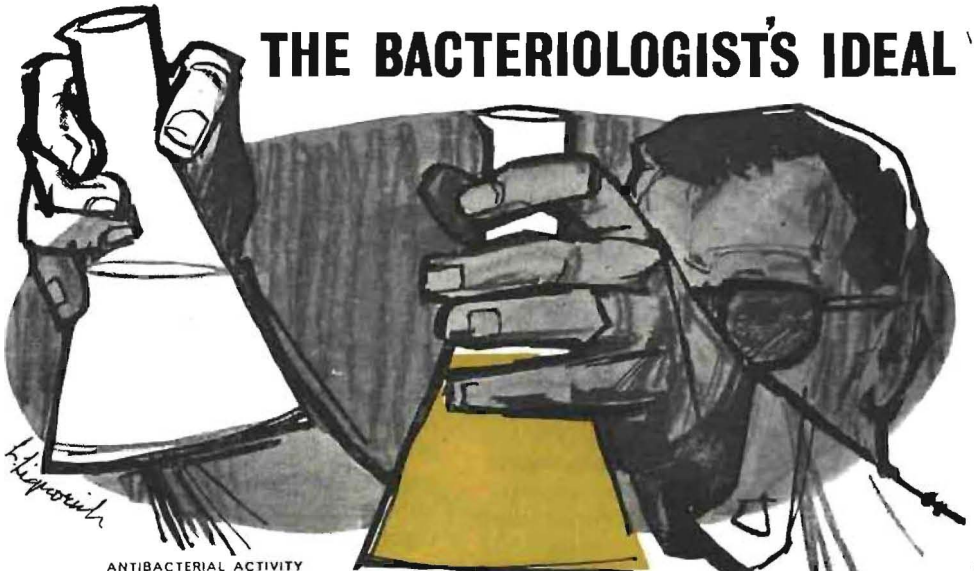

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As supplied by Dr. P. L. Uys, Municipal Veterinarian, Pretoria

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SALE BILL

Supplied by courtesy of Drs. P. L. Uys & S. V. O'Brein, Munisipal Veterinarians, Pretoria

Here is a sale-bill composed by Eoghan O'Sullivan, an eighteenth century Irish poet, which ranks as the most extravagant eulogy of a horse known, as well as being a masterpiece of alliteration.

"Saturday, the sixteenth September, seventeen and sixty-nine, will be sold or set up for for sale at Skibbereen the robust horse 'Spanker', the property of Thomas O'Donnel, Esquire.

"A strong staunch, steady, sound, stout, sinewy, safe, serviceable, strapping, supple, swift, smart, slightly, sprightly, spirited, sturdy, shining, sure-footed, sleek, smooth, spunky, well-skinned, sized and shaped, sorrell steed of superlative simmetry, styled 'Spanker', square-sided with a small star and steps singularly stately, slendershouldered and smart-sighted, free from strain, sprain, spasms, string-halt, stranguary, sciatica, staggers, scaling, sallander, surfeit, seams, scouling, strangle, strenuous swelling, soreness, scratches, splints, squint, squirt, scruff, scales, scurf, scars, scabs, scarred sores, scattering, shuffling, shambling — gait, or symptoms of sickness of any sort.

"He is neither stiff-necked, stiff-mouthed, shabby-coated, sinew-shrunk, spur-galled nor saddle-backed, shell-toothed, slimgutted, surbated, skinscabed, short-winded, splay-footed or shoulder-slipped, and is sound in the sword-point and stifle-joint, has neither sick-spleen, sleeping-evil, setfast, nor snaggle-tooth, sand-cracks, swelling-sheath, subcutaneous sores nor shattered hoofs; is not sour, sulky, slow, surly, stubborn or sullen in temper; neither shy, sly, nor skittish, slow, sluggish, nor stupid.

