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A COMPARATIVE STUDY OF ARSENITE OF SODA, BENZINE HEXACHLORIDE, DDT, TOXAPHENE AND COMBINATIONS OF THESE IN THE CONTROL OF TICKS

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Since the introduction of dipping of cattle as a means of controlling ticks just after the start of the century, arsenite of soda has been almost exclusively used.

That it did its work well, there is no question. Areas previously unsuitable for stock owing to the tick menace were rendered comparatively safe, and East Coast Fever was kept well in check in most infected areas, while in others complete eradication was effected.

Then came the forties when arsenite of soda fell from grace owing to its inability to control a resistant variety of Boophilus decoloratus (the Blue tick), and the search for other preparations began.

Bekker was the first to find in the field that the addition of nicotine to arsenite of soda solutions gave a good control of the arsenic resistant Blue tick, but owing to the fact that nicotine was almost impossible to obtain in satisfactory quantities, its use was impracticable.

Later Thorburn, Whitnall and Bekker began independent work on benzine hexachloride (B.H.C.) and D.D.T. and it was found that formulations of these two preparations effectively controlled the arsenic resistant Blue tick, and in 1947 the Veterinary Department, in a Government notice valid for one year, allowed the use of B.H.C. and D.D.T. either separately or in conjunction with arsenite of soda.

At the same time, veterinary officers were instructed to select farms controlled by reliable owners and closely observe the effects of these new dips when left in the hands of the farming public.

Accordingly the necessary farms were selected and on one of these, the farm 'Mistley', where the dipping tank had been freshly filled and a B.H.C. suspension dip was being used at .01% gamma, the Blue tick infestation grew steadily worse despite the fact that the dip strength was well maintained, and controlled by chemical tests.

It was first thought that the dip was at fault and a report was made to another worker, Thorburn, who immediately suspected the presence of a B.H.C. resistant tick. Subsequently laboratory tests by Whitnall et al. showed this to be the case. Later, field work confirmed these laboratory findings.

Thereafter, this B.H.C. resistant Blue tick made its appear-

ance throughout the East London area and was later reported in Bathurst and Natal.

And now, before going on to some of the experiments carried out, it is necessary to give some idea of the methods used for the assessment of tick infestation, as it was felt that some standard method, not based on mere judgment, should be used throughout these experiments.

In the case of the Blue tick, the neck of an experimental beast was divided by an imaginary vertical line into four areas — Right front, right back, left front and left back. These areas were scraped in turn on consecutive weeks with a curved grapefruit knife and the scraped off material was caught in a special funnel with one flat side and corked at the bottom. Throughout these experiments five head of cattle were used in each similarly treated group and the same part of the neck of each member of the group was scraped 30 times. The contents of the funnel were then thoroughly washed out into a small jar with 40% alcohol. Later, on return to the laboratory, the contents of the jar were passed through an organdie square and the larvae, nymphs, males and females of the Blue tick remaining on the organdie were counted separately and recorded. The state of engorgement of each stage was also recorded.

In the case of Amblyomma hebraeum (Bont tick), the experimental animals were thrown and an individual count of female Bont ticks made. The sum total for the group was recorded together with the state of engorgement.

Rhipicephalus appendiculatus (Brown tick) and Rhipicephalus evertsi (Red tick) are often too numerous to be counted individually so assessments had to be made — in the ears in the case of the Brown tick and under the tail in the case of Red ticks.

0 was recorded where no ticks were found;
1 for up to 10 ticks;
2 for 10 to 30 ticks;
3 for a fairly heavy infestation;
4 for a heavy infestation;
5 for a very heavy infestation.

The sum total for these figures for the group, i.e. 10 ears in the case of the Brown tick and 5 tails in the case of the Red tick, were recorded together with the state of engorgement.

For comparative purposes, and in order to obtain as much information as quickly as possible, more than one group of five head was treated concurrently on each experimental farm. That is, one dipped group, 0, 1, 2 or 3 sprayed groups and an untreated control group.

In the case of the sprayed groups the spraying was done with a good hand spray pump, but it was not intended to study spraying technique and effects but rather to simulate dipping by thoroughly wetting the animal — about 3 gallons of fluid per animal were necessary for this purpose. In this way the effects

of washes in the dipping tank and sprays could be compared.

Now reverting back to the farm 'Mistley', it must be explained that only Blue ticks were studied. Here it was found that different proprietary preparations of B.H.C., either in suspension or in emulsion, failed to give complete control even at strengths up to 0.1% gamma.

At the same time, D.D.T. in emulsion plus .04% arsenite of soda as a stabiliser gave control at 0.1% para para, but this strength did allow a very slight development of the Blue tick and must be regarded as sub-minimum. The minimum effective strength was later found to be 0.1% para para initial filling of the tank and 0.2% para para replenishments, giving eventually a tank strength constant of approximately 0.14% para para.

While the 'Mistley' experiment was in progress, it was decided to study the effect of B.H.C. as compared with arsenic on the Bont and Brown ticks and at the same time to ascertain whether the addition of arsenite of soda to B.H.C. suspension was necessary or not.

Therefore three farms with adequate infestation of these ticks were selected, and the dipping tanks were filled as follows :

Thornvlei — .02% gamma B.H.C. suspension + .16% arsenite of soda.

Ridge Valley — .02% gamma B.H.C. suspension.

Bridge View — .16% arsenite of soda.

The results showed that B.H.C. suspension alone was superior to arsenite of soda and furthermore the addition of arsenite of soda did not enhance the effect of B.H.C. Rather did it appear to detract from its value and this may be due to the fact that arsenite of soda tends to encourage Bont ticks to pack in clusters in which form they appear to withstand insecticides better.

The same phenomenon in regard to Brown ticks was noted in other experiments. Whenever a heavy infestation of Brown ticks was encountered, that is where they were packed on the ears, even the most efficient dips failed to control them until three or four dippings had been given.

In the past, it has always been said that arsenite of soda owes much of its success to a sterilising effect on the female tick. In vitro work definitely indicates this effect. But in the experiment carried out on the farm 'Bridge View' where for a full year continuous weekly dipping was carried out, there was no decrease in the veld infestation of Bont ticks and Brown ticks up to two years after the start of the experiment.

Another question that veterinarians were asking themselves was whether it was necessary to add arsenite of soda to a tank containing D.D.T. E 20 emulsion, and it was decided to check up on this.

The two farms 'Thornvlei' and 'Dew Point' which showed similar infestations of Bont, Brown and Red ticks, were selected and both dipping tanks were filled with E20 D.D.T. emulsion dip

at the rate of 1 gallon to 200 gallons at the initial filling and 1 gallon to 100 gallons for all replenishments. Arsenite of soda at .16% strength was also maintained in the 'Thornvlei' tank.

The arsenite–D.D.T. emulsion wash showed the better control throughout. Where the emulsion was used alone, the control of Bont, Brown and Red ticks appeared to become progressively worse until a state of almost free engorgement of Brown ticks in the ears and Red and Bont ticks under the tails was taking place. The bodies, however, were free from ticks.

Approximately two months from the start of the experiment the emulsion in the 'Dew Point' tank showed signs of breaking down and samples taken and left to stand showed very obvious sedimentation of D.D.T. This was not the case in the 'Thornvlei' tank, where the D.D.T. arsenic mixture was used.

How far the failure of the E20 Emulsion to control Bont, Brown and Red ticks was due to a break in the emulsion or to the fact that (as will be discussed later), D.D.T. in suspension at this strength is not satisfactory for the control of these ticks, is not known, but it can definitely be concluded that the addition of arsenite of soda to D.D.T. E20 emulsion dip is very necessary for the control of Bont, Brown and Red ticks.

With regard to D.D.T. suspension, tests were carried out on the farm 'Three Silos' where a fair infestation of the B.H.C. resistant Blue tick had been encountered, but where previously sustained dipping in B.H.C. at strengths in excess of 0.02% gamma had almost eradicated the Bont tick and had considerably reduced the Brown and Red tick infestation.

The dipping tank was filled with D.D.T. to give a suspension of .225% p.p. and concurrently .15% p.p., .225% p.p. and .3% p.p. spray groups were treated.

The results showed that complete control of Blue ticks was given by all except in the case of the dipped group when the tank strength fell to below .15% p.p. owing to sedimentation and ineffective agitation due to the small number of cattle being dipped (65 head in a 2,760 gal. tank). As the weeks progressed, however, it was noted that while the Blue ticks were under control, the Brown and Red tick infestations increased and these ticks engorged fairly freely even in the .3% p.p. spray group.

This experiment started at the end of January, 1950, when Brown tick activity had reached its height in the district, so that one cannot regard D.D.T. suspension dip as efficient for the control of Brown and Red ticks at strengths up to .3% p.p.

While on the subject of D.D.T. suspension dip it might be as well to refer to an experiment on the farm 'Needs Camp', where .5% p.p. D.D.T. suspension was used.

On this farm, a heavy Bont tick and light Brown tick and Red tick infestations were present. Here, while the control of Bont, Brown and Red ticks was fairly good, it did not show up as well as B.H.C. suspension at .02% gamma had done in the case of

these ticks on other experimental farms. The Blue tick control, however, was excellent. Bearing in mind therefore the expense of D.D.T. wettable powder and the large quantities required to maintain a .5% p.p. strength, dipping in such a strength cannot be recommended.

From the foregoing, it will be noted that B.H.C. at .02% gamma is effective against all our species of ticks of economic importance except the resistant Blue tick, while D.D.T. is effective at strengths in excess of .15% in the case of suspensions and approximately .14% in the case of emulsions against all Blue ticks, but inadequate for the control of Bont, Brown and Red ticks.

It therefore follows that a combination of these two dips at adequate strengths would be the answer to the control of all ticks.

Such combinations have been used in four tanks and the results have been more than satisfactory. It was expected to control all ticks with the combination dip but the degree of efficiency was higher than anticipated. It is felt that this is due to a synergistic action. In the United States this action has also been noted but there it has been referred to as an "Additive" effect.

The strengths used in the East London area were .02% g. B.H.C., 0.225% p.p. D.D.T., .02% g. B.H.C. and .3% p.p. D.D.T. The former was effected by adding correct quantities of B.H.C. and D.D.T. wettable powders separately to the tank while the latter combination was specially mixed and packed at the factory. In any event, both have given equally satisfactory results.

So much for B.H.C. and D.D.T. for the moment. Now what of Toxaphene ?

Since December 1949, experiments have been carried out with various formulations of Chlorinated Camphene — the chemical name for Toxaphene. While at the start a wettable powder from the United States was tested, more recently an emulsion and powders made in the Union have been tried.

At the outset, it was obvious that in chlorinated camphene we had a highly efficient tickicide, and as time went on the following conclusions were arrived at :

(1) That for Bont tick control, chlorinated camphene must be regarded as the dip of choice. Its action in this respect is miraculous.

(2) For the Brown and Red tick control, chlorinated camphene is as good as B.H.C. at effective strengths.

(3) For Blue tick control, chlorinated camphene, while at first giving a good control, later proved to be inefficient for the control of the B.H.C. resistant Blue tick. With the better preparations, only a few Blue ticks managed to reach the engorged adult stage mainly on the underline, but this very definitely indicates the possibility of the Blue tick eventually reacting to chlorinated camphene in the same way as it did to B.H.C.

(4) The minimum effective strength for Blue tick control at the start of the experiment was .2% but for the control of the other ticks lower strengths were effective.

Throughout these experiments, observations on the possibility of increasing the dipping interval to 14 days to maintain efficient tick control have been carried out. Dip strengths have been increased, stickers have been added and other substances to increase the residual effect of the insecticides, but it is regretted that efficient control at 14 day dipping or spraying intervals has not been effected, especially in the case of the Brown and Red ticks.

Even during seven-day treatments and using the best insecticides at adequate strengths, it was not possible to obtain an absolute control of the Brown tick during the hot humid period from December to March, when the engorgement period of these ticks is probably extremely short.

With regard to the Red tick, even when using the best preparations at adequate strengths at seven-day dipping interval engorgement will occur occasionally. This is most probably due to the fact that although the dip comes in contact with the ticks, its action is minimised, due partly to the oily nature of the predilection site and partly to the dilution and washoff of the dip by urine and faeces.

Arising out of the foregoing, comes the question of whether the clipping of brushes and ears and handdressing of the ears and tails are necessary for efficient Brown and Red tick control.

Definitely the clipping of brushes and ears is not necessary. Throughout the experiments, when the dipping interval and type and strength of dipping material were adequate, good control of Brown ticks in unclipped ears and tails was maintained.

With regard to handdressing, in view of the short engorgement period of the Brown tick during the hot humid months from December to March, a seven-day dipping interval is too long for satisfactory control, and handdressing is essential for absolute control. For the remainder of the year, however, good control is effected without handdressing.

Regarding the control of Red ticks in the anal region, handdressing is always essential for their complete control in that part.

Of course the remarks concerning the handdressing of the ears are dependent upon a thorough wetting of the ears during the plunge into the dipping tank.

And now let us consider what constitutes a suitable dipping tank when using the newer and more expensive dips.

The emphasis, it is felt, should be on a good plunge, ensuring a thorough wetting of the head and ears, rather than a long swim. With a view to improving the plunge it is suggested that the entrance to the tank should slant down at a gradient of 1 in 3 to the edge, with good kick plates on this slope. The water level should be about 9 inches below the edge of the take off, and the depth at

least 7 feet at that point for a distance of 14 feet. Three tanks with entrances built on these lines have been in constant use during the experiments, and careful observations show that this type of entrance resulted in splendid plunging with thorough wetting of the heads.

Then again, with the use of these new dips, smaller dipping tanks appear to be more suitable than the larger ones. The reason for this is firstly that with more frequent replenishments, the proportion of fresh insecticide added will be greater and more beneficial, and secondly, bearing in mind the extremely high cost of the new dips, the initial cost of filling a tank will be less damaging to the pocket of the farmer.

It is felt that something should be said about the loss of biological activity of these newer insecticides. As far as B.H.C. suspension is concerned, there is definitely a loss of efficiency. This is fairly rapid but when strengths in excess of .02% gamma are used, the dip will still be effective for all practical purposes up to 12 months.

Toxaphene when used in wettable powder form at .2% gave very definite indications of having lost efficiency after being in the tank a year.

No loss of biological efficiency as far as D.D.T. is concerned has been definitely established but it is felt that there is no reason why in wettable powder form D.D.T. should not act in the same way as the other wettable powders.

Under the circumstances, it is recommended that where these new insecticides are used, the dipping tanks should be cleaned out and refilled at least every 12 months.

Most of the wettable powders registered to-day give a very fine suspension, but insufficient stirring up of the tank by the cattle passing through has been noted on several occasions, especially when small numbers of cattle are dipped at a tank. Therefore plunging is recommended in all tanks containing wettable powders before dipping operations. To splash the wash in the upper half of the tank is superfluous. Deep plunging at the bottom of the tank with a heavy metal plunger is required to bring all the powder into suspension.

Finally it is felt that some practical advice should be given with regard to the use of these new insecticides in the control of ticks.

First of all it must be remembered that D.D.T. is the only insecticide so far used, apart from nicotine, that will control the B.H.C. resistant Blue tick. The use of nicotine, as has already been stated, is at present impracticable, so that wherever this tick is present, D.D.T. must be used.

At the same time, D.D.T. has been shown to be unsatisfactory for the control of Bont, Brown and Red ticks so that it cannot be used alone but always in combination with one of the other dips.

Therefore the following dips may be used under the following circumstances :—

(1) Where no arsenic resistant Blue tick exists:
   (a) Arsenite of soda .16%;
   (b) Arsenite of soda .16% plus .1% p.p. D.D.T. emulsion with replenishments at double rates or 0.2% p.p. D.D.T. wettable powder with replenishments at 0.3% p.p.;
   (c) B.H.C. at 0.03% gamma W.P. or emulsion;
   (d) B.H.C. at 0.03% gamma W.P. or emulsion plus 0.2% p.p. D.D.T. W.P.;
   (e) Toxaphene 0.25% W.P. or emulsion with replenishments at 0.375%;
   (f) Toxaphene 0.25% W.P. or emulsion with replenishments at 0.375% plus D.D.T. W.P. .2% p.p.

(2) Where an arsenic resistant tick is present, all the foregoing except arsenic may be used.

(3) Where an arsenic and B.H.C. resistant tick is present, all the foregoing except arsenic and B.H.C. should be used.

(4) Where an arsenic and B.H.C. and Toxaphene resistant tick is present, all the foregoing except arsenic, B.H.C. and Toxaphene can be used.

This will mean that when a man has arsenic in his tank but fails to kill the Blue tick, he can either add D.D.T. or B.H.C. but in any event, it would be advisable to clean the tank out first and then add arsenic and D.D.T. mixture or B.H.C.

If a man with B.H.C. in his tank should fail to control his Blue ticks, then D.D.T. should be added to the tank. If the B.H.C. has been in his tank for, say, 6 months or more, it would be advisable to clean the tank out and start with a fresh B.H.C.–D.D.T. mixture.

In the event of a man finding he cannot control the Blue tick with Toxaphene in his tank, he should add D.D.T. or change to the Arsenic–D.D.T. mixture or B.H.C.–D.D.T. mixture.

Where Bont ticks are the main source of worry, Toxaphene is the dip of choice. Where Brown ticks are the main trouble B.H.C. or Toxaphene is recommended.

HEARTWATER IMMUNISATION UNDER FIELD CONDITIONS IN SWAZILAND

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Summary

Some aspects of heartwater immunisation of cattle under field conditions in Swaziland have been described.

It has been shown that the incidence of deaths from heartwater in imported adult bulls can be reduced to a very low level by this method of immunisation.

Introduction

Cattle ranching is the major industry of Swaziland. The big ranches are all situated in the lower Middle- and Bushveld areas and losses due to tick borne diseases are high, especially in imported adult cattle. Progressive ranchers regularly imported from the Union and United Kingdom purebred pedigree bulls to improve their herds. Mortality amongst these valuable animals was from 70 to 100%.

While redwater and anaplasmosis can to a large extent be prevented and cured, heartwater is in a different category. This disease was responsible for over 95% of all losses in imported animals and it was essential that these losses should be reduced.

In the beginning of 1945 one of us (JFF) went to Onderstepoort for a week to study the technique of heartwater immunisation and to acquaint himself with details of field experiments on it already carried out in the Union of South Africa. One susceptible sheep was infected with the "Mara" strain of Rickettsia ruminantium and brought to Swaziland by car. This strain was used for immunising cattle until the "Ball 3" strain became available in 1949.

Immunisation Scheme

Treatment of Sheep Reservoirs

To obviate accidental infection of susceptible sheep they are kept in an isolated wire netting enclosure under thatch where they are fed napier fodder and hay.

Supplies of susceptible sheep were not easily obtained as they had to be derived from known heartwater-free farms. After experiencing difficulties connected with transport from the Karoo area, a regular supply was obtained from a Swaziland farmer in the heartwater-free zone. He has been supplying these sheep ever since and only twice has the strain been lost due to non-reacting sheep.

Two susceptible sheep are ordered at a time and inoculated with infected citrated blood. Two new sheep are ordered immediately this is done and are available for sub-inoculation at the opportune time.

Originally temperatures were taken twice daily, but it was soon noticed that afternoon temperatures were unreliable because of hot climatic conditions. The heartwater reaction sets in after 10 to 14 days but sub-inoculations are made only after the temperature has been 105°F or over for three days. There are instances, however, where a sheep's temperature does not go higher than 104° to 104.5°F. In these cases the sub-inoculation is carried out on the fourth day after the temperature has reached the maximum. This procedure has enabled us to maintain the reservoir of infective material.

As sheep are housed very imperfectly in the open it is necessary to keep the reactors under constant observation — sudden adverse climatic conditions lead to deaths and loss of infective blood.

When there is no demand for infected blood for cattle inoculation, the sheep are treated after sub-inoculation into new reservoirs has been done. This treatment has been modified periodically. Uleron sodium and later 16% W.V. Sulphamezathine, both given intravenously, were the first drugs used. The treatment now employed is the intravenous injection of 10 c.c. 33⅓% W.V. Sulphamezathine per 100 lbs. bodyweight at twelve-hourly intervals until the temperature is normal. One to four injections usually are sufficient.

Where a fair amount of blood is drawn from a sheep it usually does not survive, but on an average 50% of all infected sheep recover. These recovered animals are resold to the supplier but only after they have been specially marked to obviate the possibility of their resale as susceptible animals.

The Administration approved expenditure of £250 per annum for the first year. This was increased to £500 in subsequent years but is only enough to pay for the sheep, some hay, the necessary drugs and an African labourer to care for the sheep. The Veterinary Officer stationed at Bremersdorp is in charge of the scheme and has had to do this work in conjunction with his numerous other duties. In spite of many calls on his time the immunisation of cattle has been a most successful service to the ranching community.

Immunisation of Cattle

The actual immunisation of cattle will be dealt with under two headings : calf and adult immunisation.

From the beginning ranchers have accepted this scheme with enthusiasm but it was thought wise to start on a small scale and extend it gradually as experience was gained. To control

the scheme properly and to save it from abuse and criticism in cases of failures due to carelessness, it was decided that a qualified veterinary officer must personally do the injections of the calves on the ranches, while adult animals had to be brought to a Quarantine Station where they were under the personal supervision of the veterinary officer until after the reaction. This was later modified in the case of a few reliable farmers who now collect blood at the bleeding centre and inoculate their own calves.

(a) *Calf Immunisation*

Calves under three to four weeks old acquire, usually without severe reaction, an immunity after inoculation with infected blood (Neitz and Alexander 1941). They thus only receive the initial intravenous injection of sheep's blood and are then left undisturbed and untreated.

Due to the difficulty of advising ranchers of the dates (which are uncertain) on which infected blood will be available a system was evolved whereby all their young calves were kept in a camp near the house and could be rounded up with the minimum of delay. Ranchers have to notify the Veterinary Officer every ten days whether they have any calves for immunisation so that unnecessary travelling is avoided.

The methods of distributing the infected blood also vary according to the distance the ranches are situated from the bleeding centre. For those near by, the required amount of blood is tapped from the reactor at the same time as the sub-inoculation is done. The amount of blood drawn from the donor varies between 1,000 c.c. and 2,300 c.c. at a time.

Where a ranch is some distance away and there is any possibility that inoculation cannot be completed within four hours after bleeding, the live reservoir (sheep) is taken by car and bled on the spot. In practice both reacting sheep are usually used on the same day. When, as often happens, both sheep do not react simultaneously inoculations are carried out on different days.

Up to 300 calves have been injected in a day by a single operator even when he has had to travel a distance of 250 miles and stop at eight to ten immunising centres.

Accurate records have not been kept but it is believed that the mortality in immunised calves from heartwater has been considerably reduced. Ranchers are rearing a higher percentage of calves born and have practically no losses in the six to nine months age group, whereas this particular age group suffered the highest losses before they started immunising their calves. There is no known case where losses in calves of under three weeks of age could be attributed to the severity of the reaction.

The cost to ranchers is 1/- per dose and a charge is made for the mileage travelled from the bleeding centre to his farm

and return to headquarters. Where several ranchers are visited the same day the travelling expenses are shared on a pro rata basis.

(b) *Adult Immunisation*

The immunisation of adult cattle is more complicated and the reaction is usually severe. Most ranchers, who imported bulls welcomed the scheme and were prepared to take the risks. From the outset it was successful. Losses in imported animals are now negligible.

In order to keep a close watch on the temperatures of imported bulls they were originally kept at Aird Farm (5 miles from Veterinary Headquarters) in small camps during the day and stabled under a converted verandah by night. They were fed hay and napier fodder only although the owner could, if he wished, supply concentrates as additional feed. The animals were dipped once a week and hand-dressed daily.

The Farm Manager was responsible for taking their temperatures twice a day but here again the evening temperatures were discontinued after a short time. He kept the bulls under close observation and telephoned the Veterinary Officer whenever anything untoward was noticed. When the Farm Manager's post was abolished, imported bulls were kept on the Mpisi Government Farm. This is about 15 miles from Bremersdorp and is in the charge of a European and is on the main road and telephone.