"He never slips, stripes, strays, stalks, starts, shy, stops, shakes, swells, snivels, snibbles, snuffles, snorts, stumbles, nor stocks in his stall or stable, and scarcely or seldom sweats; has a showy, skittish switch-tail or stern, and a sage set of shoes to stride on. He can feed on stubbles, sheaf-oats, straw, sedges, and Scotch grass; carries sixteen stone on his stroke with surpassing speed over a six-foot stone or sod wall.

"His sire was the sly, sober 'Sydus', on a sist of 'Spindle-shanks' by 'Sampson and Sporter', son of 'Sparkler', who won the Sweepstake Subscription Plate last season at Sligo. His selling price is sixty-six pounds, sixteen shillings and sixpence, sterling."

SOCIAL AND PUBLIC RELATIONS SERVICE

Dr. P. Howell of the Virology Section of the Veterinary Research Institute Oonderstepoort is spending a year at the Research Institute (Animal Virus Deseases) Pirbright, England, and at other centres.

Professor J. D. Smit, Assistant Chief, Veterinary Research Institute Oonderstepoort is on an official visit to Britain and Europe.

Dr. P. R. Mansvelt, Assistant Chief, Veterinary Field Services, Pretoria is on an official visit to Britain and Europe.

Dr. W. M. Mc Hardy of Cooper & Nephews, Johannesburg, is attending a conference in London, on behalf of his Company.

Dr. J. E. Dorrington of Bellville, Cape Town has received a grant from the University of Pretoria for research into Lungworms in dogs. We extend to him our congratulations.

Dr. D. W. Verwoerd of the Veterinary Research Institute, Onderstepoort has obtained the degree of D.Sc. at the University of Pretoria. Our congratulations and best wishes go to him.

Dr. C. H. Flight, Assistant Chief, Veterinary Field Services, Bloemfontein, is on leave prior to retirement on superannuation. He will make his home at East London. We wish him the best of health and good fortune.

Dr. Eberhard Munz of the Institute of Tropical Medicine, University of Munich, has arrived at Onderstepoort where he will spend at least a year studying animal Viruses and other tropical diseases of Animals.

Dr. A. M. Harthoorn of the Physiology Section of the Faculty of Veterinary Science, Royal College Nairobi, is spending some time at the Veterinary Research Institute, Onderstepoort.

Dr. Domes Mion of the Bologne and Milan Universities and of Elizabethville, is spending four months at the Veterinary Research Institute, Onderstepoort.

Dr. K. C. A. Schultz who has retired from the service of the Veterinary Research Institute, Onderstepoort, is now employed in the Department of Nature Conservation of the Cape Provincial Administration, at Cape Town.

He will stydy methods for the control of vermin and other types of destructive wild life.

We wish him every success in his new sphere, and hope that he and his family will continue to enjoy the best of health.

Dr. C. L. Craig, Private Veterinary Practitioner, Pretoria, was found not guilty of contravening the provisions of the Pretoria City Council's By-law for keeping more than three dogs in his Veterinary Hospital. A contribution on the keeping of dogs in the areas of local authorities in the Republic will appear in the September issue of the Journal.

BOOK NEWS

The latest new publications received include:—

VIRUSES OF VERTIBRATES, Sir Christopher Andrewes. A new book of major importance intended to provide essential information on viruses affecting man and other vertebrates. It serves three purposes, viz:

(*a*) to tell the reader what is known about a virus;

(*b*) to help him indentify an unknown virus, and

(*c*) to marshal the data on which classification of the viruses can be based. R6.95.

BAILLIERE'S VETERINARY HANDBOOK, Hendersen and Strattin. This is the latest version of Banham's Veterinary Posology which has long been one of the veterinarians' most frequently consulted handbooks, having in compact form, all the facts and figures needed in everyday practice. R2.25.

CURRENT VETERINARY THERAPY, Small Animal Practice: ed. R. W. Kirk. Written by a number of contributors, each of which is intimately conversant with his particular topic, it provides the small animal clinician with easily accessible information on the latest accepted methods of treating medical conditions encountered in a pet practice, including caged birds; 513 pages; R11.00.