When in 1949 infectious sterility was diagnosed in the Union a quarantine station for all imported bulls became necessary. It was erected on the outskirts of Bremersdorp. Here the bulls are under the constant observation of a trained Swazi and the veterinary officer sees them as often as is necessary (usually daily). They are dipped every day in D.D.T. E20 Emulsion. This centre has been most convenient for carrying out immunisation of imported adult cattle.

The animals are each inoculated intravenously with 10 c.c. infected blood and here again the subsequent treatment has undergone a few changes and modifications.

When the scheme started 10% Uleron sodium was injected intravenously at the rate of 10 c.c. per 100 lbs. liveweight on the eighth day after injection with vaccine (blood) and again on the fifteenth day irrespective of any rise in temperature. When any rise of temperature was recorded blood smears were taken and, if negative for redwater or anaplasmosis, Uleron sodium was injected every twelve hours until the temperature dropped to normal.

It is interesting to note that in many animals the first rise in temperature is due to redwater and that appropriate treatment reduces the temperature to normal. In view of the fact that the animals are kept scrupulously free from ticks we assume that

these are relapses. This more or less supports the findings of Neitz and Alexander with Aberdeen Angus cattle.

It was soon noticed that the injection of Uleron sodium on the eighth day had no effect on the temperature which in any case usually rose only after the thirteenth to fourteenth day. In their experiments Neitz and Alexander (1945) also show that the earliest cases occur on the thirteenth day with the average between the eighteenth and twenty-fourth days. Treatment was, therefore modified — Uleron sodium was injected on the thirteenth day and again on the fifteenth day after the injection with infective ovine blood. Reactions were less severe and cases responded better to subsequent treatment.

When Sulphamezathine became available the 16% W.V. solution and later the 33⅓% W.V. solution were used intravenously at the rate of 15 c.c. per 100 lbs. live weight. All injections before any rise in temperature were discarded and latterly treatment is carried out after the temperature reaction is evident. A course of three injections at eight-hourly intervals is usually effective. Isolated cases do occur where the temperature will not drop to normal with the Sulphamezathine treatment. In these Uleron sodium is used, usually with success.

(Note : Sulphamezathine is not as irritant as Uleron sodium and only a local inflammatory swelling develops when any leakage occurs into the subcutaneous tissues.)

In some animals the temperature reaction starts as late as the 28th day. If there is no reaction by the 30th day (and this does happen in many cases) a second injection of infected blood is given. If there is no reaction after two blood injections the animal is considered immune. Only about 1% react to the second injection.

The Financial Aspect

Income and expenditure in connection with this scheme depend on many factors. The biggest item of expenditure is the purchase of sheep reservoirs. These have lately become expensive. Other expenses depend on the number of animals immunised.

Table I — Immunisation of Calves and Adult Cattle

Year	*Cattle immunised*		*Estimated Value*	*Adult mortality during immunisation*		*Revenue*
	Adults	*Calves*		*Total*†	*Per Cent*	
1945	64	419	£9,500	5	7.8	£213
1946	59	841	5,270	1	1.7	219
1947	116	1,169	5,000	9	7.76	406
1948	62	1,597	5,145	1	1.6	265
1949	—*	1,745	3,490	—	—	87
1950	73	2,668	11,420	3	4.11	640

† Total deaths from ALL causes. * No imports of adult animals.

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THE POSSIBLE APPLICATIONS OF THE NEW HYPOTENSIVE (METHONIUM) DRUGS IN VETERINARY PRACTICE

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Onderstepoort

Introduction

Penta- and Hexamethonium compounds are to-day in daily use in human medicine and surgery. Their main actions are to lower the blood pressure and reduce gastric secretion and they are, therefore, used for the treatment of hypertension and gastric ulcer in human beings. A more recent application of these drugs has been to produce a temporary hypotensive state during surgical operations in order to reduce haemorrhage. It is in this field that they will probably have their greatest use in veterinary practice. The objects of this paper are:—

1. To bring these drugs to the notice of our veterinary colleagues;
2. To report experiments on dogs and horses — species on which little experimental work has been done and
3. To suggest some conditions in which they may be of value.

Mode of Action

Penta- end Hexamethonium compounds block the impulses through the ganglia of both the sympathetic and para-sympathetic nervous systems. Paton (1951) considers that they reduce the blood pressure only by the release of autonomic tone and not by any direct vascular action. Once sympathetic tone has been abolished, repeated doses have no further effect. Referring to cats, Paton states — "a dose of 1–2 mg/kgm. usually causes a moderate fall in blood pressure but additional amounts up to 20–30 mg/kgm. have no further effect." This aspect will be discussed again under dosage.

The blocking of the autonomic system results in the abolition of the normal pressor and buffer reflexes and the subject therefore becomes very susceptible to postural alterations in blood pressure. The new low blood pressure level is, however, remarkably constant while the animal is prone.

Tracing No. 1 (at the end of this article) illustrates the partial blocking of the cardio-vascular reflexes very well. Under the influence of a small dose of pentamethonium iodide the pressor reflex initiated by carotid occlusion was markedly retarded and

reduced. Likewise faradic stimulation of the peripheral and of the cut vagus nerve caused a reduced effect.

Again owing to the abolition of the compensatory reflexes, the actions of adrenalin and acetylcholine are exaggerated under the influence of these ganglion blocking agents.

Effects on Dogs

Dogs were anaesthetised with nembutal and the femoral blood pressure recorded by direct canulization to a mercury manometer. The breathing was recorded by means of a T-type canula inserted in the trachea and connected to a membrane tambour. Having recorded the blood pressure under these conditions methonium compounds were injected intravenously at a standard initial dosage of 20 mg/100 lb. The dose was repeated at intervals to note the effect.

It was found that within 30 seconds of injection the mean arterial blood pressure dropped suddenly by some 60 m.m. Hg. but immediately rose again to a new level some 15 to 45 m.m./Hg. below the original pressure. The pulse was extremely rapid during the initial drop but very quickly returned to only slightly faster than normal.

Repeated injections caused a further drop in blood pressure in most cases but, for reasons stated above, the further drop was not proportional to the extra amount of drug administered. The following table summarises the effects on a series of four dogs.

Table I

The effects of Penta- and Hexamethonium compounds on the Mean Femoral Blood Pressure of Dogs.

Total Dosage	*Mean Femoral Blood Pressure*			
mg./100 lb.	*Dog* 1. (*C*5)	*Dog* 2. (*C*6)	*Dog* 3. (*C*5)	*Dog* 4. (*C*6)
0	110	120	135	110
20	65	90	120	80
40	45	—	120	70
80	40	55	105	—
120	—	—	100	—
160	—	—	100	—

The variation in susceptibility is in accordance with experience in humans.

In human thoracic surgery Lewis (1951) recommends an initial test dose of 20 mg. Assuming an average human body weight of 150 lbs. this represents approximately 13 mg. per 100 lbs. After 3 minutes the blood pressure is measured to assess

the effect of the test dose. According to the reaction further doses of 30 mg. each are given until the desired pressure of 55 to 56 m.m. Hg. systolic is reached. The pressure remains at this level for 25 to 50 minutes. If required, repeat doses can again be given.

Unfortunately we have no convenient method of measuring the arterial pressure of our patients so that dosage will have to be more arbitrary. On the above experience we would recommend an initial dose of 20 mg/100 lbs. With a mean pressure below 60 the femoral pulse can hardly be felt. Further dosage must be gauged on the amount of haemorrhage, the feel of the pulse and auscultation of the heart.

Horse

No references could be found to the use of these drugs in large animals. An aged gelding, due for destruction, was made available for study. The animal was anaesthetised with chloral hydrate intravenously, supported by chloroform inhalation. An initial dose of 100 mg/100 lbs. hexamethonium bromide reduced the mean carotid pressure from 135 tot 110. When the dose was repeated the pressure dropped to 90.

At this stage a deep incision was made into the shoulder muscles. The flesh appeared dry and there was practically no oozing of blood. A small artery which was severed gave one squirt and then dried up. An experienced equine surgeon present expressed the opinion that this absence of oozing would greatly facilitate many difficult operations.

It would appear that the effective dose per 100 lbs. body weight in the horse is considerably higher than in the other animals for which figures are available. Owing to the marked individual variation in susceptibility already mentioned it is difficult to draw conclusions from an isolated case. The experiment does prove, however, that the horse reacts in the usual way and that relatively large doses can be given in safety. It is suggested that an initial dose of 50 mg/100 lbs. be tried until more data are available.

Goats

The effects of the drugs were tried on two goats as representatives of the ruminant class. It appeared that these animals were much less resistant as a dose of 20 mg/100 lb. caused a marked drop in blood pressure. It would, therefore, appear that caution should be exercised in the use of these drugs in cattle until more experience has been gained. The initial dose should not exceed 20 mg/100 lbs.

During all our experiments the animals' breathing was unaffected by the low pressure and the heart beat was regular. The effects last over an hour.

Toxicity

As already explained these drugs have a wide therapeutic index as moderate excess dosage does not result in a proportionate drop in blood pressure. Repeated dosage has been shown to cause no changes in organs such as the liver and kidneys.

As the drugs are excreted in the urine, their action may be excessively prolonged in cases with impaired kidney function. (Milne and Oleesky, 1951). The low blood pressure further reduces the filtration rate and so a vicious cycle may be set up. This fact should be borne in mind when dealing with dogs with chronic nephritis. In such cases it would probably be advisable to restore the blood pressure to normal an hour or so after the operation to facilitate elimination.

Antidotes

The action of the methonium compounds can be reversed by sympathomimetics. Methedrine appears to be most commonly used in human practices. Quite fortuitously we discovered that the administration of a strophanthine derivative (K-strophanthosid) caused a prompt and sustained return of the blood pressure to normal. This was confirmed in the case of two dogs and the one horse. The drug was given at the rate of 1 mg/100 lbs. body weight and in all cases the blood pressure returned to the original level within 15 minutes (see Tracing No. 2.)

General Effects of Low Blood Pressure

According to the literature, the human brain must be carefully protected against the injurious effects of marked hypotension. This is done by keeping the patient in bed with the feet elevated. It occurred to us that if this was necessary with our patients it might constitute a serious drawback to the use of these drugs. Normal conscious dogs and goats given full doses exhibited no outward symptoms however. Animals anaesthetised and treated with methonium compounds came round perfectly normally. The fact that our animal patients may rise while still hypotensive would, therefore, appear to be of little concern.

The Effect on Anaesthesia

It is claimed that induced hypotension reduces the amount of anaesthetic required with consequent more rapid recovery of consciousness. In one dog given penta-methonium prior to nembutal the dose of the anaesthetic was reduced by 25% of the usual 1 c.c. per 5 lbs. Recovery was correspondingly quicker. In all other cases the usual full dose of anaesthetic was given followed by the methonium compound.

Discussion

In our opinion these drugs should play a valuable role in veterinary practice, especially in operations where haemorrhage is a serious factor, such as tumour resections, spaying of bitches in season, amputations of the penis or udder, etc. Other conditions which came to mind are epistaxis, and delayed post-castration haemorrhage in horses, where they could be used in conjunction with blood coagulants. They might also be used in traumatic internal haemorrhage provided the blood pressure is not already dangerously low.

Acknowledgments

We wish to thank the following firms for their generous gifts of drugs used in our investigations: Allen and Hanburys for

"Antilusin" (pentamethonium iodide)

"Hexathide" (hexamethonium iodide).

May and Baker for "Vegolysen" (hexamethonium bromide), and Sandoz Ltd., for "Strophasid" (K. stropanthosid from Stropanthus kombe.)

In our trials we could detect no differences between the actions or dosage of the various methonium compounds used.

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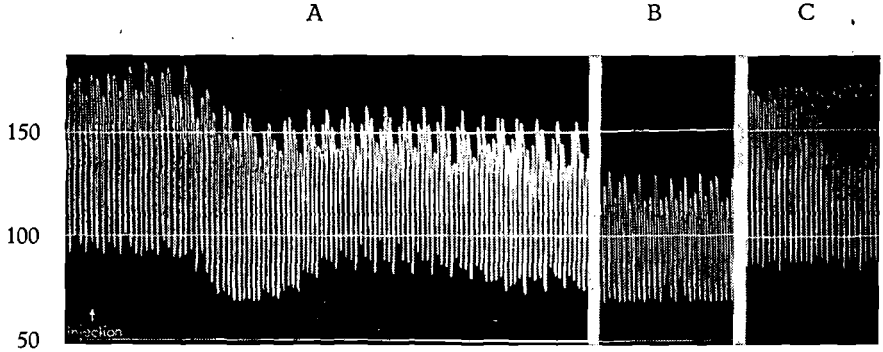
The Effect of Hexamethonium bromide (Vegolysen M & B) on the Carotid Blood Pressure of the Horse

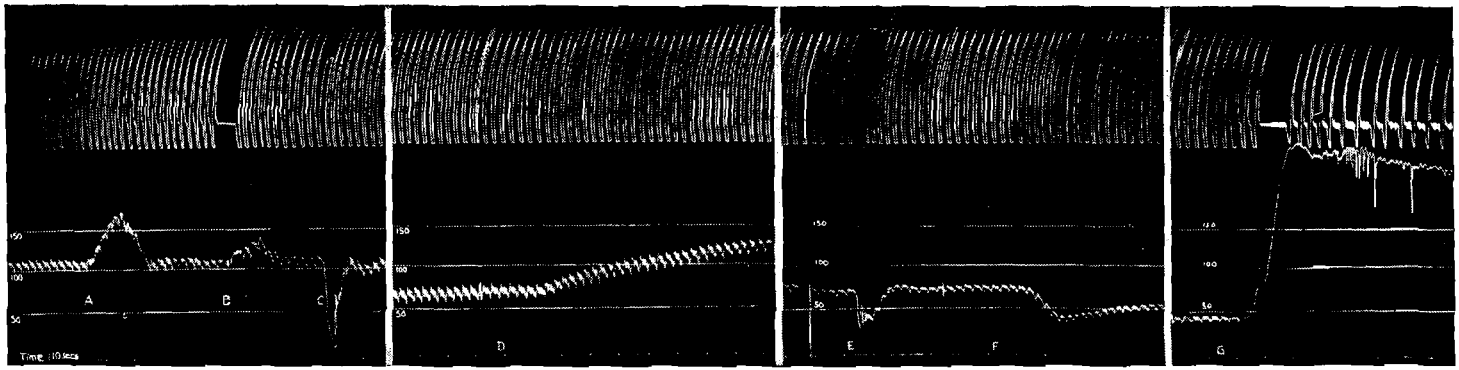


A: Effect of injection of 100 mg./ 100 lbs. body weight.

B: After total dosage of 200 mg./ 100 lbs.

C: Restoration of blood pressure 15 mins. after injection of 1 mg./ 100 lbs. Strophasid.

THE EFFECT OF PENTAMETHONIUM IODIDE (ANTILUSIN A and H) ON THE FEMORAL BLOOD PRESSURE & RESPIRATION OF THE DOG



Before Injection
B.P. 110 mm. Hg.
A: Bilateral Carotid Occlusion.
B: Section of Left Vagus N.
C: Farradic stimulation Left Vagus Nerve.

One minute after injection of .5 mg./kilo
B.P. 65 mm. Hg.
D: Bilateral Carotid Occlusion. Note slow rise in B.P.

B.P. returned to 65 after carotid release
E: Vagus stimulation as at C. Note reduced effect.
F: Injection of further .5 mg./kilo Antilusin.

2 minutes after injection of further 1.5 mg./kilo Antilusin
G: .5 c.c. 1/1000 Adrenalin i.v.
B.P. returned to 55 in 7 minutes.

OBSERVATIONS ON NAPHTHOXYETHANOL SUSPENSION ("ANAVENOL") AS AN ANAESTHETIC FOR THOROUGHBRED HORSES, WITH SOME REMARKS ON ANAESTHESIA WITH CHLORAL HYDRATE

J. QUINLAN
Cape Town

(The observations carried out in South Africa were done in conjunction with Drs. G. L. Faull and D. Burgess)

During a visit to Eire in 1950 I attended the Meeting of the National Veterinary Medical Association at Ballsbridge, Dublin. Among the demonstrations was one by Prof. P. A. M'Grady on the use of "Anavenol" as an anaesthetic for the horse. The animal used was a light, draught horse type. After the demonstration I got in touch with the representative of Imperial Chemical Industries, who attended the meeting, and requested that I be supplied with a quantity of "Anavenol" for experimental purposes, as well as copies of the literature on its use. I was impressed with the possibilities of "Anavenol" in inducing light anaesthesia for operations of short duration in thoroughbred horses.

Since doing postgraduate study in Germany and Switzerland during 1922 and 1923 I had used intravenous chloral hydrate, with chloroform inhalation when necessary, as an anaesthetic for thoroughbreds. This method has given most satisfactory results during a period now approaching 29 years. For the past four years dissolving the chloral hydrate in 10% dextrose-saline has proved most satisfactory. Previously it was dissolved in sterile tap water. The excitement stage during induction that has been described in articles giving its contra-indications, has never been experienced. Excitement during recovery has been experienced in a few horses. It has certainly been most unpleasant when it did occur.

Our patients are always anaesthetised in the standing position, an area in the jugular furrow having been previously anaesthetised. Perfect quiet is maintained all around during the introduction of the anaesthetic. The horse goes down under the influence of the drug without a struggle. To prevent injury an anti-backbreaking harness is used. The surcingle and the cavesson only are put on before the horse is on the ground. The crupper, cross reins and over-check are adjusted before the hobbles are put on. The hobble rope is not pulled tight so that there is never any severe strain on the limbs. We have not had an injury of any sort since using this method of control in horses.

The chief disadvantage with chloral hydrate as an anaesthetic is the time it takes a horse to rise after having had a full dose.

We usually keep horses on the ground until they have almost completely recovered from the anaesthetic. We consider this better than allowing them to rise and then having to be held up until muscular inco-ordination has passed off.

With "Anavenol" we thought we had an anaesthetic with the same degree of safety and efficiency as that experienced with chloral hydrate. I had an opportunity, while teaching surgery to the veterinary students at Onderstepoort Laboratory, of experimenting with every anaesthetic offering promise as more suitable than chloral hydrate for thoroughbreds. After twenty-eight years' experience, I have not found one. I realise that there can be no errors in technique in the intravenous injection of chloral hydrate. But correct technique must be employed in many other intravenous injections to avoid jugular phlebitis.

While in Eire, I had an opportunity of doing operations under "Anavenol" anaesthesia. I did four crib-biters (Forssell's operation) and one roarer (ventriculectomy). The anaesthetists were my colleagues Messrs. Fennelly, J. M. Farrell, J. S. Cosgrove and W. Davidson. In all cases the horses were prepared by withholding food and water from the previous evening. An induction dose was given as recommended. This was followed by a further dose, sometimes two, during the operation. Instructions for the use of the drug were carried out in detail.

In two horses there were to me (inexperienced in the use of "Anavenol") alarming respiratory and cardio-vascular symptoms. I was assured by Mr. Fennelly, who had already used "Anavenol" in more than fifty operations of short duration, mostly castrations on hunters and draught horses, that these were nothing to cause undue worry. In any case they passed off without apparent ill effects. However, I found it difficult to predict what to expect from the same sized dose of "Anavenol" in horses of the same weight and condition. In some of my operations anaesthesia was far from satisfactory. There was difficulty in keeping anaesthesia sufficiently deep, apart from cardio-vascular and respiratory symptoms.

On my return to South Africa, I decided to give "Anavenol" a more extensive trial. I was most enthusiastic about its value on account of the apparent ease of induction and the relatively short period of muscular inco-ordination following completion of the operation.

In co-operation with Drs. G. L. Faull and D. Burgess I began using "Anavenol" for thoroughbreds in our hospital in Cape Town.

Our experience under the environmental conditions prevailing in Cape Town, soon caused us to discontinue its use: all our observations were made on thoroughbreds.

A three-year-old gelding showed most alarming respiratory and cardio-vascular symptoms which, however, passed off. In a

six-year-old mare in which anaesthesia was most unsatisfactory it was found necessary to continue with chloroform, and after the recommended dose had been given, she had three long periods of apnoea: She became almost pulseless, necessitating intravenous heart stimulation, and tricuspid regurgitation followed. Our final experience has made us decide to discontinue "Anavenol" as an anaesthetic for thoroughbreds: a valuable three-year-old colt in ideal condition for operation was prepared in the usual way, no food or water being given from the previous evening. Instructions in administration were carried out in the greatest detail. 100 c.c. of "Anavenol" were given in 120 seconds, when the colt collapsed suddenly. He showed immediate, alarming cardio-vascular and respiratory symptoms, long periods of apnoea and a large jugular pulse. The periods of apnoea were interrupted, at long intervals, with deep sighs only. Later the pulse became imperceptible. Intravenous cardiac stimulation and artificial respiration, continued for twenty minutes, failed to resuscitate the colt. The symptoms were so acute from the moment of collapse that it was apparent this colt was beyond resuscitation.

Autopsy showed a markedly dilated heart, with a thin right ventricular wall. The spleen was eight times the normal size with marked engorgement. The autopsy would appear to be similar to that described by Parry (1950) but in his case there was no mention of splenic enlargement.

In all we have used "Anavenol" in eleven operations on thoroughbreds: crib-biting (Forssell's operation) 5; roaring (ventriculectomy) 1; firing knees 2; excision of hygroma 1; castration 2. In Eire is was used while I operated on four crib-biters and one roarer.

The results have been unsatisfactory in so far as the depth of the anaesthesia was unpredictable in thoroughbreds of the same weight and condition: Alarming cardio-vascular and respiratory reactions were experienced: a dose of 100 c.c. caused death in a healthy three-year-old colt, weighing approximately 900 lbs.: a dose of 250 c.c. caused a most alarming reaction, necessitating intravenous cardiac stimulation, in a six-year-old mare, weighing approximately 925 lbs.

We make a routine examination of the heart before giving an anaesthetic. From these examinations, as well as those for insurance purposes and for soundness, it would appear that cardiac disease must be exceedingly rare in thoroughbred horses, at least changes demonstrable at clinical examination. In fact cardiac disease would appear to be infrequent in South Africa in all breeds of horses not affected with acute febrile disease. The records of the post mortem hall of Onderstepoort Laboratory, where several thousands of post mortems on horses have been carried out, substantiate this statement. Consequently we find it difficult to agree that the acute symptoms experienced by us, and fatalities

experienced by three South African colleagues and one by ourselves, when using "Anavenol" are sequelae to prior myocardial weakness. We feel that "Anavenol" is highly toxic for thoroughbred horses in our environment and it is unsuitable for anaesthesia with our present knowledge. It has been used in South Africa only by experienced anaesthetists, carrying out the instructions of the manufacturers. Our South African colleagues who used "Anavenol" have discontinued its use as an anaesthetic.

Parry (1950) indicates certain factors which may cause unpredictability, amongst which is "prolonged starvation for more than 24 hours, or withholding of water. Our cases had had no food or water since the previous evening, a period of not more than 16 to 18 hours before operation. None of the other factors mentioned by him was present.

We find thoroughbred horses may be particularly sensitive to the influence of certain drugs. In fact we use only 75% of the maximum dose of some drugs recommended. We are particularly careful when using chloral hydrate intravenously for light chestnuts of an excitable nature. Our only moments of anxiety with chloral hydrate have been in horses of this colour. During an experience of 28 years of surgery covering a total of over 2,000 anaesthesias in equines, using chloral hydrate, I have had three fatalities, all in light chestnuts.