YEAR BOOK OF VETERINARY MEDICINE, Vol. 1, 1963. The object of this is to give the reader better access to the large volume of world wide veterinary literature. It is divided into three Sections viz: Large animal medicine, Small animal medicine, and laboratory animal medicine. Edited by Riley, Smith and Flynn. R7.25.

GRASS TETANY, André Voisin. This has practical information for practising veterinarians and research workers. It contains a comprehensive review and bibliography of 343 references. The pathogenesis of grass tetany is fully dealt with. R5.75.

PARASITISM, J. F. A. Sprent. A new book which provides an introductory text on host-parasite relationship, it is essentially a general treatise on immunology. R2.45.

BOOK REVIEW

ANIMAL ANAESTHESIA
VOLUME I—LOCAL ANAESTHESIA

BY

MELCHIOR WESTHUES AND RUDOLF FRITSCH

Translated from German to English by A. David Weaver and published by Oliver and Boyd (1964)

223 pages with numerous drawings and illustrations

Price in London 45/-

The authors have felt that the time has come to collate and place in book form the numerous publications dealing with anaesthesia. This, the first volume, deals only with local anaesthesia, and a second volume dealing with general anaesthesia is to follow shortly.

At the back of Volume I is listed some thirteen pages of bibliographical references in closely printed presentation which bears out their contention. In the foreword they point out that they have limited the field of local anaesthesia to those techniques in which they have had personal experience, and have omitted techniques for which they can see no practical application.

Although Part I covers the general principles of local anaesthesia, the major portion of the book is given to the techniques of local anaesthesia (Part 2), and covers in excellent detail terminal, regional, paravertebral, and spinal anaesthesia with a chapter on blocking of peripheral sympathetic nerve trunks. Each injection is carefully described giving a description of the anatomy with shaded drawings and diagrams for each of the domestic animals. Attention is also paid to the length, gauge, and shape of the needle, and the percentage and quantity of the local anaesthetic of choice. The difficulties in making these injections have not been overlooked and the snags are frankly discussed.

One small weakness must, however, be pointed out. On page seven the indications for the use of local anaesthesia listed for the dog are:—"Extraction and filling of teeth; entropion and ectropion; treatment of corneal abrasions and lens extractions; . . . . ". Although it has been emphasised that each case should be treated on its merits, and that pre-medication with sedatives should be the usual adjunct of local anaesthesia, these surgical interferences where delicacy is required should rather be done on the unconscious patient. Also are there many cases of dental caries requiring the dreaded drill?

The student, lecturer, practitioner, and research worker can all benefit from this book. The format and layout is good, the style easy to follow, and all in all it is good value for money.

J.L.D.

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"METABOLIC DISORDERS OF DOMESTIC ANIMALS"

By D. E. Stevenson and A. A. Wilson

Blackwell Scientific Publications, Oxford

(1963) p.p. 195. Price 35/-

This is a disappointing book. From the title one expects a collation of the present knowledge on those conditions generally classified as "metabolic disorders" including experimental findings with regard to the various species of domestic animals and to breeds within those species. In fact, too much of the text is taken up with recapitulations of subject matter which is available in numerous standard text books. For instance, nine pages are taken up on a discussion of acid-base balance of which less than two are devoted to clinical aspects and even here no reference is made to specific conditions in domestic animals as such. Another difficulty is the definition of "metabolic disorders". In this book five pages are devoted to the various types of nephritis, an aspect fully dealt with in books on veterinary medicine, while photosensitivity is not included.

The book is also badly balanced, 25 per cent of the text being devoted to calcium, magnesium and phosphate metabolism but hypophosphorosis is dismissed in one paragraph.

The book also contains numerous omissions and doubtful statements. For instance, two obvious mathematical errors occur on page 12. Milk fever is defined as a "tetany syndrome", yet typical tetany rarely occurs in this condition. In discussing renal oedema no mention is made of the possibility of plasma protein loss. Ketonaemia and fatty liver are stated not to occur in non-pregnant, non-lactating ruminants. Such conditions are by no means rare. Urobilinogen is said to be further oxidised to stercobilinogen, "the dark pigment found in faeces". The two are probably chemically identical and both are colourless.