We would suggest that "Anavenol" should be subjected to more intensive experimentation before it can be recommended to the veterinary profession as an anaesthetic for thoroughbreds. In our opinion it is extremely dangerous. The remarks of Gold and Longley (1951) support our observations on the apparent toxicity of "Anavenol" for horses. Pickup (1950) remarks on the unsatisfactory anaesthesia which he saw at a demonstration on the use of "Anavenol" as an anaesthetic. Parry (1950) made a limited observation on the use of "an improved form of Anavenol: "Anavenol K", that is "Anavenol" with the addition of sodium thialbarbitome. He claims that it appears to have significant advantages over "Anavenol" alone for anaesthesia of short duration in the horse. He says, however, that the danger of apnoea during injection is slightly increased, while hyperpnoea is reduced greatly. Harrow (1950) says that "Anavenol K" is an excellent anaesthetic for horses. He bases this assumption on the result of "more than 30 anaesthesias in 10 animals of varied age and condition". The breed of the experimental horses is not mentioned.

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AN OUTBREAK OF LAMKRUIS IN MERINO LAMBS

E. M. ROBINSON
Onderstepoort

In December 1947, while the writer was on a visit to Knysna, C.P., he was asked to examine some merino lambs suffering from a form of partial paralysis.

History. On this farm which borders on the lagoon at Knysna cases of this condition occur annually in lambs about two to three months old. The owner only keeps about fifty sheep, all Merinos, and they run where they like on the farm. Prior to the writer's visit they had been running in a grass camp near to the homestead for about a month.

Examination of Cases. Several lambs showed weakness when walking, but three showed inco-ordination of the hind limbs with staggering gait and a tendency to fall. There did not appear to be any loss of sensation in the hind limbs.

A tentative diagnosis of "lamkruis" was made and the lamb which appeared to be the worst was killed. No pathological changes were found in the internal organs. The spinal cord was removed from the thoracic region to the sacrum and preserved in formalin for examination at Onderstepoort. Grass samples were taken and also wool samples from some of the lambs, for analysis. The wool was taken from a recent clip done on the farm and the grass from different parts of the veld. A copper deficiency was suspected and on analysing it this was found to be the case with the grass sample. A soil analysis had been done by an Extension Officer shortly before the investigation was carried out. Unfortunately copper was not mentioned in the analysis, of which a copy is given.

	Topsoil	*Subsoil*
pH	4.70	4.82
Total N	.101%	.08%
Total P	.045%	.37%
Available P	.0003%	.0002%
Potash	.136%	.12%
Available K	.007%	.007%

The farm lies on the south side of the lagoon and has only a small flat arable area, the rest being hills, with a variety of trees including a lot of milkwoods. The soil is sandy but at the

depth of about a foot one comes on to what is apparently a thick deposit of shell material. All the farms in the area are phosphorus deficient and cattle do not grow out well. It has been noticed that sheep and pigs easily fracture their bones.

The spinal cord was examined by Dr. Schulz in the Pathological Section at Onderstepoort and he reported that it showed the typical changes seen in cases of "lamkruis" or "sway back".

It may be of interest to mention that the poultry on the farm suffer from a form of leg weakness, starting at the age of a month and gradually becoming worse. The writer saw several cases in Rhode Island Reds. They showed a staggering gait turning the hocks outwards when walking but sometimes inwards as well. Dr. Coles of Onderstepoort considers that the cause is most likely a manganese deficiency. This would mean that there must be a phosphorus, copper and manganese deficiency on the farm.

Summary

An outbreak of "lamkruis" in the Knysna district is described.

SOME DISEASES ASSOCIATED WITH BREEDING OF HORSES

C. W. A. BELONJE
Middelburg (Cape)

(*Concluded*)

PART II

POST NATAL DEATHS

DISEASES OF FOALS

I. SLEEPY FOAL DISEASE

Cause — Shigella viscosum equi. (10, 11, 18, 19.) Synonyms B. equirulis. B. nephritidis.

Occurrence — It is responsible for one third of all foal deaths in the Newmarket area in England and causes heavy mortality in the U.S.A. The South African position is unknown but the organism was discovered here in 1908.

Symptoms — The onset is early, the majority of foals dying the first, second or third day after birth. Many show the characteristic symptoms at birth and are in a semi-comatose condition — commonly called " sleepers ". Some are too weak to stand, others are barely able to stand, and still others are able to walk but are sick, dull and listless. Some are not noticeably weak but show symptoms of a nervous disorder. They walk round the stall continually, refusing to nurse. Others that appeared normal at birth are stricken suddenly and live but a short time. The illness is characterised by sudden onset, extreme prostration and death. During the course of the disease the pulse, respiration and temperature increase. About one third of the affected cases die within the first twenty-four hours.

In foals which die at two or three days old the principal symptoms are those of emaciation, affected hock, hip or knee joints, and/or pneumonia.

Post mortem — Usually no external lesions are seen. The mucous membranes of the eyes, nose and mouth may be injected and somewhat jaundiced. The navel may be moist or an abscess may be present there. In cases which are prolonged, joint swellings are seen. There is often an excessive amount of straw coloured fluid in the pleural, pericardial and peritoneal cavities. Small haemorrhages on the surfaces of the heart, lungs and spleen are always noted and in very acute cases, no other lesions may be present. Enteritis affecting the small intestines is sometimes present.

In practically all cases, save the most acute ones, the principal changes are found in the kidneys. Congestion, adherence of the capsule and the presence of cortical abscesses are the principal changes found

in these organs. The peri-renal tissue is often gelatinous. The cortical abscesses are of an embolic nature affecting the glomeruli and are from a pin point to a pinhead in size. The condition is primarily a glomerulonephritis followed by suppuration and necrosis. The medulla of the kidney is not so seriously involved. The lungs may have similar abscesses scattered throughout their substance, especially beneath the pleura. In many cases the synovia is bloodstained and more viscous than normal. Only in rare cases are any more pronounced changes observed.

Mode of Infection — Many adult horses including brood mares are "carriers" of the organism. It is frequently found in the tonsillar region and in the intestines but very rarely in the genital tract. It is thought that prenatal infection, although uncommon, is possible by means of migrating worm larvae carrying the organisms from the dam's intestines to her bloodstream and thence across the placenta to the foetus in the womb.

Postnatal infection is believed to be the most common method, the organism entering via the mouth, respiratory tract or umbilicus. Probably the oral entrance is the most common and via the navel least so as local lesions are very rarely found at that point.

Thus, infection in the newly born foal may occur from the dam during suckling or by licking, etc. Possibly, other factors besides the pathogenic organism may be concerned in the production of the disease, such as nutritional factors. Small undersized foals usually contract the condition.

Treatment — Streptomycin has been found effective in early cases.[37] The initial dose is 2 gm. followed by 0.5 gm. every four hours. It is important that treatment should not be discontinued at the first sign of clinical improvement. (Maximum dose is 4 gms. initially, followed by 1.5 gm. four times daily.)

Prevention — Hygienic measures must be taken to disinfect foaling boxes, loose boxes, udders, attendants' hands, etc. Attention must be paid to the navel at birth. The organism does not persist in the uterus of the mare and cause the death of successive foals, or set up inflammatory changes in the genital tract that result in sterility. The organism was however easily found in the alimentary tract and also in the tonsillar crypts of the horse and it is thought possible that if these micro-organisms do find their way from these sources into the bloodstream of the pregnant mare, it is possible that they are carried to the uterus and invade the foetus. Because the origin and portal of entrance of Shigella viscosum equi are unknown, it is difficult to suggest a method of prevention and control. The practice of good breeding hygiene reduces the incidence of the disease. [10, 11]

Preventive Inoculation — The organism has a number of variants each of which has a different antigenic structure. It appears impossible to make one vaccine to immunise the mare against all these different types. An autogenous vaccine might prove satisfactory in an outbreak. The immunity would be passed to the foal through the colostral milk after foaling.

II. Streptococcus Pyogenes-equi Infection [10, 14, 15]

This infection is either prenatal or postnatal in origin. Cases of prenatal infection include foals dead or ill at birth and those that show symptoms of illness soon after birth. The symptoms and pathological changes observed in foals that die from streptococcic infection vary with the age of the foal and the length of the illness.

Symptoms — In foals born dead the changes most often observed are petechiae on the serous surfaces, particularly the pleura and epicardium. Peritonitis is present in some, and occasionally there are circumscribed areas of congestion and haemorrhages surrounding the umbilicus.

In foals that are sick at birth and die within twenty-four to forty-eight hours, the most prominent symptoms are extreme weakness and prostration. Similar symptoms were first observed in foals that lived a few days but were not visibly ill when born. The most marked pathological changes observed at post mortem were haemorrhages of the serous surfaces and peritonitis.

In other foals that are not visibly ill when born, the first symptom to become apparent is often disturbance of the digestive tract, diarrhoea or constipation followed by diarrhoea. The stump of the umbilical cord remains soft and oedematous. If the foal lives for several days after the appearance of symptoms, one or more joints of the legs usually become involved. Upon post mortem examination lesions of general septicaemia are found. The umbilical vein is enlarged and in many cases filled with pus. Infected organs and joints readily yield streptococci upon inoculation into glucose broth. This is the condition known as *Joint-Ill.*

Although Joint-Ill may be caused by a number of pathogens, the streptococcus described is responsible for the greater proportion of these cases. The disease is commoner in heavy draught breeds than in thoroughbreds.

Infection — Foals possibly contract the infection in *utero* as described. They may contract it from the surroundings or from the dam through contact or in the milk sometimes, when the dam is suffering from streptococcal mastitis. Infection after birth enters at the navel as a rule.

Treatment — Penicillin and sulphonamides are the effective drugs [37] and are successful not only in saving life but in preventing any permanent injury to the joints when used early enough and in correct doses. Where the joint lesions are well marked, the cavities are filled with pus and in the worst cases erosion of the joint cartilages may take place. In resolving cases, it is the union of these eroded surfaces that causes the permanent deformity and limitation of movement in the joints.

Prevention — Preventive measures are taken as described for infection in the mare and in addition hygienic precautions are observed at foaling in regard to cleanliness of the surroundings and disinfection of the navel. Vaccines as described (under mare) have been used to protect the dam and, through the colostrum, the foal also.

Streptococcal septicaemia causes the deaths of almost one tenth of all foals which die in the Newmarket area in England.

III. Escherichia Coli Infection

In many foals in the U.S.A. and in the Newmarket area in England the only bacteria isolated from this particular condition were members of the colon-aerogenes group. While there is the possibility that these organisms may have invaded the body and joints after death, it is considered that in a certain percentage they were the causative factor of death. [10, 11]

The infection usually occurs in very young foals although some are ill at birth. They present symptoms of increased temperature and pulse rate besides being dull and weak and refusing to nurse. Death frequently occurs within twenty-four hours after the onset of the disease.

The changes observed at post mortem examination are those of a general septicaemia. Peritonitis is present. There is often a severe enteritis. In many cases the joints are involved and the synovial fluid contains purulent flocculi.

The infection is believed to be of uterine origin. Many of the mares were known to be affected with endometritis due to bacteria of this group [10, 11] and some of the infections in foals undoubtedly originated from such mares.

Treatment is by E. Coli vaccines and seras and streptomycin may be tried.

IV. Corynebacterium Equi

This disease generally occurs in foals two to four months old [10, 11] in the U.S.A. The animals exhibit high temperatures and a purulent nasal discharge. The disease produces a bronchopneumonia with abscess formation. The course of the disease varies from six to fourteen days. On post mortem examination abscesses are found in the lungs, mediastinal lymph glands and at times in the mesenteric, colic and hepatic lymphglands as well as in the liver. In a few instances this micro-organism was isolated from the genital tract of mares and from aborted foetuses.

V. Other Organisms

Other organisms isolated from dead foals in Kentucky have been the following:—

(a) Salmonella typhi-murium.
(b) Salmonella abortivo-equinus.
(c) Clostridium tetani.
(d) Clostridium septicum.
(e) Stephylococci.

In the case of S. typhi-murium the disease is characterised by a high temperature, marked depression, abdominal pain and a foetid diarrhoea.[10, 11] Infection is believed to occur after birth and can cause primary outbreaks of salmonellosis in foals or sporadic cases where exposures, dietary upsets, or other agitative factors incite the bacterium to invade the body tissues. Treatment is by the use of gut active sulphonamides, e.g. sulphathalidine, and streptomycin.

VI. Foals Bacteriologically Negative

A. Many foals are born dead or die the first day and no bacteria can be isolated.[10, 11] Some of these deaths are due to dystokia or difficult or delayed parturition. Probably a small number are the result of streptococcal infection from which no organisms can be isolated.

Some of the negative foals that die at ages of two days or more have abnormalities of the internal organs, particularly persistence of the ductus arteriosus and foramen ovale and anomalous imperfections of the small and large intestines.

The majority however are foals dead at birth in which no adequate explanation of the cause of death can be offered.

B. *Haemolytic Disease of Newborn Foals.* [26–32, 36] Due to an earlier recognition of this disease more and more cases of this nature are being reported at Newmarket. The present knowledge of the disease may be summarised as follows:—

1. There is a presumably dominant hereditary property in the blood of the foal inherited from the stallion and absent in the mare.
2. The selective action of the antibodies affecting the foal with blood properties of the stallion and the absence of symptoms in the foal having the blood properties of the mare.
3. A preparatory phase of several pregnancies with normal foals having the dominant property of the stallion which is required for immunisation.

The process appears analogous to the condition of the Rh. factor in the human, except that there is no intra-uterine damage to the foal.

The condition is therefore dependent upon a hetero-specific pregnancy, either the stallion being homozygous or heterozygous positive for the dominant factor and the mare homozygous recessive. In the first instance the foal will be 100% positive for the factor and in the second case there is a 50% chance of its being negative.

The iso-immunisation of the dam appears to be the result of transplacental passage of foetal blood or perhaps only by the factors separated from the red cells, although the latter view is very questionable.[31] The positive pressure supplied by the foetal heart, the very slow and sluggish circulation in the uterine sinuses and the minute dose of red cells apparently required for antibody production, would provide the more likely mechanism of foetal blood transfer. The assumption of the existence of gross lesions has not been demonstrated.

In this manner the mare becomes actively immunised but the degree of immunisation is largely dependent upon the degree of sensitisation, which in turn influences the concentration of antibodies in the colostrum. The antibody particles are relatively large and cannot pass the very thick placental barrier and up to the present no cases of intra-uterine damage to such foals have been recorded. The sensitisation and the immunological response of the mare proceeds without outward indications and is entirely symptomless.

Symptoms — The foal seems to be normal at birth and develops symptoms within twelve to ninety-six hours after birth after taking the colostrum in which the antibodies are concentrated. If there is a very high concentration the symptoms develop very rapidly and death is acute. In smaller concentrations the symptoms are less marked and spontaneous recovery frequently takes place.

The bowel of the foal being very permeable during its first twenty-four hours of life, allows the absorption of the antibodies into its blood stream. After that time the intestinal lining becomes thickened and chemically changed, preventing further antibody absorption.

The antibodies in the bloodstream cause intravascular haemolysis, the red cell disintegrating and freeing its haemoglobin. The red cell count may drop from the normal 9½ million down to 2 million per m.l. and even less. In acute cases the liver and kidney cannot cope with the free haemoglobin and haemoglobinuria becomes evident. Progressive lethargy and weakness set in, and pallor and icterus of the visible mucous membranes occur. The foal fails to suck, although it will suck if supported under the dam. Finally it lies down and becomes too weak to move. Respiration is usually normal except when terminal cardio-vascular insufficiency develops and then hyperpnoeic breathing with frequencies up to 80 per minute may be encountered. Tachycardia is present constantly and in some cases the heart frequency is raised from the normal level of about 60 to frequencies up to 120-180 beats per minute. The heart beat is clearly visible. Mortality is very high.

Autopsy — On post mortem examination the carcass is generally icteric and the blood watery and yellowish. Microscopically the chief changes found are

(a) Liver — erythrophagocytosis, haemosiderosis, jaundice, diffuse degeneration, focal necrosis of the liver cells and perhaps cirrhosis. Bile thrombi are present in all bile canaliculi.
(b) Kidney — extension of the tubular type of epithelium into the glomerular capsules of the kidneys occurs in cases of some duration and may be connected with the excretion of large quantities of abnormal pigments.
(c) Brain — shows evidence of neuronal degeneration.
(d) Haemopoietic tissues in the bone marrow become very diminished with much haemorrhage.

Diagnosis — (i) *Direct Coombs Test* — A drop of foal's blood is added to a small tube containing 0.6% sodium citrate in physiological saline. The cells are centrifuged down and washed three times in saline to remove the plasma. These cells are then added to a drop of a suitable dilution of rabbit anti-horse globulin serum. This may be done on a tile at room temperature or in a small tube, which is then incubated at 37 degrees C. The result can be examined macroscopically and microscopically. If the cells have

been sensitized IN VIVO by maternal antibody they agglutinate on the addition of the rabbit antiglobulin serum.

(ii) *Indirect Coombs Test* — This is performed on the mare's serum to find the antibody content. It is done as follows:—

(a) The erythrocytes of the stallion or from any other horse known to contain the positive dominant factor are washed from all traces of serum protein by suspending them in a saline medium. The mixture is centrifuged repeatedly, aspirating the saline and replacing it with fresh saline each time. A 2–4% suspension in saline is then made.

(b) The mare's serum is first cleaned by centrifuging and warmed at 56 degrees C for half an hour to an hour. This is to destroy all haemolysins. It is then titrated in the following dilutions of 1 : 2–4–8–16–32–64–128–256–512–1024. To ¼–⅓cc. of above dilutions 2–3 drops of the 2–4% suspension of positive cells (a) are added. Each tube is shaken up thoroughly.

(c) Incubate thirty minutes and read macroscopically.

(d) Centrifuge the tubes, remove the supernatant fluid, add ½ cc. saline, shake thoroughly, spin and aspirate again. Wash the cells three times in this manner.

(e) Add 1–2 drops rabbit anti-horse globulin serum of suitable strength (usually 1:10) to the red cell precipitate. Shake well and incubate for thirty minutes at 37°C.

(f) Read the result macroscopically and microscopically for agglutination and note to what extent the cells agglutinate and in which dilution this takes place.

A rising titre towards the end of gestation indicates that the dam is actively producing increasing quantities of antibodies in the bloodstream and that the process of iso-immunisation is taking place. [28, 34, 35]

Treatment — (i) *Preventive* — It is generally accepted that in the absence of intra-uterine damage to the foal it can only contract the disease from the colostrum of its dam. Hence it follows that preferably the foal should be put to a nurse mare or its dam should be milked out hourly for at least 24-36 hours before allowing the foal to suckle [27, 35]. This is based on the observation that the antibody is concentrated in the milk and the foal's bowel permeability decreases rapidly. A certain amount of jaundice may occur from which spontaneous recovery takes place.

This last procedure has not proved entirely satisfactory. The starvation of the foal for twelve to twenty-four hours (except for glucose water feeding) seems to have a very detrimental effect in reducing resistance to septicaemic infections. Several deaths have taken place following this procedure and haemolytic streptococci have been isolated from the internal organs.

(ii) *Transfusion* — Great difficulty was at first experienced in the finding of a suitable technique which made total or partial

exsanguination with simultaneous transfusion a practical possibility. This may now be regarded as solved.[36] The removal of as much as possible of the foal's own blood and its replacement by compatible blood will promptly curtail the haemolytic process, correct the anaemia, dilute any unattached antibodies and minimize further injury to tissue cells.

Naturally the longer the exposure to the action of the maternal antibodies, the greater will be the destruction of red cells and the graver will be the injury suffered by vital organs such as the liver, the brain and blood-forming tissues.

It is of course impossible, even by the most radical replacement transfusion, to remove all the sensitized blood cells; many of the immature forms have not yet been released from the medullary centre of erythropoiesis. But given good liver function the foal should cope easily with this residual problem.

The procedure adopted is as follows:[36]

(a) Six bottles of 500 cc. capacity containing 120 cc. of a glucose-citrate anti-coagulant solution are filled with compatible donor's blood and kept warm.

(b) The foal is fastened in a horizontal position on a well-padded table and if necessary nikethamide administered.

(c) The lower fore limb is straightened out and a tourniquet applied over the elbow region. The internal subcutaneous vein of the forearm stands out prominently and after clipping and disinfection a hypodermic needle is introduced and a polythene catheter passed for 3-4 inches along its course. The hypodermic needle is withdrawn and an elastoplast bandage applied over the area to keep the catheter in position. The blood transfusion apparatus is then connected up allowing a slow blood drip of about 120 drops a minute.

(d) After passing from 250–500 cc. steps must be taken to remove blood. This is done by passing a polythene catheter in a similar fashion into the upper jugular vein in a cranial direction. A 1.5 m.m. polythene tube may be used and extraction facilitated by the use of a syringe or by the passing of a very big bored catheter using a bigger hypodermic needle or a trocar and canula for its introduction.

(e) The inflow and outflow of blood should then be correlated to correspond to avoid wide fluctuations of the blood-volume during the procedure.

(f) The volume transferred varies according to the case but should not be less than 2,000 cc. and need not exceed 4,000 cc. The amount withdrawn may be equivalent or up to 500 cc. less.

(g) Because of the high incidence of streptococcal septicaemia in jaundiced foals the administration of Penicillin is advisable.[37]

(h) In weak foals artificial feeding should preferably be by the rectal and parenteral route as foreign body pneumonias have been encountered where oral dosing was resorted to.

C. *Punctured Rectum* — Retained meconium cases are frequently met with and respond very well under expert attention. Several foals were brought to the laboratory where the rectum was damaged through the introduction of instruments leading to perforation.[33] Peritonitis and death followed with the bacteriological examination revealing a predominant infection of coliform organisms.

D. *Barker* — A most peculiar condition met with is the foal emitting a sound resembling the bark of a dog. The condition is invariably fatal. There appears to be some difficulty in its clinical recognition as foals definitely diagnosed as "barkers" by private practitioners proved to be septicaemic infections, mainly caused by Shigella viscosum-equi on laboratory examination. It does seem as if the dyspnoea of pyrexia may give rise to expiratory sounds simulating the "barker" and cause clinical confusion.

The most constant finding in "barkers" (although frequently absent) is the presence of one or more (5th–6th) broken ribs at a distance of 1–2 inches above the costo-chondral junction either on the left or right side. This area corresponds closely to the elbow joint in a flexed position. Speculatively one would say that the foal during the final stages of parturition has one limb retracted and during its passage through the bony pelvis had the elbow joint compressed into the thorax causing fracture of the ribs in many cases.

The heart frequently shows myocardial haemorrhages visible through the epi- and endocardium. The present theory is that the injury affects the phrenic nerve resulting in diaphragmatic spasms which lead to the sharp expiratory cough or "bark". The condition is almost one hundred per cent fatal.

One idly wonders if a subclinical case of thoracic compression may not develop into the whistler or roarer in later life. It was noticed that all the affected foals exhibited an enormous depth of chest and it may be this physical characteristic which is inheritable and predisposes the foal to such injury.

E. *Wanderer* — Here the foal soon after birth seems incapable of nursing its dam. It constantly walks around, usually in one direction. With good management and nursing and feeding by stomach tube if necessary, most recover in about a week.

F. *Ruptured Bladder* — A few odd cases of rupture of the dorsum of the bladder have been reported. Ascites becomes very marked and unless drained and operative procedures undertaken to close

the bladder the foal will die. The cause of the condition is unknown as the urethra appears fully patent. A possible explanation may be that the bladder is distended during parturition and bursts through compression in the passage of the foal over the pelvic brim.

G. A great problem is the nursing of the orphan or sick foal.

(i) Where iso-immunisation of the mare is known to have occurred by history or by serological tests, the foal is removed and fed on glucose water for the first twelve to twenty-four hours of its life, while the mare is being stripped at hourly intervals. Yet a few of such foals die. Serologically they give a negative agglutination test and show no drop in the erythrocyte count. Bacteriologically, haemolytic streptococci have been isolated from the internal organs proving death to be the result of a streptococcal septicaemia. It is clear from these cases that the lack of colostral milk deprives the foal of its chance of obtaining the various antibodies in bulk and becoming passively immunised. The starvation may decrease resistance further and bacterial invasion with septicaemia is the result. Hygienic and preventive antibiotic treatment may be advisable.