A list of references appears at the end of each chapter, but the sources of many assertions are not indicated.

R.C.

EAST AFRICAN WILDLIFE JOURNAL VOL. I

Published by the East African Wildlife Society,

P.O. Box 20110, Nairobi, Kenya

Pages 131—Illustrations & Photos 24—Sketches 15—Graphs 11

Annual Subscription 15/- in East Africa—17/6 elsewhere

This journal first appeared in August 1963. The next issue is due in August 1964. An interesting foreword by Elspeth Huxley on the task of the relatively new science, Wildlife Management, to preserve indigenous fauna and flora and to adapt their maintainance to present day circumstances, is a realistic appreciation of the need for specialization in this most important new science.

The publication contains eight articles and ten Research Notes, all of which are well presented. An interesting article by H. P. Ledger, Animal Husbandry Research Unit, describes a standardised technique for the comparison of the body and carcase composition of East Africa's wild and domestic ruminants, in an attempt to evaluate the meat production potential of East African ruminants in its relation to the overall problem of land use.

The Elephant problem at Tsavo, by J. Glover, East African Agriculture and Forestry Research Station, Muguga, is an article which will be found informative for those whose task it is to prevent overpopulation of this class of wildlife. This article is augmented by one presented by P. Napier of the Department of Veterinary Services and D. L. W. Sheldrick of the Tsavo Royal National Park, in which the difficulties of preserving food for other game species, in areas inhabited by elephant, is very aptly discussed and illustrated.

An interesting article on the Black Rhinoceros by A. T. A. Ritchie gives considerable detail about the features of this species of game and its conservation in East Africa.

Another interesting and well presented article is one by H. F. Lamprey of the Tanganyika Game Division, on the ecological separation of 14 common ungulate species living in close contact with each other.

The other articles contained in the publication are equally informative. There seems little doubt that the Editorial Committee of the East African Wild Life Society has been selective in the presentation of contributions for publication in their journal.

The Research Notes form a worthy place in this journal, which is designed to promote the Science of Wildlife Management. A hitherto undescribed species of Babesia, not yet named, and suspected of being associated with illness in an elephant, is referred to.

There seems little doubt that the Journal of the East African Wildlife Society will be a popular publication for all who have to do with wild life conservation and the development of the Science of Wild Life Management.

The publication is attractively bound in a hard cover, well printed and illustrated on good paper and can be confidently recommended to all who are interested in Wild Life Conservation.

A. M. D.

A MEMOIR

DR. REINHOLD JOHANNES ORTLEPP

The death of Dr. R. J. Otlepp, an Honorary Associate Member of the South African Veterinary Medical Association since 1951, took place at his home on 12th April, 1964.

Born on 10th May, 1894 in Melmoth, Zululand, this eminent scientist has enjoyed an international reputation in his chosen field of helminthology with some 70 publications to his credit.

Having matriculated at the Maritzburg College in 1911, he entered the Natal University College in 1912, but continued his university training the ensuing year at the Victoria College in Stellenbosch and acquired his B.A. degree with distinction at the University of the Cape of Good Hope, as a result of which he was awarded the Queen Victoria bursary. He completed his M.Sc in 1917, majoring in Zoology. In 1923 he acquired the Ph.D degree in Zoology (Helminthology) under Prof. R. T. Leiper at the University of London, where he worked in the Institute of Agricultural Parasitology and was awarded the D.Sc. degree in 1936 by this University.

During the course of his scientific career Dr. Ortlepp has held positions in many universities and research institutes. Thus, from 1918 to 1919 he was a lecturer in Zoology at the University of the Witwatersrand. In 1920 he was acting professor of Zoology at Rhodes University, Grahamstown. He spent the years 1921 until the end of 1927 in Europe, where, for six years, he occupied the position of research worker at the Institute of Agricultural Parasitology and was appointed as honorary helminthologist to the Zoological Society of London. During this period many of his vacations were spent in work at different research institutes, e.g. with Prof. O. Fuhrmann at the University of Neuchatel; in the Natür Historische Staatsmuseum, Vienna and the Marine Biological Station in Napels.