(ii) The sick foal presents many difficulties. Many post mortems show various stages of broncho-pneumonia of foreign body origin the result of inexpert drenching. In pyrexias the foal often nurses insufficiently to maintain basal metabolism. Thoroughbred foals are born lean and hardly show any accumulations of fat anywhere in the body. The amount of reserve energy must be small and easily exhausted by pyrexia, tachycardia and hyperpnoea. No research into artificial feeding of such foals has yet been undertaken. Parenteral and rectal administration of glucose-saline is to be preferred to the oral route and the careful intra-peritoneal injection of hydrolysed proteins should be considered.

Part III. — STERILITY IN MARES

Barren mares can be divided into two groups based on clinical findings although the breeding record and regularity of oestruation are always a great help in making the final decision.[20]

I. *Infected Mares* — Classified on the basis of the type of infection found on bacteriological examination as follows:—
   (a) Mares infected with Streptococcus pyogenes-equi.
   (b) Mares infected with Encapsulatus genitalium.
   (c) Mares infected with miscellaneous organisms.

II. *Non-Infected Mares* — Classified clinically and bacteriologically as follows:—
   (a) Mares apparently normal.
   (b) Mares with abnormally large cystic ovaries.
   (c) Mares with abnormally small ovaries.

(d) Mares physiologically exhausted.
(e) Mares with ovarian and uterine tumours.
(f) Mares with chronic cystic degeneration of the uterine wall.
(g) Mares with cystic degeneration and chronic fibrosis of the ovaries.

I. INFECTED MARES

A. Streptococcus Pyogenes-equi

The organism usually causes a chronic inflammation of the genital tract, but in some cases it may become acute.[16, 14, 20]

Cause — Streptococcus pyogenes-equi [16] is ubiquitous in the U.S.A. [8, 14, 16, 20] and England [16] but no work has been done on it in South Africa. The organism has been called S. genitalium in the U.S.A. [20] It is a Gram positive, haemolytic streptococcus possessing the fermentative characters attributed to the streptococcus pyogenes group. It has been found uniformly virulent for rabbits and non-pathogenic for guinea pigs.

Symptoms — These are confined to local changes in the uterus. No systemic involvement occurs as this particular type of streptococcus is of relatively low pathogenicity. Failure to hold to service may be the earliest sign that infection is present, or a whitish flocculent discharge may exude from the vulva. In some cases air is aspirated audibly when trotting or galloping. Malformation or imperfect apposition of the vulvar lips may be noticeable. On occasion, the first indication of the streptococcal infection in a mare may be the occurrence of abortion at any time during pregnancy.

Diagnosis — It is made on examination, history and bacteriological findings. In acute cases the vaginal mucous membrane is found congested and moist, the blood vessels are distended, tortuous and stand out with great prominence. An exudate is noticeable. It may be very thin, slightly cloudy or frothy or of a thick yellowish white character containing many flocculi. The cervix is congested and moist, the mucous membrane swollen and glistening, with the folds greatly enlarged and the os uteri not as firmly closed as in normal mares. Infected mares show a hypersecretion during the oestral period which may subside appreciably during the anoestral period.[20]

In chronic cases the exudate is decidedly mucopurulent, always present in a greater or smaller amount, the vulva, the inner surfaces of the thighs and the tail being soiled with dried exudate. Perineal injuries which occur at the time of parturition are of rather frequent occurrence and always predispose to infection of the genital tract.

The bacteriological examination consists in the aseptic introduction of a sterile cottonwool swab into the cervix and culturing it in glucose-broth with direct culturing on blood-agar, or subculturing.

Infection — The streptococcus involved can be found on the external genitalia of practically all mares and in the cervix of many mares within nine days after foaling. Transmission of the disease may be via the stallion in two ways — mechanically, from mare to mare, and by the stallion himself actually being infected with streptococci in his own genital tract.[14]

Malformation of the vulva as described favours the setting up and continuation of the infection. Possibly nutritional and hormonal factors play a part in determining why any particular mare should become infected clinically.

It is, however, an established fact that the majority of streptococcal infections of the genital tract originate in the mare that has foaled recently. Normally the great majority cleanse themselves before the tenth day because of the natural bactericidal power of the uterus and the outflow of the uterine secretions as oestrus approaches.

In many mares these organisms are able to establish themselves and produce pathological changes, i.e. metritis, which results in sterility. When a mare infected with these organisms conceives the result is usually abortion or a diseased foal.

Prevention — This is based on hygienic measures, particularly in regard to the pre-service clinical and bacteriological examination of all mares. Disinfection of the stallion before and after service is theoretically desirable but practically very difficult. The possibility of contracting infection at 'foal heat' services should be borne in mind. Prompt attention should be given to mares which damage the vulva at foaling. There should be prohibition of the handling of the mare's genital tract by persons not properly qualified, e.g. the practice of opening up the cervix by stud grooms. This favours the ingress of infective material to the uterus.

Preventive Inoculation — Vaccines, consisting of killed cultures of the organisms, have been used in the treatment of this condition with varying results. They appear not to have given any spectacular results. Nor does it appear as if sufficient antibodies are passed in the colostrum to safeguard the life of the foal against postnatal infection.

Treatment — This is still the subject of intensive research but the following lines may be mentioned.

(i) Anti-streptococcal vaccines have proved unreliable.

(ii) The intramuscular administration of massive doses of Penicillin, i.e. 1,000,000 units every 3–4 hours for three days, has proved disappointing.

(iii) Prevention of aerovagina by performing Caslick's operation, whereby the lips of the vulva are sutured for a certain part of their lengths is only applicable to suitable cases, i.e. rattlers or windsuckers as they are often called. This treatment actually depends upon the natural defensive and recuperative power of the body in cleansing

itself. The operation merely prevents re-infection from the exterior. In principle this procedure in my opinion is unsound. One should never close in an infection and the rational treatment should be the local treatment of the uterus and vagina first before narrowing the external lumen.

(iv) Local treatment appears to be the most likely form to be successful [17] and tests are being performed to test the efficacy of various douches.

B. Encapsulatus Genitalium

This occurs widely in the U.S.A. [20] but has not been isolated in England or South Africa.

Cause — The organism has been found to belong to the group of organisms designated by Julianelle as Type B of the Friedlander bacilli. Most of the strains belonging to this type are of animal origin while the strains of the other types have been found in infections in humans.

Symptoms — Clinically the hairs of the tail usually are soiled and matted and dried exudate is visible on the quarters adjacent to the external genitals. Upon rectal examination the walls of the uterus feel abnormally thick and the organ as a whole is enlarged. In a few cases, particularly older mares, pyometra in varying degrees may be found.

Although the differential diagnosis between this condition and the metritis due to other micro-organisms should always be confirmed by bacteriological examination there are certain changes which are rather typical and characteristic of this infection.

The exudate is always thick, often containing many flocculi, exceedingly viscid and tenacious in consistency and slimy to the touch. The colour varies from a dull grey to a yellowish-white. The visible portion of the vaginal cervical membrane has a dull reddish-brown colour.

During oestrus, exudation is profuse in all cases. In some cases the genital tract may return to a state approaching normal during the interval between oestrus periods. Manual examination of the genital tract will reveal the slimy exudate and cultures are invariably positive, regardless of the time when they are taken.

Infection — On the basis of field and experimental data, encapsulated bacilli may be transmitted from mare to mare by the stallion at the time of service, the greatest danger being the first few days after serving an infected mare. Stallions do not become permanent carriers of the infection.

Barren mares, free from infection of the genital tract, are more resistant to infection at the time of service than are foaling mares.

Prevention — This is fundamentally a question of sanitation and breeding hygiene.

Treatment — Both Penicillin and the sulphonamides have proved ineffective against this organism. Streptomycin or the later antibiotics may prove more beneficial.[24]

C. Miscellaneous Organisms

(i) Salmonella abortivo-equinus. The incidence of this organism seems to have receded considerably in Kentucky, no doubt owing to the almost universal adoption of preventive inoculation against equine contagious abortion.[10] The disease is absent in England and its incidence in South Africa is unknown.

(ii) Escherichia coli and Bacillus pyocyaneus have been isolated from the genital tract in a few barren mares [15, 20] in Kentucky causing vaginitis, endo-cervicitis, metritis and salpingitis. The incidence appears very low. Other organisms mentioned [14] do not appear to play any rôle of importance.

II. NON-INFECTED MARES

A. Mares Apparently Normal

A great many barren mares in Kentucky were found to be free from any organisms.[20] No reasons are advanced for this condition but in the light of later knowledge the following explanations may be advanced.

(i) *Genital infantilism* [17, 24, 38] — There is every likelihood that inadequate endometrial preparation for nidation must be regarded as forming an adverse environment for the growth of the embryo and must constitute a potent cause of early foetal death. This may be the condition encountered in the very young maiden mare or the maiden mare with a hard racing record. (Immaturity).

(ii) *Endometrial involution* — Infections, and perhaps hormonal deficiencies, lead to a destruction of the endometrial structure with disappearance of the uterine crypts. Implantation may become impossible. No work has been published on the physiological changes of the equine uterine mucosa before, during and after oestrum, work which is most essential in clearing up many of these aspects of the problem.

(iii) *Ovum* — Questions raised in this connection are (a) how long can an ovum live in a mature Graafian follicle, and (b) is there a possibility of its being lost after rupture (C.F. extra-uterine pregnancies of human), due to accident or due to a slight abnormality of the funnel of the Fallopian tube, and (c) is the ovum fairly resistant to a slightly adverse environment, e.g. increased alkalinity or acidity of the upper genital tract.

(iv) *Servicing* — The fact that higher fertility results from mating as near as possible to ovulation is now unquestioned. The determination of the time of ovulation, by rectal palpation, cervical

and vaginal congestion and cervical dilatation are already in use and have given excellent results. Servicing at the wrong time of the oestral period may result in infertility.

(v) *Heavy milkers* — Anoestrus during lactation is a common feature in many breeds and is apparently due to reflex inhibition of the pituitary from secreting gonadotrophins, the receptor nerve endings being situated in the teat substance and stimulated by pressure.[24] The liberation of gonadotrophins from the pituitary after parturition is strong enough to overcome the lactation inhibition and mares with bad breeding records should be carefully checked through what may be their only heat period before weaning. These mares usually come into oestrum normally shortly after their foals have been weaned.

(vi) The possibility of the stallion's infertility, complete or partial, should not be lost sight of. Over use may cause temporary infertility as well.[17, 38]

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STANDARDISED TICK NAMES FOR SOUTH AFRICA

Drawn up in 1952 by G. Theiler, Onderstepoort

In view of the increasing interest which is being taken in ticks by the layman, it has been decided to standardise the names of the commoner species, so that the same name will be used for the same tick throughout the country.

Latin Names	*Popular Name Adopted*	*Popular Names which Lapse*
The *Ixodidae*	The Shield ticks Die Skildbosluise	
Genus *Amblyomma*	Bont ticks Bontbosluise	
A. hebraeum	The South African Bont tick Die Suid-Afrikaanse bontbosluis	The Bont tick Die Bontbosluis
A. variegatum	The Tropical Bont tick Die Tropiese bontbosluis	The Variegated tick
A. pomposum	The Star Bont tick Die Ster Bontbosluis Portuguese "Caraca estrela"	The Angola Bont tick
A. marmoreum	The Tortoise tick Die Skilpadbosluis	
Genus *Aponomma*	The Reptile tick Die Likkewaanbosluis	
A. latum	The Snake tick Die Slangbosluis	
A. transversale	The Python tick Die Luislangbosluis	
Genus *Rhipicephalus*	The Brown tick Die Bruinbosluis	
R. appendiculatus	The Brown Ear tick Die Bruinoorbosluis	East Coast Fever tick The Brown tick Die Bruinbosluis
R. capensis	The Cape Brown tick Die Kaapse bruinbosluis	
R. evertsi	The Red-legged tick Die Rooipootbosluis	The Red tick Die Rooibosluis
R. evertsi mimetica	The South West Africa Red-legged tick Die Suidwes-Afrika Rooipootbosluis	

Latin Names	*Popular Name Adopted*	*Popular Names which Lapse*
R. oculatus	The Hare tick Die Haasbosluis	The Eyed tick
R. distinctus	The Dassie Brown tick Die Dassie-bruinbosluis	
R. sanguineus	The Kennel tick	The Tropical Brown Dog tick
	Die Hok-bosluis	Die Tropiese Hondebosluis
R. simus	The Glossy Brown tick Die Blink Bruinbosluis	The Black Pitted tick Die Pokdalige bosluis
R. follis	Die Karoo Brown tick Die Karoobruinbosluis	
Genus *Rhipicentor*	Hedgehog ticks Krimpvarkbosluise	
Genus *Hyalomma*	The Bont Legged tick Die Bontpootbosluise	
H. rufipes rufipes *H. transiens*	The Bont Legged tick Die Bontpootbosluise	
H. rufipes glabrum	The Pale Bont Legged tick Die Vaalbontpootbosluis	
The Genera *Boophilus* and *Margaropus*	The Blue ticks Die Bloubosluise	
B. decoloratus	The Blue tick Die Bloubosluise	
B. fallax	The Madagascar Blue tick The Malagas-bloubosluis	
M. winthemi	The Winter Horse tick Die Winter Perdebosluis	Lounsbury's tick Lounsbury's-bosluis The Winter tick Die Winterbosluis The Argentine tick Die Argentynse bosluis
Genus *Haemaphysalis*	The Eyeless ticks Die Ooglose bosluise	
H. leachi	The Yellow Dog tick Die Geel Hondebosluis	The Common Dog tick Die Gewone bosluis

Latin Names	*Popular Name Adopted*	*Popular Names which Lapse*
H. silacea	The Ciskei tick Die Ciskei-bosluis	The Fish - River - Bush tick Die Visrivier - ruigte-bosluis The Border tick Die Grensbosluis The "Transkei" tick Die Transkei-bosluis
H. aciculifer	The East African Eyeless tick Die Ooglose Oos-Afrikabosluis	
H. cooleyei	The Eyeless Dassie tick Die Ooglose Dassiebosluis	
The Genus *Ixodes*	The Russet ticks Die Roeskleur-bosluise	The Paralysis ticks Die Verlammingsbosluise
I. pilosus	The Sourveld tick Die Suurveldbosluis	The Paralysis tick Die Verlammingsbosluis The Bush tick Die Bosbosluis
I. rubicundus	Die Karoo Paralysis tick Die Karoo - verlammingsbosluis	
The *Argasidae*	Tampans	The Leather ticks
Otobius megnini	The Spinose Ear tick Die Stekelrige Oorbosluis	
Ornithodorus moubata	The Eyeless tampan Die Ooglose tampan	The Hut tampan
O. savignyi	The Sand tampan Die Sandtampan	The Eyed tampan
A. verspertilionis	The Bat tampan Die Vlermuistampan	
Argas persicus	The Fowl tampan Die Hoendertampan	The Fowl tick Die Hoenderbosluis
Larvae	Larva	"Seed ticks"
	Fynbosluisies Bosluislarwe	Saadbosluise, kiembosluise, peperbosluise, bosluisies

CASE REPORT

PYLORIC SPASM IN A DOG

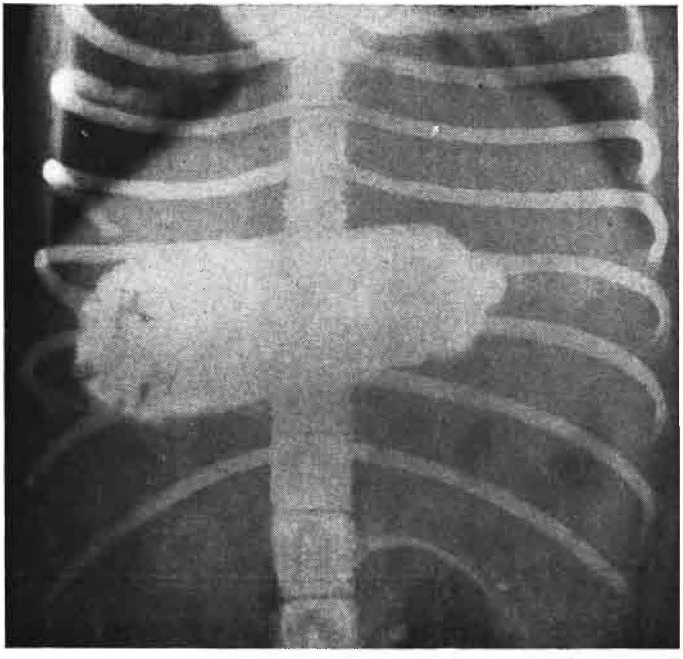
C. F. B. HOFMEYR
Pretoria

Pyloric spasm is of rare occurrence in the dog. No reference to this condition could be found in any of the standard textbooks consulted, except in that of Kirk ("Index of Diagnosis" 1939) p. 201–202.

The present case is of special interest in that it shows features different from those recorded by Kirk.

The Subject of this communication was a six-months-old male smooth-haired fox terrier in good condition, of very excitable temperament and very well cared for.

Fig. 1



History. The pup had shown for the previous three months an increasing tendency to vomit. Apparently as a result it had an increase of appetite. During the week or two preceding examination, vomition had become more and more forceful until the food was expelled a matter of a yard or more, a true projectile vomit.

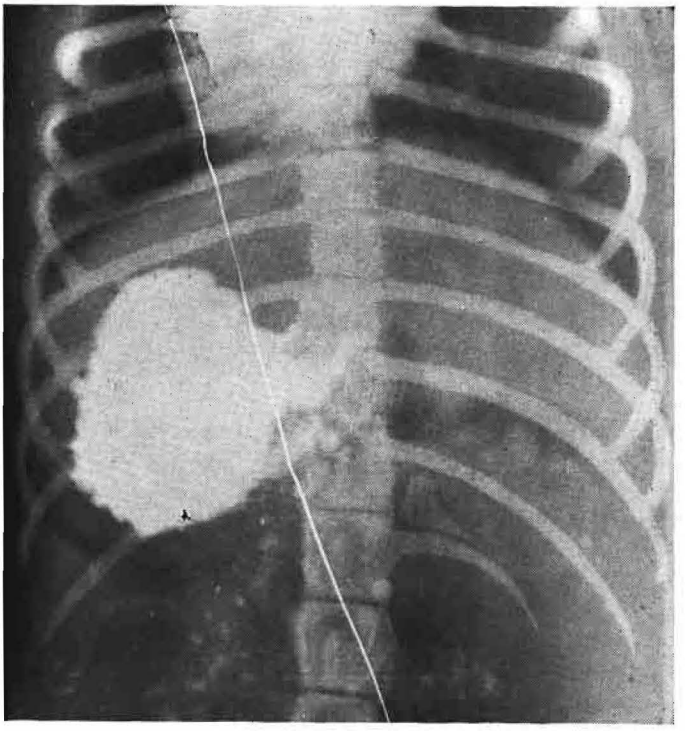
Clinical Examination. This was completely negative. The stomach could not be located by palpation as it was empty.

The possibility of pyloric stenosis was mentioned to the client and X-ray examination suggested.

X-Ray Examination. This was conducted as follows: The case, after having had it's last meal 15–18 hours previously, had shadoform (barium sulphate) administered **per os.** A skiagraph taken immediately, and subsequently at 10-minute intervals up to 30 minutes after the barium meal. All photos were similar (see Fig. 1) and no barium passed the pyloric sphincter in that time.

In order to confirm the results the same procedure was repeated the next day with identical findings.

Fig. 2



On the third day 1 drachm eumydrin (1–10,000) was administered, followed immediately by the barium. The first skiagraph was similar to those taken on the previous days, but the second, taken after 10 minutes, showed clearly that the barium was progressing down the duodenum (Fig. 2).

Eumydrin (1–10,000) 1 drachm a.c. was then prescribed for a few weeks. The vomition did not recur and the dog made a complete recovery.

Discussion. The projectile vomit is characteristic of pyloric stenosis in babies. This symptom in the dog immediately focussed suspicion on the pylorus. The patient's good condition was proof that if the suspicion was correct, the spasm was intermittent. This again excluded cicatricial contraction, tumours, foreign bodies, etc. The innervation of the pyloric sphincter being sympathetic, it is reasonable to expect the spasm to occur during periods of excitement, as when visiting a consulting room. This is borne out by the findings in the first two series of X-ray photographs. The relief of the spasm after the eumydrin strengthened the tentative diagnosis. In the writer's opinion, the complete and spectacular relief and eventual cure obtained by the use of this drug, finally confirmed the diagnosis of pyloric spasm.

In children the distinction between pyloric spasm and stenosis becomes arbitrary in that the former, if it exists long enough, causes such extensive hypertrophy of the sphincter, that it in turn leads to stenosis.

The history in the present case indicated intermittent spasm of the pylorus. With the eventual development of the projectile vomit, it was quite plain, that a certain amount of muscle hypertrophy must have been present in order to make the violent expulsion of the ingesta possible. Taking the course of this affliction in children as a guide, complete stenosis might have supervened soon.

Summary.

A case of pyloric spasm is recorded and illustrated with two skiagraphs.

Successful treatment with eumydrin is reported.

The case is briefly discussed.

CASE REPORT

DIAPHRAGMATIC HERNIA IN A FOX TERRIER BITCH

J. R. FREAN

Potchefstroom

Subject: Young adult primiparous smooth-haired fox terrier bitch in eighth week of pregnancy.

History: Shortly after conception she showed spells of breathlessness which became progressively worse. She lost condition rapidly and her appetite became capricious. She often retched after a meal. She showed a preference for a posture in which her front quarters were higher than the hind. Standing on her hind legs appeared to afford relief.

Examination: Animal in advanced state of pregnancy and in poor condition. Respirations forced. No heart sounds could be heard on the left side, but were pronounced on the right. Percussion on left thorax gave resonance.

Diagnosis: Diaphragmatic hernia aggravated by pregnancy.

The owner was advised to have the condition relieved by Caesarian section, but this he refused to have done.

About ten days later he advised me that the bitch had given birth to four pups of which two were born dead. A day or two later the bitch died.

DIAPHRAGMATIC HERNIA SHOWING ABDOMINAL ORGANS IN THE LEFT THORACIC CAVITY.
[Photograph by Mr. W. A. Verbeek of the College of Agriculture, Potchefstroom.

Post Mortem: When the left thoracic wall was removed, abdominal organs only were visible. The stomach and spleen, a loop of small intestine, the left lateral lobe of the liver, and a loop of uncontracted uterine horn were all in the left half of the thoracic cavity (see Fig.). Only when these organs were removed, did the left lung become exposed, and it was less than a quarter the size of the right lung.

CASE REPORT

A NOTE ON THE SOFT PALATE (PATALINUM MOLLE) AS A CAUSE OF DYSPNOEA IN RACE HORSES

J. B. QUINLAN, G. L. FAULL, D. BURGESS and I. BANKS
Cape Town

In this *Journal* (Vol. 20, 215-217, 1950) Quinlan, van Rensburg and Starke drew attention to two cases where paresis of the soft palate caused dyspnoea in race horses. Partial excision of the soft

palate removed the symptoms. Since that publication we have met with two further cases, a two-year-old locally bred filly, and a four-year-old Irish-bred one. Both have been operated on successfully. The former has been placed twice and the latter has run prominently within six months of operation.

In the former publication it was suggested that the condition may be similar in origin to laryngeal hemiplegia ("whistling" and "roaring") but that another branch of the vagus nerve, that supplying certain muscles of the soft palate (m. palatinus and m. levator palati), was involved. None of the four cases encountered and operated on suffered from laryngeal disease.

The suggestion that paresis of the soft palate may be closely associated with recurrent paralysis aetiologically is strengthened by the fact that our most recent case has become a "grunter", although there is no evidence of "whistling" or "roaring". This is the principal reason for the publication of this note. Our two latest cases are being kept under observation to ascertain if there should be any further developments.

CASE REPORT

AN INTERESTING HOOF LESION: A CASE OF FRACTURE OF THE OS PEDIS, COMPLICATED WITH HOOF CANKER

J. B. QUINLAN, G. L. FAULL, D. BURGESS and I. BANKS
Cape Town

Subject: Thoroughbred colt, two years old, admitted to hospital 22nd January, 1951.

History: The colt suddenly went lame on the near fore leg three months previously. At that time he was examined and treated by a farrier, and a foreign body was suspected. An opening was made through the sole at the median heel between the bar and the wall. The owner, a most intelligent and well educated horseman, described the condition as having become progressively worse from the time it was first treated. After some weeks, during which the underrun sole was frequently removed and cauterised with copper sulphate, the owner who was bringing a team of horses for the summer racing season at Cape Town, brought the colt with the team. At that time it was thought he was improving. In the meantime he had substituted sulphanilamide powder for copper sulphate. On arrival in Cape Town, after a five days' journey from Johannesburg, the colt was in great pain, practically carrying the leg. At this stage he was admitted to hospital.

Status praesens: Slight weight only was borne on the toe, or the leg was carried, during walking. There was marked swelling

around the coronet especially on the median aspect. The median bulb of the heel was swollen and very painful. Palpation of the hoof was greatly resented. There was separation of the sole from the wall at the white line, from the angle of the heel to the quarter and the toe on the median aspect. Unhealthy granulation tissue protruded in places. This was covered with sulphanilamide powder, partly cauterised and stained with copper sulphate when the outer crust was removed. The sole and wall were underrun with a greyish yellow, cheesy looking, evil smelling material. When this was removed the tissue underneath was greyish-yellow in colour. A diagnosis of hoof canker was made.

Treatment: The hoof was washed, painted with tincture of iodine and poulticed to soften the horn. 25/1/51: An operation under intravenous chloral hydrate and chloroform inhalation was carried out. The wall was removed by stripping to the coronary band from the cleft of the frog to the junction of the quarter and the toe. It was found that the lesion had reached the coronet at the junction of the quarter and the heel. The sole was removed inwards to the frog from the white line. All diseased tissue was removed with a curette. The hoof was protected with sterile gauze, while a shoe to which a protective sole-plate could be screwed was put on. The exposed area was painted over with tincture of iodine. When dry it was painted over with a mixture of potassium alum, copper sulphate, and lead acetate āā oz. jss, water oz. xx. A sterile gauze bandage was applied over the exposed area. Firm pressure was maintained by means of the sole plate and an elastoplast bandage. This dressing was repeated on the sixth and eleventh days. Subsequent dressings with sulphamezathine powder were done every four or five days until 22/2/51. At this stage the lesion was completely covered with horn and the dressings were discontinued. A Bier's bandage was applied to the cannon for an hour each day during the early stages of treatment. Five grains of arsenic were given daily in the food. The colt was walked for half an hour twice daily, beginning on 1/2/51, the hoof being heavily padded.

After the operation there was a gradual improvement in the lameness. A high grade lameness however persisted, although the site of the operation appeared entirely satisfactory. Careful search of the hoof revealed no residual cankerous area. The case began to be a puzzle. The idea of making an X-ray examination of the hoof had not arisen, since it was considered to be a straight case of canker. However, the history of the case and the high grade lameness might have suggested a complication as the continuous high grade lameness did, subsequent to the operation. The lameness became very markedly worse on 25/3/51. There was a soft area on the sole, just lateral to the centre of the toe, but there was no discolouration of the horn. The horn was thinned down over this area without exposing the sensitive sole. On 3/4/51

what appeared to be a piece of granulation tissue was noticed in the centre of the softened area. There was no purulent exudate. A further operation was decided upon.

6/4/51: The operation was carried out under similar anaesthesia. The wall was stripped from the central portion of the toe to the junction of the toe and the lateral quarter for a distance of two inches upwards from the bearing surface. On stripping the wall, what appeared to be granulation tissue came away with it. The area was approximately one-and-a-half inches by three-quarters of an inch. Attached to the granulation were some pieces of bone broken from the border of the os pedis, varying in size from a pin's head to a small pea. The bone from which the pieces had broken was whitish-yellow in places, with areas from which the granulations, now partly fibrous tissue had torn away between. The pedal bone was curetted until all the exposed area was smooth and bleeding. It was dusted with sulphamezathine and aureomycin powder. The area of exposed lamina was similarly treated. An aseptic pressure bandage was applied. The dressings were repeated every three to five days until 20/5/51 when the lesion was completely covered with horn. The area over the border of the os pedis, which was curetted, healed slowly, but the repair went on per primam.

The colt has made a complete recovery. He is now quite sound. It will take approximately three months before the defect in the horn disappears.

The case is of interest since there was a lesion similar to hoof canker, complicated with a fracture of the border of the os pedis. It appears possible, from the history, that the original lesion was a fracture of the os pedis. The septic lesion was secondary and set up by the farrier exposing the sensitive tissue, followed by unsuitable treatment and insufficient protection, which allowed the entrance of infection over a period of three months.

CASE REPORT

FOREIGN BODIES IN RUMEN

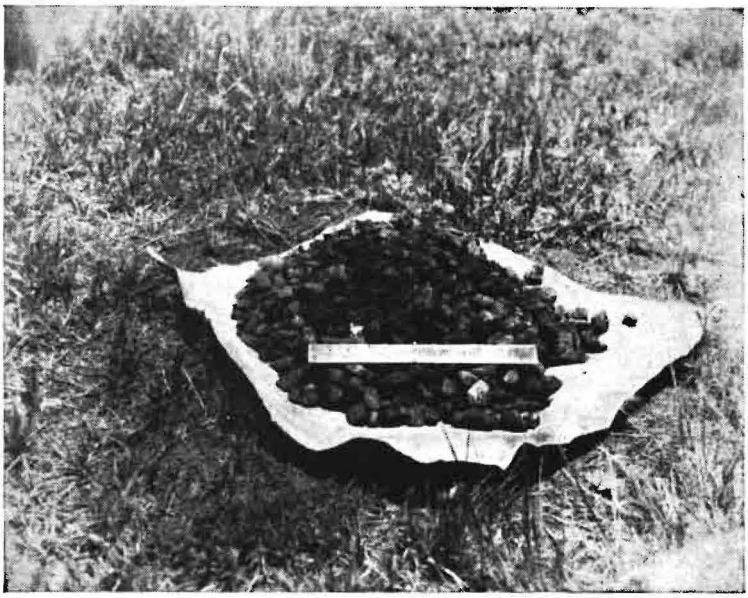
J. R. FREAN
Potchefstroom

Subject: Two year old steer.

History: The animal formed one of a group of experimental steers at the College of Agriculture. For several months he had been a bad-doer, and it was decided to slaughter him as his condition became progressively worse.

He was shot, and while being flayed, a labourer came on the scene,

and said he wanted to see the stones in his stomach. On being asked why, he said that during dipping he had heard noises in this animal's stomach resembling stones in a bag.



FOREIGN BODIES IN THE RUMEN OF A STEER.
[Photograph by Mr. W. A. Verbeek.

On opening up the rumen, this was actually found to be the case. The rumen contained a relatively small quantity of food, but a large number of stones and other foreign bodies, which, in all, more than filled a 4 gallon petrol tin. The mass weighed 64 lb.

OBITUARIES

WILLEM GERHARDUS VAN ASWEGEN (1909-1952)

It is with deep regret that we have to record the death on February 27th, 1952, of Willem Gerhardus van Aswegen at the comparatively early age of 42. He was born in Germiston and after taking a B.Sc. degree in Chemistry at the Pretoria University in 1930, he took the B.V.Sc. degree in 1936. He joined the State service and was stationed first at Umtata and subsequently was in charge of the research station at Nooitgedacht, Ermelo, from 1937 to 1941. In the latter year he resigned to take up a position as a veterinarian in the service of Pretoria Municipality, which post he occupied at the time of his death.

In 1947 he went to Greece in charge of a consignment of horses and mules for U.N.N.R.A., subsequently visiting abattoirs in different European countries.

He was studious by nature and at the same time a keen sportsman, having played Currie Cup cricket and hockey for the University first team. He was also a keen tennis player and a very enthusiastic gardener.

To his widow, father and two sons, aged nine and two respectively, we tender our deepest sympathy in their great loss.

SAMUEL BANCROFT WOOLLATT 1876–1952

With the passing of Dr. S. B. Woollatt the veterinary profession in South Africa has lost another of its pioneers. He came of English farming stock and was born in Hertfordshire on March 4th, 1876. After obtaining his diploma with distinction in 1896, he came to South Africa in 1898 and joined the Natal Veterinary Department. During the Anglo-Boer War he served in the Veterinary Corps with distinction and attained the rank of major. In 1901 he was appointed Chief Veterinary Officer for Natal at the early age of 25. He was a pioneer in the control of rinderpest and East Coast Fever and considerably assisted in the introduction of the dipping system for the latter disease in Natal.

In 1908 he resigned from the government service and took up farming, first at Stanger's Hoek and later at Connington, Rosetta. He made a name for himself as a breeder of dual-purpose Shorthorns (Bates Type) and became a senior judge of the Shorthorn breed.

He became Managing Director of the Federated Meat Industries after having previously been chairman of the Farmers' Co-operative Meat Industries, but retired from the post in 1932

to take up his beloved farming again. He was in charge of a Commission appointed by General Smuts to investigate conditions in South West Africa when the mandate was assumed. Amongst his many activities were the Presidentship of the Natal Agricultural Union of which he became a Life Member, Presidentship and Life Membership of the Mooi River Farmers' Association and the Nottingham Road one. He served on many advisory boards from time to time.

A good sportsman, his great love was polo which he played until he was 64, and Connington became a centre for all the neighbouring young people interested in the game.

He leaves his wife and four children as well as nine grandchildren, to all of whom we extend our deepest sympathy in their great loss.

MICHAEL DAVID PFAFF

It is with sincere regret that we note the death on the 27th December, 1951, of Dr. Michael David Pfaff, eldest son of Dr. and Mrs. George Pfaff, and to them the profession extends its deepest sympathy.

Michael, 23 years of age and on the point of completing his medical internship at Addington Hospital, Durban, showed pluck and fortitude of an astonishingly high order. Early in 1948 he learned that he was suffering from chronic leukaemia and that he had not long to live.. In spite of this he elected to carry on with his medical studies, and after graduation to engage in the arduous duties of a houseman. It is given to few of us to have courage like this.

J.H.M.

LETTERS TO THE EDITOR

"Igava",
P.O. Box 25,
Marandellas,
Southern Rhodesia,
27th February, 1952.

The Secretary,
The South African Veterinary Association,
Onderstepoort.

Dear Sir,

The Marandellas and Macheke farmers are desirious that a Veterinary Surgeon should establish himself in this district. To this end, certain farmers have formed a Veterinary Association for the purpose of guaranteeing amongst themselves a minimum income of £1,250 per annum to a Veterinarian, to encourage him to start practice in the district.

The Marandellas-Macheke district is a flourishing farming area some 50 miles east of Salisbury. It is good stock country, there are a large number of dairy farms, some half dozen Pedigree Herds of various breeds and a few Racing and Breeding Stables in the District. Marandellas is a very rapidly growing small town.

The opportunities for a Veterinarian to start private practice are good, the practice should rapidly develop — given the right man. Especially as the district is growing rapidly, becoming more intensively settled and is becoming one of the biggest milk-supplying areas for Salisbury.

The Association requires a fully qualified Veterinary Surgeon, who has had three or four or more years practical experience in the field after leaving College. The Association is prepared to enter into a contract for two years or more with a Veterinarian and to guarantee him minimum earnings of £1,250 per annum.

I would be glad if you would circularise your members about this position, asking anyone who is interested to apply to the above address with copies of references, etc.

Yours faithfully,

J. F. RUTHERFORD.

KALWING

In die verlede het ek van my kollegas hoor sê dat hulle nooit 'n geval van kalwing op gee nie.

Waar ek nou in 'n streek praktiseer waar ek tot 6 kalwings in een week doen en dikwels 'n paar op 'n dag, voel ek dat dit nie onvanpas is om hier 'n paar punte te benadruk nie.

'n Kalwing kan nie as 'n sukses beskou word as die koei lateraan vrek nie. 'n Veearts behoort min of meer konstante sukses te hê, mits die koei natuurlik nie deur die eienaar beseer is nie.

Die eerste punt wat ek wil benadruk is die posiesie van die koei. In die staande posiesie is dit altyd die maklikste om die posiesie van die kalf reg te kry en ook om die instrumente te hanteer. Daar dit egter dikwels

nie moontlik is om die koei staande te hou nie, veral gedurende embriotomie, is dit nodig om die koei in so 'n posiesie te laat lê dat sy nie die kalf vas druk nie. Dit is wenslik om vroegtydig 'n paar sakke te laat stop. As die koei dan gaan lê, sit die sakke onder haar kruis maar nie onder haar pens nie. In daardie posiesie lê die kalf vry en is dit nie nodig om die koei op haar rug te draai nie. Ook lê die vulva dan hoog en is dit baie makliker om te werk.

Vermy omgewings waar kaf en strooi rond lê. Dit sal altyd op waai en die veld besmet. Probeer altyd die koei in 'n skoon stal met 'n sementvloer kry.

Die volgende belangrike punt is asepsis. Higiëne is trouens die basis van goeie resultate op byna enige gebied en dit word so dikwels vergeet. Die meeste ontsmettingsmiddels is in die verdunnings waar dit by kalwings gebruik word meer 'n troos as 'n ontsmettingsmiddel. Sulke voorwerpe soos kalwingstoue, wat deurweek is van vloeistowwe van die koei en kalf, vorm 'n ideale bodem vir die bakterië. Alle toue en strumente moet dus gekook word. Dit is baie handig om 'n klein drommetjie te hê waarin die toue en kleiner instrumente in 'n outoklaaf of gewone hoë-druk-pot gesteriliseer kan word. Die embriotoom en lang instrumente, moet 'n spesiale houer hê waarin hulle maklik met 'n klein bietjie gekonsentreerde ontsmettingsmiddel bedek kan word.

Epidurale verdowing is aangewese by enige verkeerde posiesie en by embriotomie. Dit is meer effektief as dit tussen die kruis en stert werwels gegee word, as yvoorbeeld tussen die eerste en tweede stertwerwels. Oormatige hoeveelhede moet nie gegee word nie, omdat dit die koei laat val. 5 kubieke sentimeter van 'n 2% oplossing is gewoonlik voldoende.

Slegte higiëne en beskadiging van die slymvlies, is verantwoordelik daarvoor dat die vulva baie gou toe swel. Vermy dus besering van die slymvlies. Daarvoor is 'n goeie verloskundige room onontbeerlik en dit moet vrylik kebruik word. Werk doelbewus. Moenie doelloos in die baarmoeder rondkarring nie. Moenie oorhaastig wees om 'n embriotomie te doen nie. Dit is ook gewoonlik baie makliker om die kalf heel uit te haal en minder skade word daardeur aan die koei gedoen. Die beste instrumente is die praktisyn se twee hande.

As trekking toegepas word, trap teen die koei se sitbene. Dit het die neiging om die deurgang deur die pelvis te vergroot, terwyl as die koei aan die kop vas gehou word, het dit die neiging om die deurgang kleiner te maak.

Ooghakke is 'n onontbeerlike deel van die uitrusting. Waar 'n kalf met sy kop op sy sy lê, met sy bek so ver vorentoe dat 'n mens dit nie kan by kom nie, kan die posiesie gewoonlik maklik reg gekry word deur die ooghaak in die agterkant van die oog te haak en 'n bietjie te trek totdat jy die bek kan beet kry.

Waar instrumente gebruik word, moet hulle uiters versigting hanteer word en embriotoomdrade moet nie te veel keer gebruik word nie omdat hulle dan die koei kan beskadig.

Die moeilikste gevalle, is gewoonlik waar die kalf te groot is om uit te kom. Die kop kan gewoonlik sonder moeite afgesaag word. Die verdere metode van opsaag van die kalf wat in „Benesch" beskryf word is nie altyd so maklik nie. Herhaalde mislukte pogings om die draad in posiesie te kry, kan ly tot beskadiging van die koei en mislukking van die operasie.

Die mees doeltreffende metode vind ek in die volgende: Saag eers die kop af. Haal dan die voorbene af, op die onderhuidse metode. Dikwels sal die kalf dan al kan uit kom tot by sy heupe. Is hy nog te groot, steek

dan die hand binne in sy borskas en haal die hart en longe uit. Breek deur die midderif en haal die organe van die maagholte uit. As hy nog te groot is, haak 'n haak aan die ribbe en breek hulle een vir een. Die borskas val nou saam. Trek nou die kalf uit tot net sy heupe, haak en sny hom agter die vulva van die koei af. Dit is nou maklik om die embriotoomdraad tussen die agterbene deur te sit en die agterlyf in twee helftes te saag. Die helftes sal dan sonder moeite uit kom.

Waar 'n te groot kalf agterstevoor lê, is dit net so maklik om die agterbene op die onderhuidse metode af te haal. Dikwels, as eenbeen af is, sal die kalf al kom tot by sy bors. Sny hom dan af en haal die organe van agter af uit.

Weer kan die ribbe gebreek word as dit nodig is en die res volg maklik.

Waar kalwers misvormd is moet 'n mens jou diskressie gebruik. Vingermesse is soms onontbeerlik om die pad vir die draad te maak, wat anders bly aan die af gly.

J. P. KRIEL.

Wellingtonweg 39, Durbanville.
8 Augustus 1951.

PROFESSIONAL INSURANCE

The Council of the S.A.V.M.A. has made inquiries about Professional Insurance for members of the S.A.V.M.A. in response to requests received. Three types of policy are offered by Insurance Companies.

1. *Professional Liability Insurance*: This covers claims against a Veterinary Surgeon in respect of any neglect, default or error on the part of the Veterinary Surgeon or his servants in the conduct of his profession and legal expenses in contesting such claims.

2. *Accident and Sickness Insurance*: This insures against sickness and accidents.

3. *Motor Car Insurance.*

The premiums which are charged depend to a large extent on the number of persons taking out the policies. The larger the number of policies which are taken out the lower the premiums will be.

Any members interested in these policies can obtain further particulars from the Secretary, S.A.V.M.A., P.O. Onderstepoort.

for MASTITIS

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Each ready-to-use, easy-to-use, rolled-in infusion tip tube of Aureomycin Crystalline Ointment Lederle For Udder Infusion contains twice as much Aureomycin as formerly at no increase in price.

Aureomycin is effective against more bacteria commonly found in mastitis than penicillin. One infusion is active for more than 48 hours.
Infusion of infected quarters with Aureomycin Crystalline Ointment, in most cases, results in the production of saleable milk.

In cases of acute septic mastitis, in addition to udder infusion, the injectable form of Sulmet* Sulfamethazine Lederle should be used, by or on the advice of a veterinarian. Sulmet Oblets* may be given as subsequent treatment.

Veterinary Aureomycin Ointment may be used for the prevention of superficial udder infections. When obvious injuries to the udder or teat occur, it is advisable to apply this ointment locally to the wound. At the same time infuse each quarter so affected with one full tube of Aureomycin Ointment as a preventive measure against mastitic infections.

For maximum efficiency in the use of Aureomycin Ointment For Udder Infusion and best management practices and disease-control procedures for avoidance of reinfection, consult your veterinarian.

Write for folder on Aureomycin Ointment.

* Reg. U.S. Pat. Off.

Animal Industry Section

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ABSTRACTS FROM CURRENT LITERATURE

PROGRESS OF ARTIFICIAL INSEMINATION IN AMERICA

The rapid progress made by Artificial Insemination in America is reflected by the following table:—

Year	*Units*	*Herds*	*Bulls in Use*	*Cows Listed*
1939	7	646	33	7,539
1941	42	5,997	237	70,751
1943	99	23,448	574	182,524
1945	195	43,998	729	360,732
1947	608	140,571	1,453	1,125,040
1949	1,263	316,177	1,940	2,412,160
1951	1,653	476,224	2,187	4,077,706

It is significant that the number of bulls in use has not increased proportionately with the increase in the number of cows. Thus in 1939 there was one bull to 228 cows whereas in 1951 the ratio had increased to one bull for 1,864 cows.

With regard to the effect of A.I. on milk production the author points out that the average milk cow in U.S.A. produces little over 200 lb. butterfat annually. Records for 758 sires used in A.I. show that the daughters of over 80% of these sires annually produce between 375 and 525 lb. butterfat. The average production of the daughters of everyone of these 758 sires was well above the national average of 200 lb.

The income from a cow annually producing 400 lb. butterfat is 2½ times as great as one producing only 200 lb.

(D. E. Hirsch: "Dairy Breeding Co-ops in 1950-51"; U.S. Dept. of Agriculture Special Report No. 235.)

DEHORNING OF CATTLE

At a meeting of the Council of the National Veterinary Medical Association held in Edinburgh on July 13, 1951, the following resolution sent by the Technical Develpoment Committee was adopted:—

"That this Committee having collected a considerable volume of evidence on various methods of dishorning cattle, express disapproval of the method of dishorning involving the use of a ligature whether or not an anaesthetic is given at the time of application, on both humane grounds and lack of efficiency."

On further discussions reported to the Council the Technical Development Committee recommended that dehorning must be carried out under an efficient anaesthetic, the choice of which must remain within the discretion of the veterinary surgeon concerned.

(Vet. Record, Volume 63, No. 32, 11th August, 1951.)

HYALURONIDASE IN DEHORNING

The authors dissolve 3 mgm. "Rondase" (Hyaluronidase-Evans) in 5 cc. distilled water, and add 1 cc. of this solution to 100 cc. of 5% planocaine; 5 cc. of this is injected at the appropriate site.

The resultant degree of anaesthesia is remarkable compared with the

varying degrees previously obtained. In a large number of cases they have experienced no instance of imperfect or partial anaesthesia.

(B. D. Bassett & H. F. Farrell; Vet. Record, Vol. 63, No. 49, 8th December, 1951.)

AGALACTIA IN SOWS

According to the author this is usually caused by excess carbohydrate and low protein intake during late gestation.

In simple agalactia, milk flow can often be started with 2.5 cc. posterior pituitary extract and 2.5 cc. anterior pituitary extract injected deep into the muscles with correction of the diet. Combined pituitary extract injection is also helpful in sows that show cannibalistic tendencies or that refuse to nurse their newly born young.

(A. H. Quin: Vet. Medicine, Vol. 46, No. 4, April, 1951.)

INDUCTING LACTATION WITH CHORIONIC GONADOTROPHIN

A case is reported in which a sow, after farrowing, yielded no milk although the mammary gland was tense and hyperaemic. The intramuscular injection of 1,500 i.u. chorionic gonadotrophin caused milk to flow freely.

(W. L. McDonald: Irish Vet. J., Vol. 5, No. 4, April, 1951.)

ANAESTHESIA OF THE BOVINE TEAT

Very successful anaesthesia of the teat in operations for the repair of lacerations is claimed by the author by the injection of a local anaesthetic into the teat canal. He uses 10 cc. of 1% cocaine hydrochloride, but gets equally good results with procaine hydrochloride.

The milk is first drawn off with a teat syphon, and with this in situ the anaesthetic is injected slowly. After 5 to 10 minutes the external surface of the teat is tested for anaesthesia.

(G. Dykes: British Vet. Jl., Vol. 107, No. 10, Oct., 1951.)

BLOOD IN MILK TREATED WITH FORMALIN

The author claims to have treated successfully, with immediate results, 20 cows giving bloody milk, by intravenous injection of 500 cc. of a 2% formalin solution. Dyspnoea may be marked, and if so the injection should be stopped at that stage.

(J. E. Fieser: Vet. Med., Vol. 42, No. 8, 1947.)

INTRAVENOUS USE OF FORMALIN AS A HAEMOSTATIC IN DOGS

The use of formalin as a haemostatic agent was tested in 20 native dogs.

The blood coagulation time which averaged 2 mins. 29.2 seconds before the injection of formalin dropped in 15 minutes after injection to an average of 23.5 seconds. Thereafter the coagulation time increased continuously in 3 to 4 hours to the pretreatment level.