Dr. Ortlepp has been a member of the S.A. Association for the Advancement of Science since 1931, was a member of the Executive Committee and acted as President of Section D in 1943. He was a foundation member of the Suid-Afrikaanse Akademie vir Wetenskap en Kuns, receiving the Havenga Prize for Biology from this body in 1948; the Scientific Advisory Board of National Parks and the Fauna and Flora Advisory Council of the Transvaal. He was also a member of the Bilharzia Research Committee of the Council of Scientific and Industrial Research until its dissolution in 1962. From 1936 he was a member of the S.A. Biological Society and served as President in 1940. He was awarded the Senior Captain Scott Medal by this Society in 1962.

Dr. Ortlepp has displayed an extremely wide range of interests outside those of pure science as is evidenced by his having been a member of the Board of Control of the Pretoria North High School, where he served for three years as

chairman. He was also a member of the Scientific Section of the National Advisory Board of Education. From 1929 to 1931 he was a member of the Executive Committee of the Natal Agricultural Union, serving as President of this body in 1931. From 1950 until the time of his death, Dr. Ortlepp was a member of the Executive Committee of the Northern Transvaal Rugby Union and from 1950-1960 he acted as Commandant of the Wonderboom Rifle Association.

His scientific achievements have been outstanding and his publications cover taxonomic descriptions and life history studies within a compass of over 100 genera including the *Trematoda, Cestoda* and *Nematoda.* In his latter years he interested himself considerably in the internal parasites of wild life, particularly since his retirement in 1954; he accepted temporary employment and had eleven publications to his credit within this period.

The knowledge acquired during a lifetime of dedicated endeavour in the helminthological field will be sorely missed but the extensive library acquired by Dr. Ortlepp and bequeathed to the Section of Helminthology, Onderstepoort Institute of Veterinary Research, will be of inestimable value and serve as a lasting tribute to a good friend and counsellor, and worker of exceptional merit.

The Association wishes to extend its condolences to the family and expresses its gratitude for the results of many years of scientific achievement which it has enjoyed and from which its members will benefit.

R. du T.

LETTERS TO THE EDITOR

Reprinted from THE VETERINARY RECORD, DECEMBER 7th, 1963. Vol. 75. No. 49. P. 1,344, by courtesy of the British Veterinary Association and The Cooper Technical Bureau, Berkhamsted, Herts, England

VITAMIN A STATUS OF YOUNG BEEF CATTLE

SIR,—The Rowett Research Institute's method for feeding young cattle a ration without roughage, such as hay, is now frequently applied on farms and good growth is obtained. Occasionally, however, problems arise and one of these is the appearance of blindness in some animals. This has stimulated speculation about the usual witamin A status of beef cattle fed on such rations. Our limited observations on the vitamin A content of the livers from animals which were not blind may therefore be of interest.

Through the courtesy of the Director of Gleadthorpe Experimental Husbandry Farm we obtained samples of liver from animals of similar live-weight in a controlled feeding trial. In this, 10 animals were fed meal only according to the Rowett system and five animals were fed limited amounts of the same meal plus dried sugar-beet pulp and hay. The hay formed about one-third of the total dry-matter intake. Vitamin A was included in the Rowett-type meal at 4,000,000 International Units per ton.

A few samples of sugar-beet pulp and hay were obtained for carotene estimations, and the vitamin A contents of samples of the meal were also checked. From the results obtained it was possible to calculate the total amount of vitamin A activity consumed by each group and, from this, the average consumption by individual animals. This information is summarised in Table I. It has been assumed that the carotene of the sugar-beet pulp and of the hay was equally utilised by the animals, and that 1 mg. gave 400 I.U. vitamin A activity.

On this basis the individual intakes of vitamin activity were lowest in Group 2 which was fed the meal, hay and sugar-beet pulp.

TABLE I
SUMMARY OF TRIAL

Group	Feed Period (Days)	No. of animals	Vitamin A consumed 10^6 I.U.	
1. Rowett meal	264	8	8.78	
	301	2	9.00	
2. Rowett meal.. +hay .. +sugar beet.. pulp ..	301	5	2.07 4.38 0.16	6.61

Transverse slices of liver weighing about ¼ lb. were obtained from the cattle at slaughter. These slices were finely chopped and duplicate samples taken for the estimation of vitamin A by saponification followed by the Carr-Price colorimetric procedure. The average result for each animal and the group means are given in Table II.

TABLE II
VITAMIN A CONTENTS OF WET LIVERS
(INTERNATIONAL UNITS PER G.)

Group	Individual animals	Group Mean
1. Rowett meal (264 days)	16.3 12.7 13.9 2.0 48.3 13.8 21.1 28.5	
Rowett meal (301 days)	33.4 10.9	20.1
2. Rowett meal +hay +sugar beet pulp (301 days)	36.5 35.0 39.6 56.3 39.2	41.3

The mean vitamin A concentration was appreciably lower and the individual results more variable when no roughage was fed. Moreover, this reduction in storage was not simply a function of the feeding period and vitamin intake, since the 2 animals which were fed Rowett-type

meals for the same length of time as those receiving hay (301 days) also had lower reserves.

In spite of the limited nature of these observations, and the errors which could arise in calculating the individual intakes of vitamin A activity, the indications are that the absence of roughage, as in the Rowett feeding system, leads to a lower vitamin A status in young beef cattle which cannot be correlated with a lower intake. This tentative conclusion supports the report by Hale (1962) that increasing the concentrate proportion of the diet depletes liver reserves.

Nevertheless, until there is further information, our observations are merely guides for future investigations and it would be unwise to speculate on possible causes, such as dietary inhibitions analagous to the nitrate problem in the U.S.A., or possible pre-intestinal destruction as postulated under certain conditions by Klatte (1963).

We are continuing our work on this problem and would be interested in co-operating with any of your readers, in the field, and in controlled experiments.

September 17*th*, 1963.

Yours faithfully,
W. H. BEAUMONT,
W. H. PARR.

REFERENCES

HALE, W. H. & HUBERT, F. (1962). *Feedstuffs.* **34** (22). 38.
KLATTIE, F. J., HUBER, T. L., LITTLE, C. O., & MITCHELL, G. E. (1963). *Ibid.* **35** (18). 28.

Die Redakteur,

J.S. Afr. vet. med. Ver.

Geagte Redakteur,

FILARIA-DERMATITIS VAN SKAPE

In "Sheep Diseases" deur Newsam (1952) (Williams & Wilkins) word 'n velsiekte van skape genoem "Blood worm, Filarial Dermatitis or Sorehead", beskrywe. 'n Toestand wat presies daarmee ooreenstem word dikwels in die distrik Malmesbury, veral in die sandveldarea langs die kus, gesien. Verwysing na, of beskrywing van, die siekte is nog nie in Suid-Afrikaanse literatuur gesien nie en word ook nie in "Veterinary Helminthology en Entomology" (1934) van Mönnig genoem nie.

Die siekte is deur Kempe beskrywe en in New Mexico, Colorado en Arizona gesien, word veroorsaak deur 'n wurmparasiet van die Filariafamilie en waarvoor die naam *Elaeophora schneideri* voorgestel is. Dit kom in die vel en bloestroom voor.

Die vernaamste teken van die siekte is 'n groot, korsagtige, rou seer, wat hoofsaaklik op die voorkop van skape, veral tussen die horings, ontwikkel; maar ook verder tot die oog en bekdele kan versprei. Daar is 'n kwaai gejuk en aangetaste diere krap die letsel baie met hul agterpote. Gewoonlik word nie meer as 2–5 per sent van die diere in 'n trop aangetas nie. Hulle genees nie vanself nie en gewone middels wat deur boere gebruik word, help niks nie.