The dose was about 1 cc. per k.g. bodyweight of a 5% solution of formalin.

The formalin was found to produce no permanent ill-effects.

[A. C. Gonzaga & A. R. Galuten: Indian Vet. Jl., Vol. 27 (1951), pp. 411-416.]

COLONIAL RESEARCH STUDENTSHIPS

1. The Secretary of State for the Colonies proposes to offer in 1952 a limited number of POST-GRADUATE STUDENTSHIPS tenable at a British University or research institute or organisation, either in the United Kingdom or overseas, for periods of up to two years, in preparation for research appointments in the Colonial territories in the following fields:

(a) Fisheries.
(b) Soil Science.
(c) Agriculture.
(d) Ecology.
(e) Stored Products Entomology.
(f) Insecticides, Fungicides and Herbicides.
(g) Veterinary Science.

It would be a condition of the award that the student undertakes, if so required within the 6 months immediately following the conclusion of the studentship period, to serve in a research appointment for not less than three years in any Colonial territory selected by the Secretary of State. During the tenure of the studentship a maintenance allowance is payable at the rate of £300 per annum (£360 per annum if training is at Oxford, Cambridge or London), with the addition for a married student of £110 per annum marriage allowance plus children's allowances. These allowances are all tax free. Provision is made separately for the payment of fees.

2. Candidates for Veterinary Research Studentships should hold a veterinary qualification registerable with the Royal College of Veterinary Surgeons. A candidate taking a degree this summer may apply before the result of the degree examination is known.

3. Application forms are obtainable from Under Secretary of State, Colonial Office (Research Department), S.610, Sanctuary Buildings, Great Smith Street, London S.W.1. Completed applications should reach the Colonial Office not later than 31st March, 1952.

BOOK REVIEWS

QUESTIONS AND ANSWERS — VETERINARY. Edited by J. V. Lacroix and H. Preston Hoskins. American Veterinary Publications Inc., Evanstan, Ill., U.S.A., 1951, 210 pages. U.S. prices 4.00 dollars.

On the title page of this unusual book appears in brief what it sets out to present, viz., " replies by 138 authorities to more than 500 selected questions submitted by readers of the North American Veterinarian."

The subject matter covers a very wide field and includes answers to a great variety of medical, surgical, gynaecological, obstetrical and toxicological queries on points which have puzzled individual veterinarians practising in the United States. These are grouped on the basis of species. The sections or " chapters " are thus: bovine, equine, porcine, ovine — caprine, canine-feline, avian and miscellaneous. Reference to any particular point is facilitated by a carefully compiled index.

The questions and answers have been selected from those appearing in the North American Veterinarian during the period 1945 to 1951. Veterinary science, like human medicine, is a dynamic organism, with the consequence that no book on these subjects, published at any moment can remain completely up to date for any length of time. One finds here, for instance, that penicillin in some of the replies is still regarded as an expensive drug and that the use of the newer antibiotics is not given its due weight. For the same reason too, a South African veterinarian, so accustomed to dealing with atony of the rumen in cattle, will note the absence of any mention of the value of acidification of the ruminal contents in this condition.

From its very nature it will be obvious that this book is not intended for the as yet unqualified student, as it presents no systematic description of diseases, operative procedures, treatments and the like. It is essentially for the qualified man who has been practising for anything from six months to sixty years. He cannot fail to derive benefit from the perusal of its pages nor fail to be stimulated by many of the replies. He may not always agree, but some of the treatments and techniques given may well cause him to re-evaluate some of his own habits and ideas.

Your reviewer will certainly look forward to the next selection of " Questions and Answers ".

W.D.M.

RIFT VALLEY FEVER*

M. W. HENNING
Onderstepoort

Rift Valley fever is an acute, infectious disease principally of sheep and cattle, causing a heavy mortality in young lambs and calves, and abortion in pregnant ewes and cows. It is characterized by a short incubation period, extensive, non-purulent, necrotic changes in the liver, a leucopenia, and sometimes by the presence of acidophilic, intranuclear "inclusions" in the liver cells. It has a wide host range, including the human being and the monkey, and is readily transmissible to several species of rodents. Under natural conditions human beings may become infected during the course of an epizootic among domestic animals, or by handling infected material. Illness in the human being may be the first indication of the existence of an epizootic of Rift Valley fever in a particular locality.

The disease is caused by a pantropic virus which can be fixed in nervous tissue by serial passage in mice. This virus can also be adapted to the developing chicken embryo. Transmission under natural conditions is probably effected by an arthropod vector, most likely by the mosquito, several species of which have already been incriminated.

HISTORICAL. Montgomery (1912) and Stordy (1913) were the first to report the existence of an acute and highly fatal disease of lambs on the Government Farm at Naivasha and on other farms in the Rift Valley. This disease appears to have been known in the Rift Valley for many years, usually occurring during wet seasons. Sometimes it was confined chiefly to lambs but in other outbreaks cases of abortion and death were reported in adult sheep and cattle; at the same time an influenza-like malady was noted in human beings. Montgomery (1912) suggested that the disease was distinct from Nairobi sheep disease. But it was not until Daubney, Hudson and Garnham (1931) gave a detailed description of an extremely virulent epizootic in young lambs and adult sheep on a farm north of Lake Naivasha in the Rift Valley, that its cause was realized. All the workers engaged in this investigation contracted the disease, and further enquiry revealed that most of the natives employed as shepherds in the infected area had suffered from a similar illness. Approximately 200 human cases were brought to their notice.

A few years later Daubney and Hudson (1933) investigated an outbreak of Rift Valley fever in cattle about 60 miles from Lake Naivasha. Their attention was directed to the existence of the disease by the incidence of human cases on the same premises where cases of abortion in goats had occurred.

* To be printed in "Animal diseases in South Africa." Published by courtesy of the Central News Agency.

Rift Valley fever was not known in South Africa before 1951 when several outbreaks of a strange and unknown disease were reported in the Western Free State by State Veterinarian van der Linde. Later similar outbreaks occurred in the Western Transvaal and Bechuanaland. Many of these epizootics were attributed to enterotoxaemia and bluetongue, but there was very strong evidence to show that some were caused by a disease not previously encountered in the Union. In several of the outbreaks very young lambs died in large numbers, or adult ewes either died or aborted. In cattle the disease was characterized by abortion, hyperthermia, abdominal pain, blood-stained nasal discharge, stomatitis, coronitis and photophobia. Some of these cases ended in death (Alexander 1951).

The first definite evidence that an unusual disease had made its appearance in the Union was furnished when five of seven persons assisting with an autopsy of a bull that had died on a municipal farm, Rietvlei, developed an influenza-like disease (Mundel and Gear, 1951, Alexander, 1951). The farm Rietvlei was located about ten miles from the centre of Johannesburg and about four miles from the Palmietfontein airport. The bull was noticed sick for about two days and manifested violent abdominal pain before it died. The post mortem lesions described were small sub-epicardial, sub-endocardial and sub-serous haemorrhages, oedema of the gall-bladder and focal necrosis of the liver.

The similarity of this disease to Rift Valley fever was readily recognized by workers at Onderstepoort. Blood and organs from the affected bull were examined histologically and various laboratory tests were performed. These included animal transmission, filtration and serum neutralization tests. In addition pathological specimens previously submitted from the Free State and other infected areas were examined. At the same time sera from the five patients were examined by workers of the South African Institute for Medical Research. These tests revealed conclusively that the bull, the five human patients, and some of the animals in the Free State and other outbreaks had suffered from Rift Valley fever. Virus was isolated from one of the Rietvlei patients, and it was further established that several workers at Onderstepoort and in the field who had handled infected animal material had contracted the disease.

DISTRIBUTION. Apart from Kenya where the disease was first recognized by Daubney, Hudson and Garnham (1931) Rift Valley fever has a wide distribution in Africa. Findlay, Stefanopoulo and MacCullum (1936) showed, by means of serum neutralization tests of sera of African natives, that the disease existed in the Anglo-Egyptian Sudan, Uganda, French Sudan, and French Equatorial Africa. They could not find any trace of its presence in the countries along the east coast of Africa. Smithburn, Haddow and Gillett (1948) isolated the virus from different batches of wild-caught mosquitoes from the Semliki Forest of Western Uganda.

During 1951, when the disease made its first appearance in South Africa it seemed to have been particularly prevalent in the "pan-veld"

area where the existence of several small pans furnishd an excellent breeding ground for mosquitoes during wet seasons.

The disease does not occur under natural conditions outside Africa, but several cases of infection in laboratory workers have been reported in America, Europe and Japan.

ETIOLOGY. On account of the necrotic changes in the liver Daubney and his co-workers (1931) at first thought that the cause of the disease might be a Salmonella infection; but they soon determined that small doses of blood, liver and spleen of affected animals were highly pathogenic for susceptible animals and that the infective agent could pass Chamberland filters up to grade L11.

Broom and Findlay (1933) showed that the size of the Rift Valley fever virus particle, estimated by means of gradocol membranes, lay between 23 and 35 millimicrons.

For preserving the activity of the virus over long periods Kitchen (1934) advised desiccation of serum-virus in vacuo from the frozen state.

MacKenzie (1933) succeeded in cultivating the virus for 13 consecutive generations in a medium composed of chick-embryo and Tyrode's solution. The characters of the virus remained unaltered during the procedure and there was no loss of titre. Saddington (1934) also cultivated the virus in vitro, the medium used being Tyrode's solution and minced ten-day old chick-embryos. He further reported the cultivation of Berkefeld filtrates of the virus in the chorio-allantoic membranes of chick-embryos.

The virus of Rift Valley fever is normally pantropic, having a selective affinity for the parenchymatous cells of the liver in which it causes an extensive necrosis. MacKenzie and Findlay (1936) have shown that the hepatotropic attribute of the virus can be changed to neurotropism by serial intra-cerebral passage in mice. After 30 mouse passages the virus becomes fixed for nerve tissue and when inoculated intra-cerebrally in mice invariably produces an encephalomyelitis without liver necrosis. When this virus is administered to Rhesus monkeys by the intra-cerebral or intra-nasal routes it sets up a fatal encephalomyelitis ,but when given intra-peritoneally the monkeys exhibit only a slight fever reaction.

Smithburn (1949) confirmed that strains of Rift Valley fever virus passaged serially by the intra-cerebral route in mice acquired enhanced neurotropism with a concomitant reduction in hepatotropic affinities. The intra-peritoneal inoculation of the neurotropic virus in mice resulted in an increased resistance to the intra-cerebral inoculation of neurotropic virus and complete immunity to the hepatotropic virus.

The neurotropic adaptation of the virus resulted in a profound modification of its affinities for the tissues of lambs. Whereas the pantropic virus invariably entered the blood stream the neurotropic virus did not. Moreover, the neuro-virus caused no reaction of any consequence when inoculated into sheep. The adaptation of the virus to nerve tissue was associated with a decline in antigenic potency, the pantropic virus apparently inducing a higher titre of antibodies.

Nevertheless, an adequate antigenic potency was retained by the neuro-virus to stimulate the formation of sufficient specific antibodies in sheep for their protection against the effects of the pantropic virus.

Kitchen (1950) found that virus up to the 50th intracerebral mouse passage exhibited both tropisms when inoculated into Rhesus monkeys. During subsequent passages in mice the neurotropism progressively increased while the pantropism progressively decreased. At the 81st passage neurotropism predominated, the pathogenicity of the virus for the monkey has disappeared, and circulation of the virus could no longer be demonstrated in an inoculated monkey. After the 90th generation the virus appeared to be completely fixed to the nervous tissue. Henceforth it was unlikely to circulate in the blood stream or to exhibit pantropism, so that insect vectors could not acquire the infection. A laboratory worker, however, became infected with the 68th neuro-variant by the intranasal route. On the first day of his illness this virus exhibited both tropisms for mice — but on the fourth day only the heptatotropic property could be demonstrated. It was apparent therefore, that there was a tendency for both the human being and the monkey to cause a revival of the hepatotropic property.

TRANSMISSION. Daubney, Hudson and Garnham (1931) showed that Rift Valley fever could be transmitted regularly to susceptible animals by the sub-inoculation of infective blood or serum. But they found that susceptible sheep kept in intimate contact with affected sheep failed to contract the disease. Even lambs nursed by ewes showing clinical symptoms did not become infected. Sheep screened in mosquito-proof cages and exposed in infected localities failed to contract Rift Valley fever, whereas sheep kept unprotected in the same environment became infected. Moreover, when susceptible sheep were moved from valleys and low-lying areas, where the disease was prevalent, to pasture situated at a higher altitude, no further cases of illness occurred.

From these observations they inferred that there was probably some arthropod vector operating in low-lying areas, and that this arthropod was absent at the higher altitudes. This led them to undertake the systematic trapping of mosquitoes in the infected localities for transmission experiments. Several hundreds of mosquitoes belonging to different species were caught and tested, but only one of the *Taeniorhynchus* species could be incriminated (Daubney and Hudson, 1933). Mulligan (1937) reported that a percentage of Aëdes species, collected in an infected area during an epizootic, might harbour the virus, but all attempts at transmission of the virus by bite failed.

Later Smithburn, Haddow and Gillett (1948) isolated Rift Valley fever virus from six different catches of mosquitoes from the uninhabited Semliki Forest in western Uganda. The mosquitoes involved included six species of the genus *Eretmapodites* and three of the genus *Aëdes*. They believed, however, that species of *Eretmapodites* were the most likely vectors. They could find no evidence of infection in human beings living in the vicinity and assumed that they were

dealing with the mosquito phase of an epizootic probably involving wild animals. Smithburn, Haddow and Lumsden (1949) further demonstrated that culicine mosquitoes of the *Eretmapodites chrysogastor* group were able to transmit the virus of Rift Valley fever from lamb to lamb, lamb to mouse, mouse to mouse, and mouse to lamb by bite.

Although the evidence implicating arthropods, particularly mosquitoes of the genus *Eretmapodites* as the most likely vectors to farm animals under natural conditions is very strong, there is much evidence to prove that the handling of infected material is a common means of infection of man. Daubney and Hudson (1932), using filtered ovine blood, reported the transmission of Rift Valley fever to a human volunteer. It is well-known that several laboratory workers have become infected after handling infected material in spite of the adoption of careful precautionary measures, such as the use of rubber gloves and mask when performing an autopsy. Francis and Magill (1935) believe that Rift Valley fever virus may gain entrance to the human body via the respiratory tract. They described three such cases. One of these was a laboratory assistant who apparently had acquired the infection via the respiratory tract whilst engaged in scraping and painting an animal room in which experimentally infected animals had been housed three months previously. But it is likely that infection may enter the tissues in various other ways, e.g. through the skin and mucous membranes. Sometimes the mode of entrance remains obscure. Thus Freed (1951) reported a case where a teacher contracted the disease in some unknown way about four weeks after he had visited a farm and possibly had made contact with animals. Schrire (1951) stated that three of the five cases described by him had no contact with animals.

Workers at Onderstepoort have found that the virus of Rift Valley fever may be discharged in the milk from a cow that was artificially infected with virulent material. But so far no case of the disease has been recorded where the milk has acted as a vehicle. On the contrary, Daubney and his co-workers (1931) found that lambs nursed by ewes actively infected remained healthy when otherwise protected from infection.

PATHOGENICITY. Sheep, particularly very young lambs, cattle and goats are the animals which generally contract the disease under natural conditions. Human cases frequently are associated with outbreaks of the disease, as the previously mentioned reports of Daubney, Hudson and Garnham (1931), of Daubney and Hudson (1933) and of Mundel and Gear (1951), as well as that of Mulligan (1937) prove. As the handling of infective material seems to be a common means of infection of man, it is not surprising that the incidence in laboratory workers dealing with the disease is high. This has been the experience in South Africa as well as elsewhere.

Findlay (1931) described three cases in England occurring in laboratory workers who had performed necropsies on lambs infected

with virus from Kenya. Kitchen (1934) also reported three cases in laboratory workers occurring in spite of the strictest precautionary measures. Smithburn, Mahaffy, Haddow, Kitchen and Smith (1949) described eight cases in laboratory workers in the Yellow Fever Research Laboratory at Entebbe, Uganda, and further demonstrated neutralizing anti-bodies in the blood of several exposed persons who had shown no clinical symptoms. Although they realized that the probability of complete recovery was very high, they stressed the serious risk of infection to persons engaged in investigating Rift Valley fever.

The only fatal case on record so far was reported by Schwentker and Rivers (1934); it involved a pathologist who became infected while investigating the disease. A few weeks after infection thrombophlebitis set in, ending in death. Schrire (1951) reported six cases associated with macular exudates and one with retinal detachment. Freed (1951) described a further case in which retinal changes had occurred.

Even a much attenuated virus may retain its pathogenicity for man. Kitchen (1950) reported a case where a laboratory worker became infected by the intra-nasal route with the 68th mouse passage neuro-variant. Sabin and Blumberg (1947) reported a case of accidental infection in a laboratory worker with a strain of Rift Valley fever virus which had undergone at least 300 intra-cerebral passages in mice, thus demonstrating that there was apparently very little modification in the pathogenicity of the virus for man during these passages. At Onderstepoort a laboratory worker became infected accidentally with a strain of virus that had been passaged intra-cerebrally for 86 generations in mice and then ten generations in chick-embryos (Haig and Kaschula, 1952). Matumoto, Iwasa and Endo (1950) also believed that there was no loss of pathogenicity of the virus for human beings as result of repeated mouse passage. They reported a case of accidental laboratory infection with a strain of virus passaged through mice for 14 years.

Daubney, Hudson and Garnham (1931) and Findlay (1931) have shown that several other species of animals are susceptible to the virus of Rift Valley fever. Rodents of the family *Muridae* are particularly susceptible and the mortality rate in some species of mice may be over 99 per cent. In other species (e.g. Mastomys and Mystromys spp.), however, symptoms could not be produced (Haig and Kaschula, 1952). Rats, wild rodents and golden hamsters are also readily infected. Cats exhibit merely a transitory infection associated with a mild febrile reaction. According to Francis and Magill (1935) ferrets are also susceptible. After intra-nasal instillation of respiratory discharge from human cases they produced a disease in ferrets characterized by fever, marked pulmonary changes and haemorrhages. Indian and South American monkeys develop a febrile, non-fatal form of the disease associated with typical blood and liver changes, but the African monkey, although showing active virus in the circulation does not manifest any obvious clinical symptoms. Findlay (1932b), has shown that this

relative insusceptibility of the African monkey is not due to the presence of immune bodies in the blood as antibodies develop after the inoculation with active virus.

Of the indigenous ruminants so far only the African buffalo (Syncerus caffer) has been proved to be susceptible (Daubney and Hudson, 1933). Guinea-pigs, rabbits, the mongoose, hedgehogs, tortoises, frogs and birds are completely refractory to infection.

SYMPTOMS. The incubation period of Rift Valley fever is very short. The first symptom of the disease is a fever reaction which may be detected in experimental cases from 20 to 72 hours after infection.

In young lambs symptoms are often indefinite, and the course is very brief. Affected animals are disinclined to move, refuse to eat and often exhibit some form of abdominal pain. They go down very soon and when in the recumbent state, may be unable to rise. Death usually supervenes within 24 hours, but unless the animal is carefully watched, it may die before any obvious symptoms are manifested.

In adult sheep the disease often passes unnoticed. Sometimes an affected animal is found dead without having shown any indication of illness. Sometimes vomiting is the only clinical symptom observed, yet the sheep may be found dead a few hours later. Pregnant ewes that survive an attack usually abort during the course of the illness or during convalescence.

In cattle the symptoms are frequently indefinite. There is usually a brief febrile period which may be accompanied by inappetence, profuse salivation, severe abdominal pain, foetid diarrhoea, a staring coat and complete cessation of lactation in milch cows.

In some of the outbreaks in the Orange Free State the symptoms were characterized by hyperthermia, a blood-stained mucous or mucopurulent discharge from the nose, hyperaemia of the buccal mucosa, erosions on the tongue, the lips and the cheeks, lameness, coronitis and hyperaemia of the skin around the dew claws; and the unpigmented skin, particularly in areas such as the teats, the udder and the scrotum, was dry, hard and cracked (Alexander, 1951).

As a rule, the mortality in cattle is not high but sometimes death occurs as a result of an acute attack or from sequelae such as abortion in pregnant cows.

The incubation period in man varies from four to six days and the disease is characterized by its sudden onset. The initial symptoms are malaise, nausea, hyperthermia, epigastric pain and a sensation of fullness over the region of the liver; there is usually a lack of gustatory discrimination and a total aversion to food. This is followed by rigors, violent headache, characteristic flushings of the face, injection of the conjunctiva, photophobia, generalized aching pains in the back and joints, vertigo and sometimes epistaxis. Sometimes the patient remains constipated for three to ten days.

The fever usually persists for two or three days, but it may last

for as long as ten days or more. As the temperature falls, the symptoms gradually subside. Sometimes there is a second rise of temperature on about the sixth day, accompanied by a recurrence of clinical symptoms and a characteristic diphasic temperature chart. The illness in man is rarely fatal, and recovery is followed by a long and lasting immunity, but serious sequelae such as thrombophlebitis, serous retinopathy affecting the macula and even retinal detachment may sometimes supervene.

COURSE. In young lambs the disease runs a rapid course, death frequently supervening within 24 hours of the onset, and the mortality in new-born lambs may be as high as 95 per cent. In adult sheep the course is also rapid but the mortality rarely exceeds twenty per cent. Infected pregnant ewes usually abort. In cattle abortion is also a frequent sequel, but the mortaliity in all age groups is probably not more than ten per cent. Although the risk of infection in human beings who handle infected material is very great, death and unfavourable sequelae are not frequent.

LESIONS. Daubney, Hudson and Garnham (1931) and Findlay (1931, 1933) have shown that the most characteristic lesion involves the liver. This is essentially the result of a focal necrosis. The changes in adult sheep differ somewhat from those found in lambs, depending largely on the acuteness of the illness and on the rapidity of the pathogenesis. Whereas the liver necrosis in adult sheep is focal in character, it is widespread in lambs, affecting the whole organ and giving it a bright yellow and fatty appearance.

Other less obvious lesions are small subscapular haemorrhages and a distinct mottled appearance of the liver, oedema and small haemorrhages of the lymph nodes and of the gastric and intestinal mucosa, sub-epicardial and sub-endocardial ecchymoses, capillary arborescences of the spleen, especially along the free border, congestion of the renal cortex and degeneration of the tubules. Localized haemorrhages may also be observed in other parts of the body.

Schulz (1951) found that the lesions presented by animals affected with Rift Valley fever in South Africa differ appreciably from those reported elsewhere. The main differences involved the spleen, the lungs, the adrenals and the gastro-intestinal tract. Schulz (1951) invariably noted marked hyperaemia and oedema of the lungs of adult sheep on autopsy. He also observed subpleural and focal pulmonary haemorrhages in a few cases. The adrenals were found to be enlarged with ecchymoses in the cortex and medulla. Tumor splenis occurred with petechiae beneath the capsule; hydropericardium and distinct, sometimes marked, haemorrhagic gastro-enteritis were found in many of the cases.

Schulz (1951) reported marked cyanosis of the mucous membranes, the skin and the udder, and haemorrhages in the axillary region, the medial aspect of the hind limbs and in the distal parts of the extremities. In cases of severe diarrhoea the perineal region was usually soiled with bloodstained faeces. In the majority of cases

haemorrhages of varying size were visible under the peritoneal covering of the stomach and intestines, and areas of necrosis involving the ileum, caecum and colon were found near the ileo-caecal valve.

The lesions presented by cattle resemble those found in sheep but Schulz (1951) reported, in addition, an acute catarrhal stomatitis associated with erosions of the mucosa, necrosis of the skin on many parts of the body, particularly the udder and scrotum, haemorrhages in the light-coloured portions of the skin, laminitis, coronitis and exungulation of the hoofs. A very marked ascites was present sometimes.

Daubney *et al.* (1931) and Findlay (1931, 1933) have shown that the most important histological changes are found in the liver and blood. There is a focal necrosis of the liver characterized by the presence of degenerated neutrophiles and a hyaline degeneration of the liver cells. In adult sheep the liver necrosis is focal, but in lambs it is widespread involving the whole organ. The acidophilic cytoplasmic degeneration of the hepatic cells leads to the formation of hyaline bodies. This is accompanied by nuclear changes. The nucleoli of the degenerated cells are usually hypertrophic, and the cells exhibit masses of granular intra-nuclear inclusions resembling the Councilman bodies observed in yellow fever. Schulz (1951), however, was not able to demonstrate the inclusion bodies in all cases, but found marked changes in the adrenals, lungs and spleen.

The blood changes are characterized by a brief initial neutrophilia followed by a progressive and severe leucopenia which may be so marked that, especially in lambs, hardly any mature neutrophiles are demonstrable in blood films. There is a relatively large number of myelocytes present in the peripheral circulation (Findlay, 1931; Daubney and Hudson, 1933).

DIAGNOSIS. A highly fatal viral disease of ruminants characterized by a very short incubation period and extensive necrotic changes of the liver should be regarded with suspicion, particularly if cases of an influenza-like, non-fatal illness occur simultaneously in human beings who have handled infected material. For a positive diagnosis of Rift Valley fever a careful laboratory examination must be carried out, viz.:—

(1) *A histological study of the liver and blood of the suspected animal.* In cases of Rift Valley fever a non-purulent necrosis of the liver, the presence of acidophilic intranuclear inclusions in the liver, and the existence of a leucopenia will be revealed.

(2) *Mouse inoculations.* White Swiss mice are extremely susceptible and die within two or three days after receiving infective material. The virus is infective for these mice in very small doses. According to Findlay and Daubney (1931) 0.1 c.c. of a one in ten million dilution of infected blood is infective for mice. Transmission may be effected either by the intra-peritoneal, subcutaneous, intra-cerebral route, or through the scarified skin or the conjunctival sac.

(3) *Serum neutralization tests.* The diagnosis is based on neutralization tests with convalescent serum, mice being employed for the infectivity tests. Findlay (1936) and Sabin and Blumberg (1947) have found that neutralizing antibodies may be detected from four to five days after the onset of symptoms. These antibodies may persist for twelve years in the serum of an individual after a single attack and no further exposure to the virus.

(4) *Complement fixation test.* Broom (1932) demonstrated the occurrence of specific complement fixing bodies in the sera of human beings, monkeys, sheep, rats and mice that had recovered from Rift Valley fever. These antibodies were present 14 days after infection and persisted for at least six months; they could be demonstrated in animals which had not shown any clinical symptoms of disease, but which had been repeatedly exposed to infection. The degree of complement fixation was proportional to the severity of the clinical symptoms manifested. The antigen used was prepared from livers of infected mice or rats.

Matumoto, Iwasa and Endo (1905) regarded complement fixation as a useful method for diagnosing Rift Valley fever. By means of complement fixation they found that the neuro- and pantropic strains employed by them were immunologically identical.

Haig and Kaschula (1952), however, found that complement fixation bodies might not be present in detectable amounts in the sera of persons and animals infected with a strain of Rift Valley fever which was first passaged for 86 generations in mice and then for ten generations in chick-embryos. It must be pointed out, however, that the antigen used was prepared, not from the homologous strain, but from a virulent strain of virus isolated in South Africa.

Differential Diagnosis

Enterotoxaemia. When Rift Valley fever first made its appearance in South Africa in 1951, it was completely unknown so that it was mistaken for other diseases which occur in this country. Enterotoxaemia was one of these. As in enterotoxaemia, many of the cases of Rift Valley fever studied manifested a marked haemorrhagic gastro-enteritis. The two diseases can, however, be differentiated by means of a histological examination of the liver, serum neutralization and mouse transmission tests.

Bluetongue can also be differentiated readily by mouse inoculation and serum neutralization tests. White mice are highly susceptible to Rift Valley fever virus and completely insusceptible to bluetongue virus.

Daubney, Hudson and Garnham (1931) noticed that, both from the clinical symptoms in man and from the pathological changes in

animals Rift Valley fever presented certain similarities to yellow fever, Dengue fever and sand-fly fever. By means of cross-immunity and serum neutralization tests on rhesus monkeys and mice, however, Findlay (1931, 1932a) showed that none of these diseases was related immunologically to Rift Valley fever.

DIAGNOSIS IN MAN. When human patients show Dengue feverlike symptoms and where there is a history of contact with Rift Valley fever virus or with infected animals, a tentative diagnosis is justified. But, for a positive diagnosis, the virus should be recovered from the blood of the patient, or specific neutralizing antibodies should be demonstrated in the serum. Virus is present in the blood during the first three days of the disease and neutralizing antibodies from four days to twelve years after the onset of symptoms. Suspected serum is mixed with a virus preparation and 0.2 c.c. of the mixture is inoculated intra-peritoneally into mice. Control mice are inoculated in the same way with a mixture of normal serum and virus. Unless neutralizing antibodies are present in the serum, the mice will die from the virus of Rift Valley fever within two or three days.

TREATMENT AND PROPHYLAXIS. Owing to the small size of the virus particles chemo-therapeutic treatment is unlikely to be of much use unless applied very early. Recourse should, therefore, be made to serum-therapy, to the prophylactic inoculation of exposed animals, and to the removal of susceptible animals from low-lying pasture to higher altitudes.

In their original publication Daubney, Hudson and Garnham (1931) indicated that domestic animals and human beings that had recovered from an attack of Rift Valley fever are immune. This immunity might develop even in exposed animals or persons that did not show any apparent symptoms of infection. As pointed out above, Broom and Findlay (1932) reported the presence of specific complement fixation bodies in the sera of human beings and animals that had passed through an apparent or inapparent attack of the disease. These antibodies were detected as early as 14 days after infection and persisted for six months.

Findlay (1932b) found that immune bodies developed in the blood of both African and South American monkeys inoculated with Rift Valley fever virus.

MacKenzie (1935) prepared a vaccine from infected mouse blood centrifuged at 2000 r.p.m. The clear supernatant fluid was mixed with an equal part of methylene blue (1 : 50,000) and then exposed to light. The efficacy of the vaccine was in direct proportion to the concentration of the virus. MacKenzie (1935) prepared a formalinized vaccine, which remained unimpaired when kept at 4°C. for 60 days.

Smithburn (1949) found that strains of Rift Valley fever virus passaged serially in mice by the intra-cerebral route acquired enhanced neurotropism with concomitant reduction in hepatotropic affinities. The subcutaneous inoculation of lambs and sheep with the neurotropic virus resulted in the formation of specific antibodies and of immunity

to inoculation with pantropic virus. The neurotropic virus could not be demonstrated in the circulating blood of the lambs and sheep, and it caused no objective reactions of any consequence. The adaptation of the virus to nerve tissue was associated with a decline in antigenicity and a pantropic virus apparently was able to induce a higher antibody titre than the neuro virus. Nevertheless, it was pointed out that sufficient antigenic potency was retained by the neurotropic virus to stimulate the production of antibodies for the protection of the inoculated animals against the effects of the pantropic virus. Smithburn (1949) suggested that by immunizing pregnant ewes the lambs could be protected during the most susceptible four or five months after birth.

On the other hand, Mulligan (1937) reported that a vaccine prepared from mouse brain representing the 92nd intra-cerebral passage could be safely used only for lambs over six weeks of age and for adult non-pregnant sheep, but not for new born lambs and pregnant ewes. He found that it might give rise to encephalitis in lambs or cause pregnant ewes to abort, or to produce weakling lambs. For newborn lambs he advised the use of hyper-immune serum. Stefanopoulo and Nagano (1950) showed that immune serum when administered less than 36 hours after infection, would protect the animal against Rift Valley fever virus. The use of hyper-immune or even convalescent serum might, therefore, prove to be effective for the treatment of newborn lambs from non-immune ewes and for other animals exposed to infection.

Haig and Kaschula (1952) also prepared a vaccine from neurovirus obtained from mouse brain after the 86th to the 102nd intracerebral passage. They found that this neuro-virus could be readily propagated in chick-embryos, and that virus harvested after the 35th chick-embryo passage could be safely used for vaccine production. Animals inoculated with either the mouse or the mouse-plus-chick-adapted virus showed no obvious reaction to the injection, but developed an immunity which was strong enough to protect them against a challenge dose of virulent pantropic virus. The antigenic potency of these viruses was, however, comparatively low and the antibody level produced was much weaker than that following recovery from a natural or artificial infection with pantropic virus. Neutralizing antibodies were present in the inoculated animals in low titre, and complement fixing bodies could not be demonstrated in animals or human beings infected with the chick-adapted virus.

There seems to be no doubt, therefore, that both the mouse-adapted and the mouse-plus-chick-adapted virus, though of low antigenic potency, can induce an immunity which is strong enough to protect the animals against exposure to pantropic virus. The use of these vaccines should, however, be restricted to sheep over six weeks old and to adult non-pregnant sheep and cattle. They should not be employed for the immunization of new-born animals or pregnant animals. The only safe treatment for these animals is immune serum.

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THE EFFICACY OF METHYLAMPHETAMINE AS AN ANALEPTIC IN PENTOBARBITAL SODIUM OVERDOSAGE

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Onderstepoort

INTRODUCTION

The intravenous administration of pentobarbital sodium is the standard method of anaesthesia for dogs in South Africa. Although this drug is exceedingly safe in the hands of an experienced operator, the urgent need for a reliable analeptic arises from time to time. The drugs usually advocated for this purpose are picrotoxin and niketha-mide, neither of which is truly satisfactory.

Edds (1950) reported on the superiority of desoxyephedrine hydrochloride (methylamphetamine) as a cardio-respiratory stimulant in dogs under pentobarbital sodium anaesthesia. In a preliminary study on rabbits he showed that the average increase in minute volume air exchange brought about by the three drugs mentioned was:—

Nikethamide	5.16%
Picrotoxin	3.76%
Amphetamine	26.31%

In a series of dogs suffering from pentobarbital sodium over-dosage the increase was 3.2% after nikethamide and 255% after methylamphetamine.

The use of pentobarbital sodium on cats is considered by many to be dangerous. The reason is probably not that the cat is particularly susceptible but there may be a combination of the following factors :—

(i) Cats frequently resist handling, with the result that they are in a highly excitable state when the drug is administered. The somewhat forceful restraint which often has to be used adds to the risk.

(ii) The administration of an intravenous injection to a struggling cat is not easy. A certain amount of the drug may be deposited subcutaneously. As this has little immediate effect a full narcotizing dose is also given intravenously.

(iii) Without a scale it is extremely easy to overestimate the weight of a cat.

In view of Edd's Findings, it was decided to investigate the matter further.

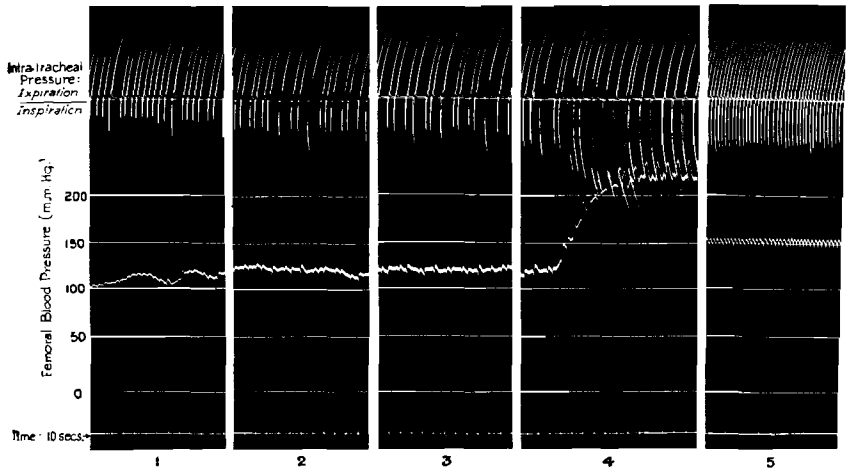
Method

Dogs were anaesthetised with pentobarbital sodium and the femoral blood pressure recorded by direct canulisation to a mercury manometer. The respiration was also recorded by means of a membrane tambour connected to a T-shaped canula inserted into the trachea.

After a preliminary recording had been made, excess nembutal was injected intravenously until severe respiratory and circulatory depression became evident. The selected analeptic was then adminis-

Fig. 1.

The Effect of Methylamphetamine Hydrochloride on the Blood Pressure and Respiration of a Dog with Nembutal Overdosage (Live weight : 36 lbs.)



1 : Nembutal Overdosage. Note fluctuating Blood Pressure, slow Respirations with decreased inspiratory effort.
2 : Five minutes after injection of ·75 mg. Picrotoxin i.v.. No effect.
3 : Five minutes after injection of ·5 c.c. Nikethamide (B.P.) i.v.. No effect.
4 : Dramatic Rise in Blood Pressure and Increase in Inspiratory Effort immediately after Injection of 10 mg. Methylamphetamine Hydrochloride (M. & B.)
5 : Thirty minutes after Methylamphetamine.
N.B. in view of other findings, the effect of the Methylamphetamine cannot be attributed to a synergic effect of the three drugs.

tered and the effect recorded. In view of the essentiality of rapid action under such circumstances a failure of response within 15 minutes was regarded as a negative result.

Results

The Effects of Pentobarbital Overdosage

The main effect of overdosage was depression of respiration characterised by a marked decrease in the inspiratory effort as is well illustrated in Figure 2, tracing 2. This specific effect on inspiration supports the suggestion that the respiratory centre is comprised of inspiratory and expiratory divisions. Cheyne-Stokes breathing was shown in a few cases.

The blood pressure was also lowered and became fluctuating, but in all deaths from pentobarbital poisoning the heart continued to beat for some time after respiration had ceased.

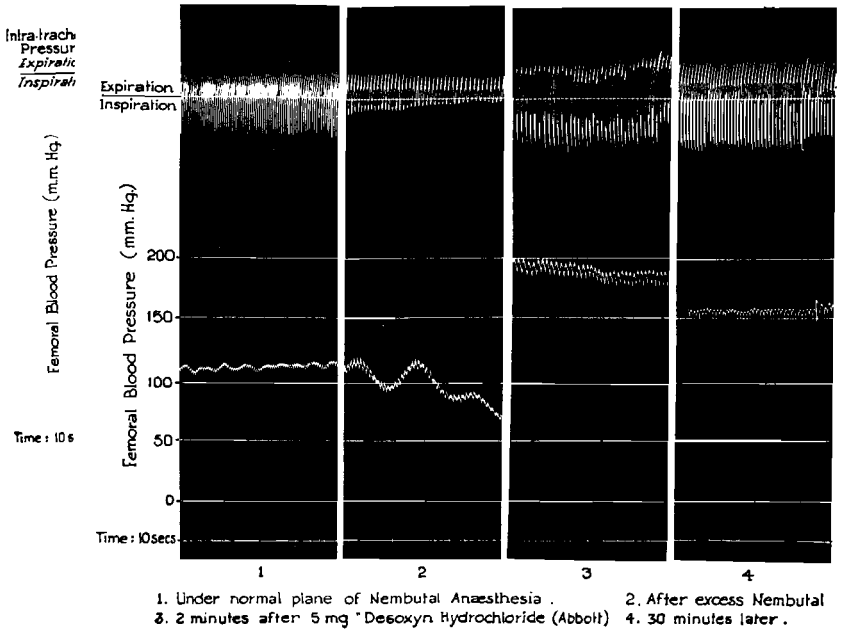
The Effects of Analeptics

The analeptics tried were picrotoxin, nikethamide and methylamphetamine. In view of the truly remarkable efficiency of the last-named drug, it was decided that, for practical purposes, further investigations were not justified.

Nikethamide was found to cause a slight transitory increase in blood pressure but had no demonstrable effect on respiration. Its beneficial effect at a dosage of .5 c.c. of the B.P. solution to dogs

FIG. 2.

The Effect of Methamphetamine Hydrochloride on Blood Pressure and Respiration in a Dog with Nembutal Overdosage.



1. Under normal plane of Nembutal Anaesthesia . 2. After excess Nembutal
3. 2 minutes after 5 mg "Desoxyn Hydrochloride (Abbott) 4. 30 minutes later .

weighing 30 to 40 lbs. was negligible. (See Figure 1, tracing 3).

Picrotoxin. Doses up to 1 mg. to similar dogs had no effect on blood pressure or respiration whatsoever. (See Figure 1, tracing 2).

Methylamphetamine. At a dosage of 10 mg. to dogs weighing 30 to 40 lbs. the intravenous injection of methylamphetamine showed immediate and dramatic effects. The inspiratory effort was markedly augmented within 10 seconds and the blood pressure rose rapidly to over 200 mm. Hg. The pulse pressure was also greatly increased. (See Figure 1, tracing 4 and Figure 2, tracing 3). The initial hypertension passed off within 10 to 15 minutes after which the blood pressure

remained constant at only slightly above normal levels. Similarly the respiration became steady and normal in depth. It was remarkable that the dogs treated with methylamphetamine, after having shown symptoms of severe pentobarbital overdosage, were actually in better condition than they had been under the normal plane of anaesthesia.

Although methylamphetamine had these powerful actions on the cardiac and respiratory centres, there was no indication of its influencing the depth of anaesthesia or of causing convulsions.

Subsequent to the experiments described, three dogs were anaesthetised with pentobarbital sodium and given excess amounts till the breathing was dangerously shallow. They were then given methylamphetamine and allowed to recover. This they did normally in all instances.

The Admixture of Pentobarbital Sodium and Methylamphetamine

In view of the above findings it was decided to investigate the possibility of mixing methylamphetamine with the pentobarbital solution for use especially in cats.

The mixture was made by adding 10 mg. methylamphetamine to 24 c.c. of nembutal (Abbott) or sagatal (May and Baker). This mixture has been kept for up to six weeks in the refrigerator without any signs of precipitation or altered pharmacologic action.

Dogs injected with the mixture passed into coma normally with the standard dose of 1 c.c. per 5 lbs. body weight and also recovered normally.

Use of the Mixture in Cats

A series of 20 cats was used. The animals were wild stable cats and resisted violently when handled. They were placed, spitting and fighting, in a sack and a limb was withdrawn through a hole in the bag. They were then injected intravenously with either pure pentobarbital or the mixture. Each cat was weighed prior to injection and the dose calculated. The total dose was injected immediately, i.e. in about five seconds. The technique can, therefore, legitimately be described as crude but this very fact adds significance to the results, which are given in the following table:—

Dose (c.c. per 5 lbs.)	Pentobarbital Sodium alone		Pentobarbital Sodium plus Methylamphetamine	
	Injected	Died	Injected	Died
1.0	6	2	6	0
1.5	3	2	3	0
2.0	1	1	1	1

All deaths took place immediately after the injection.

The three cats which received the overdose of the mixture all showed apnoea for some 60 seconds after the injection. Breathing recommenced with a deep inspiration and from then on proceeded regularly.

These results show that the safety margin for pentobarbital used on cats can be greatly increased by the simultaneous administration of methylamphetamine.

Two cats were spayed when under the influence of the mixture and there was no excess haemorrhage due to the hypertension.

Drugs Used

The drugs used were:—

Pentobarbital sodium — "Nembutal" (Abbott) and "Sagatal" (May and Baker).

Methylamphetamine — "Desoxyn" (presented by Abbott), Methylamphetamine hydrochloride powder (presented by May and Baker) and "Dexedrine" (Menley and James).

Summary

(1) Methylamphetamine has been found to be a powerful analeptic in cases of pentobarbital sodium overdosage in dogs.

(2) The addition of 100 mg. methylamphetamine to 25 c.c. of standard pentibarbital sodium solutions greatly increased the safety factor when used on cats.

(3) Methylamphetamine does not affect pentobarbital anaesthesia once it is established. If the two drugs are given simultaneously the dose of pentobarbital required is only slightly increased. If given first methylamphetamine produces great resistance to pentobarbital.

(4) Picrotoxin and nikethamide were found to have negligible analeptic actions under the conditions of the experiments.

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AN OUTBREAK OF RINGWORM IN SHEEP

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Onderstepoort

Ringworm is a condition which is rarely encountered in sheep. Hutyra and Marek (1938) give a short description of it and in the Handbuch der pathogenen Mikroorganismen by Kraus and Uhlenhuth (3rd Edition) (1928) it is mentioned that ringworm caused by Trichophyton species occurs in sheep. In this animal one gets a bran-like eruption on the neck, chest and shoulders. References to the disease in sheep appear to be very rare.

History

Recently a report was received from a farmer in the Albany district that he had a number of cases of a peculiar skin disease in his Persian sheep. He had noticed cases of this condition about three years before and he put it down to the effects of dipping (3 pounds of arsenite of soda to 100 gallons of water). At the time the report was received, there were 30 to 40 sheep affected. On treating them with linseed oil and lime water on the skin, some recovered but many died. At the time of the report, the owner was treating about 20 sheep with a salicylic acid ointment. Some sheep recovered without treatment, one ram in particular having recovered in about six months without anything being done to it and was in excellent condition. There had been no introductions for several years and no suggestion could be made as to the source of the infection. A severely affected case was sent to Onderstepoort for examination.

Examination

The case was a Persian ram in poor condition. There were small bare patches on the face, involving the nose. Bare areas were seen on both ears, under the jaw and round the throat. The skin under the chest and in both axillae was red and swollen as was that of the abdomen as well. The sheath was red and swollen and the testicles were largely hairless, there being only a few patches of hair. There was marked reddening and swelling of the skin under and round the anus. On the body there were large patches where the hair was matted and easily detached. On these patches the hair appeared to be shorter than elsewhere on the body. Both fore and hind coronets were scaly and inflamed. The left fore coronet was cracked and showed fissures. The sheep showed marked diarrhoea but it was impossible to say whether it had any connection with the other symptoms.

Several specimens of hair from the lesions and of scrapings from affected areas were examined and a ringworm infection of the

Trichophyton type was found in all the specimens examined. No further attempts were made to try and determine the species involved.

The sheep was not treated and as it was in poor condition and could not be returned to the owner, it was killed. At post mortem no changes were found internally, except a slight enteritis, of which the cause was not determined.

Summary

An outbreak of ringworm in Persian sheep is described.

A PRELIMINARY REPORT ON THE THERAPEUTIC VALUE OF CHLOROMYCETIN FOR THE TREATMENT OF CALF PARATYPHOID

(*SALMONELLA DUBLIN* INFECTION).

M. W. HENNING

Ten calves, all under 10 days of age, were used in the experiment. The calves were fed on milk in the morning and the evening. On three successive mornings, however, the milk ration was first heated to 37.5°C and infected with a fresh broth culture of a recently isolated strain of *S. dublin.* After incubation for two hours, the infected milk was given to the calves.

On the third day after the first infected feed, all the calves were showing a marked rise in body temperature associated with severe diarrhoea. All appeared obviously sick and dejected, but continued to take their milk ration eagerly.

On the fourth day five of the sick calves were treated with chloromycetin and five were kept as controls. The chloromycetin, made up in a fluid base, was administered by the subcutaneous route and each calf received 2 grams, every 8 hours for three days. The total amount of chloromycetin administered to each calf, therefore, was 18 grams.

The response to the chloromycetin treatment was very marked in all five of the treated calves, and a distinct improvement was evident within 24 hours after the commencement of the treatment; the temperature of all the treated calves had dropped to normal. On the third day the scouring had stopped completely and the faeces appeared normal; as all the treated calves were lively and active and appeared to be in a normal state, the treatment was discontinued.

On the other hand, the untreated controls remained sick for several days. The temperatures persisted at a high level and the scouring continued. The calves remained in the recumbent state for most of the time. Two of them in particular looked very miserable and gradually deteriorated in condition day after day. One died from paratyphoid on the eleventh day of the experiment, but the other one gradually improved after some time and finally made an apparent complete recovery. The other three control calves recovered more speedily.