Die siekte moet onderskei word van die sogenaamde "Harvest Mite" infeksie wat ook dikwels in hierdie area voorkom en maklik deur bv. BHC genees kan word.

Volgens Kempe is Fuadin inspuitings die enigste behandeling wat hy doeltreffend gevind het. Methyridine is ook baie doeltreffend en is een inspuiting van 5 ml 90 persent oplossing gewoonlik voldoende om die siekte te genees.

J. M. FOURIE.

Arcadiastraat,

MALMESBURY.

13 April 1964.

(Dit word betwyfel of hierdie parasiet wel *Elaeophora schneideri* is. Indien wel parasiete van hierdie aard waargeneem is, sal die seksie Helminthologie, Navorsingsinstituut vir Veeartsenykunde, Onderstepoort graag sodanige materiaal wil ontvang. Die enigste spesie van hierdie genus nl. *E. poeli*, bekend in Afrika, is gevind in die Belgiese Kongo uit beeste met 'n verspreiding na Maleia en Indië waar dit algemeen voorkom in die buffel, maar selde in beeste—Redakteur).

THE BOURGELAT MEDAL.

The Publishers of THE JOURNAL OF SMALL ANIMAL PRACTICE, Pergamon Press Limited, have generously provided the funds for the institution and award, from time to time, of a Medal. This Medal, which will be known as the BOURGELAT Medal, is to be given for outstanding contributions to the field of small animal practice, and has a value of 50 guineas. It is hoped that the first award of this Medal will be made at the end of 1964.

Conditions of award:

1. The BOURGELAT Medal will be awarded for really outstanding contributions to the field of small animal practice made by veterinary surgeons or other scientists in any area of research endeavour.
2. Any outstanding paper or papers contributed to THE JOURNAL OF SMALL ANIMAL PRACTICE will automatically be considered for the Medal. Other work may be proposed by anyone to the Editors for consideration, the proposal to be accompanied by a supporting citation indicating the grounds for the nomination. The award will not be confined to current work, but may be made for work already completed which has since been recognised as outstanding.
3. The Medal will only be awarded on the unanimous recommendation of a committee composed of the Executive Editor, the Editors, and such other members of the Consultant Editorial Board as may be present at the time of meeting. Although normally the BOURGELAT Medal will not be awarded more frequently than once in each year, no attempt will be made to award it at fixed intervals.

Further information is available from Prof. C. F. B. Hofmeyr, Department of Surgery, Faculty of Veterinary Science, Onderstepoort.

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PROFESSIONAL PROVIDENT SOCIETY OF SOUTH AFRICA

ANNUAL REPORT AND ACCOUNTS FOR 1963

PROFESSIONAL PROVIDENT SOCIETY OF SOUTH AFRICA

It is apparent from the recently published annual report and accounts of the Professional Provident Society of South Africa, that this professional undertaking sponsored by the associated professional organizations is providing an ever increasing measure of security for the members of these organizations.

In the past year direct benefits paid to members or their dependants totalled R178,000. This consisted of R61,750 in sick pay and permananet incapacity benefits; R21,465 in aid to members in paying hospital expenses incurred by their families; approximately R38,000 in cash benefits to retiring and resigning members and some R57,000 in death claims under the Group Life Assurance Scheme. In addition members' apportionment accounts were credited with interest at 6.38 per cent totalling R140,291 and dividends being the allocation of excess of revenue over expenditure, amounting to R502,368. The rate of dividend allocation was R3.20 per share for the year compared with the average Subscription rate of R3.60 per share per annum. The average cost to members of the maximum of R75 per sick pay cover was therefore only R24 for the year while to members paying the lowest subscription rate of R3.24 per share per annum, the cost of this cover is less than R3 for the entire year. It is obvious from these returns that the younger members obtain their very important cover against loss of income due to illness at negligible cost. and that professional people eligible to join the Society should do this at the youngest possible age.

The report reflects the steady and satisfactory growth and very sound financial position of this remarkable Society. Subscription income for the year increased by over R69,000 to R570,000 while investment income rose by R46,000 to R190,000. In additon contributions to its supplementary Group Life Assurance, Hospital and Retirement Annuity schemes amounted to over R555,000. Its assets increased by the record figure of R853,233 and totalled R3,645,702 at 31st December, 1963.

The funds of the Society are invested in a well spread portfolio of firstclass stocks which at the end of 1963 had a market value some R610,000 in excess of the book value. A substantial investment reserve of very nearly R250,000 has been built up. This reserve has been created from profits realized on investments and the increase in value of the growth-producing equity stocks acquired since the Society entered the investment field some three years ago. The reserve also serves the purpose of ensuring that members' interest in the funds are to some extent protected against the constant erosion in the value of money as on retirement or in the event of prior death, they are entitled to participate in this reserve, at the present time to the extent of an amount equal to 7.8 per cent of the balance standing to the credit of their apportionment accounts.

The Society which took a leading part in obtaining the income tax concession which made pension provisions for self-employed persons most attractive, has now modified its original Retirement Annuity (Pension) Fund established in 1960, by incorporating policies providing life assurance cover and pension disability benefits.

The revised scheme which is entirely competitive is designed to meet every possible individual need and combined with the other schemes offered by the Society goes a long way towards achieving a comprehensive social security plan.

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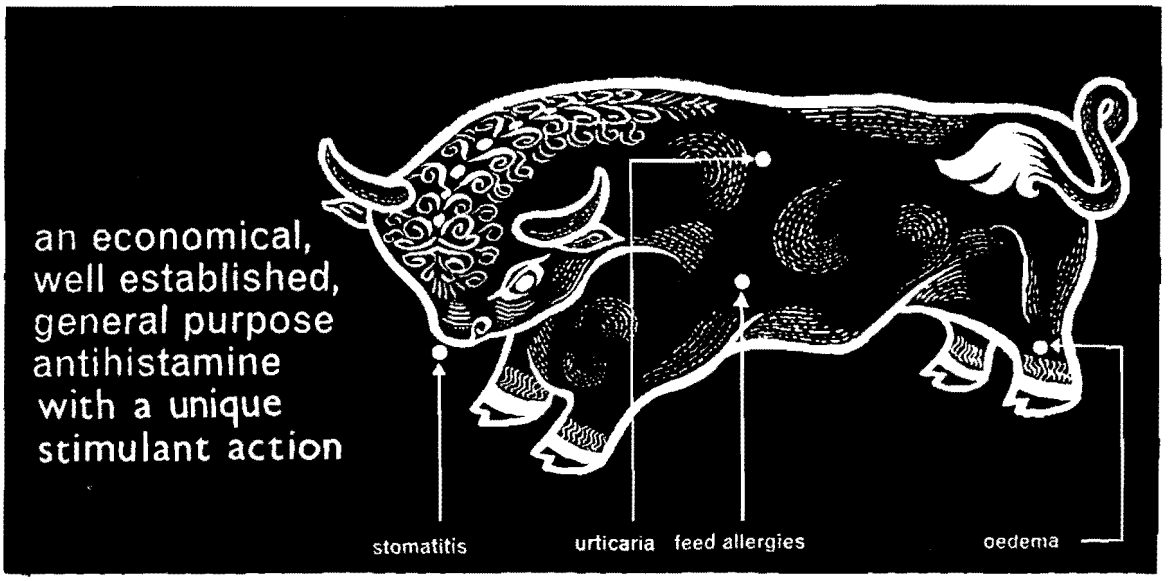

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Vyf-en-twintig tot dertig Beurse word beskikbaar gestel aan blywende inwoners van die Republiek en Suid-Wes-Afrika vir nagraadse en professionele studie gedurende die akademiese jaar wat gedurende 1965 begin.

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