Faeces cultures were made at intervals from all ten calves, the media used being MacConkey's bile salt agar and tetrathionate broth. These were positive for all the calves and remained positive for a longer

period in the five treated calves than in the four controls that survived. Four weeks after the commencement of the treatment faeces cultures from all the calves, treated as well as controls, were negative.

It should be pointed out, however, that the course as well as the clinical symptoms of the disease produced experimentally by means of infected milk are generally much milder than when the disase is contracted under natural conditions. Whereas the majority of the calves infected artificially usually recover completely from the infection, a large percentage of those that become infected naturally succumb. So far it has not yet been possible to test the therapeutic value of chloromycetin on calves naturally infected with paratyphoid, but experiments are now being planned with the object of examining the preparation under field conditions.

Supplies of chloromycetin were kindly furnished by Messrs. Parke, Davis and Company, to whom the author wishes to express his thanks.

THE ISOLATION OF AN UNKNOWN VIRUS FROM THE INTESTINES OF CHICKENS

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In November, 1950, a large commercial poultry establishment at Simonstown, Cape Province, reported excessive losses in chickens from a condition which was estimated to have caused the loss of many thousands of chickens during the previous three years. The chickens were purchased as day-olds from the largest hatchery in the Union, and were then reared to maturity.

The disease in the chickens resembled a condition often encountered, not only in the Cape Province, but also in Natal and which clinically appeared to be identical with a disease known in the United States as "stunted chick disease" (Levine 1949). This disease resembles pantothenic acid and biotin deficiency, but its cause is not known. The skin lesions in this latter condition are usually very slight. The disease is also described under other names (Norris 1941, Mason 1939), but the term "stunted chick disease" is adopted here.

The isolation of a virus from chickens suffering from this disease, is considered worth while reporting, even though its rôle in the cause of the disease has not been determined.

Description of the Disease

A brief description of the disease encountered in the chickens from which the virus was isolated is given below.

The first symptoms noted were usually at the age of six days, when the affected chickens became drowsy, showed complete loss of appetite, a marked thirst and huddled together as if they were cold. No diarrhoea was present, but the motions were passed with an excess of clear fluid. The eyelids were often stuck together. Mortality was a little higher than normal, especially after colder weather. The unthriftiness in some of the chickens persisted for 2-3 months, after which time the appearance of the flock as a whole presented a typical picture. There would be many severely stunted chickens while others were normal, and thus there was great unevenness in the flock. Many of the stunted chickens showed encrustations at the corners of the mouth. The mortality rate was low as a rule, but accumulated deaths over a period of several months represented a considerable loss. The mortality rate was highest in the early stages of the disease, which in the first three weeks could account for up to 20% in the severest

outbreaks. In older chickens it was lower, but the total mortality over the period up to 3 months of age could in rare cases amount to as much as 50%, though it was usually much lower. The losses incurred include also the stunting of a certain percentage, up to 20%, of the remainder of the flock. The insidious nature of these losses is not very apparent, but nevertheless, greatly reduces the total profits from a flock.

The post mortem appearance of the chickens in the early stages of the disease was quite characteristic. Crops were empty and in chickens killed in extremis, the duodenum often contained an abnormal amount of clear fluid, which when examined miscroscopically revealed the presence of numerous erythrocytes. Often the caeca were enormously distended with a yellow bubbly fluid containing many protozoa, predominantly species of *Chilomastix*. All the other organs appeared normal. In chronic cases, the lesions were less typical, emaciation being the most marked change.

Isolation of the Virus in Developing Eggs

A number of typically sick chickens in extremis were obtained and material was collected. Heartblood, liver, spleen and intestinal material were collected separately and the various specimens pooled. They were ground up finely and treated with streptomycin and penicillin (1000 units of each per cc.). After centrifugation the various supernates were injected on to the chorio-allantoic membrane (C.A.M.) of 8-day-old embryonated eggs, by Alexander's (1938) modification of Burnet's technique. Each egg received 0.2 cc. and they were re-incubated at 37°C. After six days the embryos were examined. In those injected with intestinal material a diffusely thickened and opaque C.A.M. was found. Negative results were obtained with material from the other organs. The thickened membranes were infected with a Gram positive bacillus. Attempts to eliminate the bacillus with the aid of streptomycin and penicillin failed, for after six successive passages the bacterium was still present. Membrane emulsion was then passed through a Boerner filter. The filtrate was bacterium-free, but it still produced the typically thickened and opaque C.A.M. A circumscribed area of the C.A.M. $\pm$ 1 inch in diameter around the inoculation site, was affected. The central area of large lesions usually showed patches of necrosis. The remainder of the embryo appeared normal. The virus did not cause death of the embryo in the early passages, but in the later passages (15-24), about 50% mortality was experienced in six days.

An attempt was made to adapt the virus to the yolk and allantoic sacs, but as lesions developed where the needle penetrated the C.A.M., this was abandoned.

Titrations of Virus Activity

C.A.M. lesion material macerated and diluted in saline, when titrated on the C.A.M. of eggs, gave titres of 10^{-5} judged on the production of typical lesions.

Size of the Virus

Filtrations through gradocol membranes were made of supernates obtained from macerated C.A.M. lesions by Mr. P. van Rooy of this institute. The virus emulsion was passed through a series of gradocol membranes, graded according to pore size and each filtrate was titrated on the C.A.M. of eggs.

Table No 1

Titration of the Virus Passed Through Gradocol Membranes

Pore size of gradocol membrane	Titre of filtrate
742$m\mu$	10^{-5}
428 ,,	10^{-5}
342 ,,	10^{-5}
230 ,,	10^{-3}
172 ,,	10^{-3}
119 ,,	10^{-1}
97 ,,	Undiluted
86 ,,	Nil

Two of the six C.A. membranes inoculated with the undiluted filtrate passed through the 97 gradocol membrane showed slight thickening. When this was subinoculated, typical lesions were obtained, while no virus passed through the 86 gradocol membrane. According to Elford's formula (1933) the diameter of the virus is $\frac{1}{3}$ - $\frac{1}{2}$ the pore diameter for pores 10 - 100$m\mu$ and, therefore, the diameter of this virus is approximately 33 $m\mu$.

Viability of the Virus

The virus was found to be stable and remained viable at room temperature for at least 72 hours, at 4°C for one month and —20°C for six months. These periods were the limit of the observations and it is possible that the virus remains active for much longer periods.

Neutralization Tests

Attempts were made to immunize two cockerels by intravenous injection with live virus at three weekly intervals. Three weeks after the last injection their sera were tested for neutralizing anti-bodies. Serum dilutions were tested against 10^3 embryo $I.D._{50}$ of the virus, the serum virus mixture being injected on to the C.A.M. No neutralization was demonstrable.

Pathogenicity

Chickens: Attempts were made to reproduce the syndrome of stunted chick disease, by the dosage of the egg propagated virus, egg

generation 9, to day-old White Leghorn chickens. These chickens originated from the Onderstepoort flock, where the disease had not been encountered. A total of 80 chickens, fed on a well balanced ration, fortified with pantothenic acid, were used in the tests. These chicks were each dosed with 0.1 cc. of 10^3 embryo $I.D._{50}$ by the intraperitoneal, intraocular, oral, intramuscular and intracerebral routes. Another group was treated by the wingweb stab method, using undiluted virus.

The results of this experiment were inconclusive. One chicken, in which the virus had been instilled intraocularly, died on the 6th day and the virus was recovered from its intestinal tract. A bacillus, belonging to the Proteus group was also isolated from its heartblood. Two other chickens, one dosed per os and another intraperitoneally, showed a sticking together of the eyelids and slight encrustations at the commissures of the beak. These and all the other chickens, developed normally.

Two cockerels, six months old, were injected intravenously with virus, but no symptoms were produced.

Other Animals: The following other animals were treated with the same virus. Baby mice, four days old, and adult mice were injected intracerebrally and intraperitoneally, with negative results.

Guinea-pigs, rabbits and pigeons were injected intra-peritoneally, with negative results.

Haemagglutination

No haemagglutination was demonstrable when red blood corpuscles of the following species were tested with the virus:—chickens, pigeons, muscovy ducks, guinea-fowls, rabbits, white rats, white mice, ferrets, cattle, sheep, horses and dogs.

Discussion and Conclusions

The aetiology of stunted chick disease is unknown. Norris (1941) refers to a condition he calls "field dermatitis" which is apparently identical with stunted chick disease. He reports that chickens on one farm may develop the field dermatitis, while those of the same breed, on a neighbouring farm and fed the same feed, escape the disorder. He excluded panothenic acid and biotin deficiency. He concludes that possibly the cause is environmental. Mason (1939) describes a pellagra-like syndrome which is marked by unevenness of growth of the flock. He questions the role of *B. coli* in its aetiology.

In the particular case described in this article, the owners had used the three best commercial feeds on the market in South Africa, without in any way preventing or curbing the disease. In addition, since it resembled a pantothenic acid deficiency, additional amounts of this vitamin were fed with negative results. The three commercial feeds used in this plant were fed successfully by other owners in the area, whose chickens originated from the same hatchery.

This and other evidence, points to the condition being an infectious one but the reproduction of the disease artificially in healthy chickens has been attempted by many workers (Levine 1949) with consistently negative results. It would thus appear that even if the virus described in this article proves to be the primary cause of the syndrome of stunted chick disease, some additional unknown factors are necessary for the production of the disease. In addition, the cultivation of the virus away from its host may possibly be responsible for some modification of it.

The finding of a virus in chickens suffering from this condition is, therefore, being reported, since it may have a bearing on the aetiology of this economically important disease. It is hoped that this report will stimulate interest, as the finding of the virus in association with stunted chick disease needs confirmation.

Summary

1. The isolation of an unknown virus from chickens suffering from stunted chick disease is recorded in view of its possible aetiological significance.

2. The virus, which was isolated on the chorio-allantoic membrane of embryonating eggs, was obtained from the intestinal tracts of chickens.

3. A general description of the disease in the chickens and of the isolated virus is given.

4. Attempts to reproduce the disease artificially with the virus in day-old chickens were inconclusive. The virus was not pathogenic for mice, guinea-pigs, rabbits and pigeons.

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BRUCELLA ABORTUS VACCINATION FOLLOWED BY A PERIOD OF LOWERED RESISTANCE TO EXPOSURE TO INFECTION

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Workers in Northern America have found indications that after Strain 19 vaccination of adult cattle in infected herds a number of vaccinates appear to contract the disease in an unexpectedly severe form. The opinion is expressed that the increased resistance to infection is not produced immediately in all cases but that actually an initial setback may be experienced; a period (negative phase) during which some animals would be more susceptible to attack by virulent organisms appears to occur.

Protection against abortion by adult vaccination is only obtainable at the well-known risks of :—

1. Development of a permanent blood serum reaction;
2. Temporary drop in milk yield for 3-10 days;
3. Temporary sterility for 1-2 months; and now possibly also
4. Temporary increased susceptibility to infection.

These items are not considered serious obstacles in ranch herds where infection is known to be widespread. In herds where preliminary whole herd vaccination is practised with the object of commencing eradication within two to five years, it would be useful to have more information about the last-mentioned risk.

Observations of this nature can only be made by practitioners and field officers. In a herd in which brucellosis control is being commenced by whole herd vaccination, titre tests should be carried out before vaccination, 30 days after vaccination and every six months. thereafter. If the work is initiated on relatively small herds the author will be able to give every assistance possible.

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PRELIMINARY REPORT ON THE TOXICITY OF RETRORSINE, ISATIDINE AND PTEROPHERINE ON RATS, WITH SPECIAL REFERENCE TO THE INFLUENCE OF SEX ON SUSCEPTIBILITY

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As long ago as the last century senecio plants were suspected of being the cause of mortality in animals in various countries. The condition was described as "Pictou cattle disease" in Canada, "Walking Disease" in Northern Nebraska, "Winton Disease" in New Zealand and "Dunsiekte" and "Molteno straining disease" in South Africa.

Various workers such as Theiler, Gilruth and van Es proved that certain species of senecio plants were responsible for these conditions, but there was always a certain amount of doubt as to the exact nature of the poison. Davis in England, Harris, Anderson and Chen in the U.S.A. and other workers also carried out experiments with alkaloids obtained from various senecio species.

Cushny also worked on the pharmacology and toxicity of senecio alkaloids. By injection of Senecifoline nitrate into rats he produced mortality and lesions resembling those in natural cases. The interval between injection and death, however, showed wide variations (24 hours to 6 days) and the amount of alkaloid injected did not appear to bear any definite relationship to the time of survival.

Davidson (1935) injected retrorsine subcutaneously into rats with the object of studying the pathogenesis of the lesions. Doses of 0.007 to 0.25 gm. were used in order to vary the severity of the lesions. No definite attempt was made to determine the exact toxicity of the alkaloid, however.

Harris et al (1942, 1946) determined the LD_{50} for hamsters by a single intravenous injection of senecionine as well as that for mice by a single intravenous injection of longilubine, integerrimine, jacobine, senectonine and sparbioline. No constant relationship was found between the size of the dose and the survival time or the type of lesion produced.

In later experiments they also determined the LD_{50} for mice

after a single intravenous injection of pteropherine, sceleratine and isatidine.

Selzer and Parker (1951) worked with retrorsine on rats with the object of studying the effect of a protein deficiency on susceptibility. The alkaloid was administered orally and the rats on a deficient diet proved far more susceptible. The type of lesion produced was the same throughout, varying only in severity. Variations in the time of onset of lesions were noted even with the same dose of alkaloid. No definite attempt was made to determine the LD_{50} of the alkaloid.

From the literature it would appear, therefore, that although a fair amount of work had been done, no clear cut picture as to the toxicity of these alkaloids had been obtained. The mortality, the period before death and the severity of the lesions produced have persistently shown inexplicable variations.

This work now to be described was undertaken with the objects of finding some explanation for these discrepancies and of determining the exact toxicities of the alkaloids for rats.

Method

Albino rats of the Wistar strain weighing from 200 to 250 gm. and about 2 to 3 months old were used. The individual rats were numbered by the ear notch system, weighed and divided into groups of equal average weight. The rats were fed on the standard Onderstepoort ration.

The alkaloids retrorsine, isatidine and pteropherine were isolated and prepared by the biochemical section at Onderstepoort from Sen. retrorsus, Sen. isatideus and Sen. pterophorus respectively. In all experiments the pure alkaloid was dissolved in citronic acid and injected subcutaneously just behind the shoulder

Retrorsine

For the first experiment 80 rats were divided into 10 groups, each of which consisted of 3 males and 5 females. The rats were kept under close observation and the number, sex, group number as well as the time of death were noted.

The results can be summarised in table No. 1.

TABLE No. 1

The effect of sex on the susceptibility of rats to retrorsine (1st Experiment)

	Females		*Males*	
Dose Mg.	*No. Injected*	*Deaths*	*No. Injected*	*Deaths*
10	5	0	3	0
12.5	5	0	3	0
15	5	0	3	1
17.5	5	0	3	2
20	5	0	3	3
22.5	5	0	3	2
25	5	0	3	2
Total	35	0	21	11

The most outstanding feature of this experiment was that mortality occurred only among the male rats. The LD_{50} for males was approximately 15 mg. for a rat weighing some 240 gms. while that for females was over 25 mg.

In view of these results an experiment was planned, using 50 males and 50 females. The dose was also spaced in order to obtain one causing 100% mortality in each sex. The same procedure as before was used and the results can be summarised in Table No. 2.

TABLE No. 2

The effect of sex on the susceptibility of rats to retrorsine (2nd Experiment)

Males

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval between injection and death in hours: 36	48	60	72	90	T.
1	207 gm.	12.5 mg.	10	—	—	1	—	—	1
2	206.5 gm.	15 mg.	10	—	3	1	4	—	8
3	206 gm.	17.5 mg.	10	6	—	—	2	—	8
4	207 gm.	20 mg.	10	9	—	—	—	—	9
5	206 gm.	22.5 mg.	10	8	1	—	1	—	10
	Total No. of Rats		50	23	4	2	7	—	36

Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours: 36	48	60	72	90	T.
1	216.5 gm.	20 mg.	10	—	—	—	—	—	—
2	218 gm.	30 mg.	10	—	—	—	1	—	1
3	217 gm.	40 mg.	10	—	—	1	2	—	3
4	215.5 gm.	50 mg.	10	—	1	1	4	1	7
5	217.5 gm.	60 mg.	10	—	1	1	5	3	10
	Total No. of Rats		50	—	2	3	12	4	21

This experiment proved conclusively that sex plays a very important part in the susceptibility of rats to retrorsine. The LD_{50} for males was 14 mg. in contrast to 45 mg. for females of the same weight and age. Also the interval between infection and death was much shorter in the case of the males, 66% of which died during the first 36 hours, whereas no females died during this period. The highest mortality amongst females occurred during the 60 to 72 hours interval.

Isatidine

In these experiments the same technique was used. After preliminary tests to determine the suitable range of dosage a final experiment was planned. The results are summarized in Table No. 3.

TABLE No. 3

The effect of sex on the susceptibility of rats to isatidine

Males

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval between injection and death in hours 36	48	60	72	90	T.
1	231 gm.	60 mg.	4	—	—	—	—	—	—
2	231 gm.	70 mg.	4	—	—	—	—	—	—
3	232 gm.	80 mg.	4	—	—	—	—	—	—
4	232 gm.	90 mg.	4	—	—	—	—	—	—
5	232 gm.	100 mg.	4	—	—	—	—	—	—
6	232 gm.	110 mg.	4	—	—	—	—	—	—
7	232 gm.	120 mg.	4	—	—	—	1	1	2
8	232 gm.	130 mg.	4	—	1	1	—	—	2
9	220 gm.	140 mg.	4	2	1	—	—	—	3
10	221 gm.	150 mg.	4	—	2	2	—	—	4
			40	2	4	3	1	1	11

Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval between injection and death in hours 36	48	60	72	90	T.
1	219 gm.	60 gm.	4	—	—	—	—	—	—
2	219 gm.	70 gm.	4	—	—	—	—	—	—
3	217 gm.	80 gm.	4	—	—	—	—	—	—
4	218 gm.	90 gm.	4	—	—	—	—	—	—
5	217 gm.	100 gm.	4	—	—	—	—	—	—
6	217 gm.	110 gm.	4	—	—	—	—	—	—
7	216 gm.	120 gm.	4	—	—	—	—	—	—
8	215 gm.	130 gm.	4	—	—	—	—	—	—
9	214 gm.	140 gm.	4	—	—	—	—	1	1
10	214 gm.	150 gm.	4	—	—	—	—	1	1
11	200 gm.	160 gm.	4	—	—	—	—	—	—
12	199 gm.	180 gm.	4	—	—	—	—	—	—
13	198 gm.	200 gm.	4	—	2	1	—	—	3
14	214 gm.	210 gm.	4	—	—	—	—	—	—
15	204 gm.	220 gm.	4	2	1	—	—	—	3
			60	2	3	1	—	2	8

This experiment proved that the influence of sex was the same as for retrorsine and that the LD_{50} for both sxes was much higher for isatidine than for retrorsine.

The dose necessary to produce mortality in females was so high that although both sides of the rat were used for the injection and a saturated solution of isatidine in citronic acid was used, there was a tendency for sloughing to take place. This fact most probably explained the absence of mortality in group No. 14.

Pteropherine

Preliminary experiments with this alkaloid indicated that females were more susceptible than males. To determine the LD_{50} an experiment was planned with the following results summarized in Table No. 4.

TABLE No. 4

The influence of sex on the susceptibility of rats to pteropherine

Males

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval between injection and death in hours 36	48	60	72	90	T.
1									
2	215 gm.	15 mg.	4	—	—	—	—	—	—
3	217 gm.	17.5 mg.	4	1	—	—	—	—	1
4	215 gm.	20 mg.	4	2	—	—	—	1	3
5	217 gm.	22.5 mg.	4	2	—	—	—	1	3
6	217 gm.	25 mg.	4	2	2	—	—	—	4
			20	7	2	—	—	2	11

Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval between injection and death in hours 36	48	60	72	90	T.
1	186 gm.	12.5 gm.	4	—	—	—	—	—	—
2	186 gm.	15 gm.	4	—	2	1	—	—	3
3	186 gm.	17.5 gm.	4	4	—	—	—	—	4
4	186 gm.	20 gm.	4	4	—	—	—	—	4
5	186 gm.	22.5 gm.	4	4	—	—	—	—	4
6	187 gm.	25 gm.	4	4	—	—	—	—	4
			24	16	2	1	—	—	19

The influence of sex on the toxicity of pteropherine proved to be exactly the opposite to that in retrorsine and isatidine, although not so pronounced. The difference in the LD_{50} was not so large but the interval between injection and death was much shorter in the females than in the males.

The effect of sex on the susceptibility of rats to retrorsine

The effect of castration on the susceptibility to retrorsine (1st Experiment).

In order to study the influence of sex in more detail a number of both male and female rats were castrated. After an interval of 2 months they were used in an experiment with retrosine.

The results are summarised in Table No. 5.

TABLE No. 5

The effect of castration on the susceptibility to retrorsine

Normal Males

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	72	T.
1	231 gm.	10 mg.	3	—	—	—	—	—	—
2	237 gm.	17½ mg.	3	—	1	1	1	—	3
3	248 gm.	25 mg.	3	—	1	1	1	—	3
4	243 gm.	32½ mg.	3	—	1	2	—	—	3
5	241 gm.	40 mg.	3	2	1	—	—	—	3
6	250 gm.	47½ mg.	3	2	1	—	—	—	3
7	233 gm.	55 mg.	3	2	1	—	—	—	3
			21	6	6	4	2	—	18

Castrated Males

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	72	T.
1	263 gm.	10 mg.	3	—	—	—	—	—	—
2	262 gm.	17½ mg.	3	—	—	—	—	—	—
3	253 gm.	25 mg.	3	—	—	—	—	—	—
4	263 gm.	32½ mg.	3	—	—	—	1	1	2
5	267 gm.	40 mg.	3	1	—	1	—	1	3
6	258 gm.	47½ mg.	3	—	3	—	—	—	3
7	258 gm.	55 mg.	3	1	2	—	—	—	3
			21	2	5	1	1	2	11

Normal Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	72	T.
1	222 gm.	10 mg.	3	—	—	—	—	—	—
2	232 gm.	11½ mg.	3	—	—	—	—	—	—
3	230 gm.	25 mg.	3	—	—	—	—	—	—
4	232 gm.	32½ mg.	3	—	—	—	—	—	—
5	225 gm.	40 mg.	3	—	—	—	—	1	1
6	227 gm.	47½ mg.	3	—	—	1	—	—	1
7	227 gm.	55 mg.	3	—	—	1	—	—	1
			21	—	—	2	—	1	3

Castrated Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	72	T.
1	248 gm.	10 mg.	3	—	—	—	—	—	—
2	257 gm.	17½ mg.	3	—	—	—	—	—	—
3	256 gm.	25 mg.	3	—	—	—	—	—	—
4	256 gm.	32½ mg.	3	—	—	—	—	—	—
5	253 gm.	40 mg.	3	—	—	—	—	—	—
6	253 gm.	47½ mg.	3	—	—	1	—	—	1
7	270 gm.	55 mg.	3	—	—	1	1	—	2
			21	—	—	2	1	—	3

This experiment indicated that the removal of the ovary had very little, if any, effect on the susceptibility of the female rat to retrorsine. Castrated male rats were slightly more resistant than uncastrated ones.

A further experiment was planned in which the sex of rats was completely reversed by means of castration and subsequent hormonal implantation. Female rats were castrated and after 2 months implanted with Oreton-F brand of testosterone and after another six weeks used for retrorsine injections. Similarly castrated male rats were implanted with stilboestrol and estradiol tablets.

Table No. 6 summarises the results.

TABLE No. 6

Influence of reversal of sex on the susceptibility of rats to retrorsine

Normal Males

				Mortality interval between injection and death in hours				
Gr. No.	*Av. Weight*	*Dose*	*No. of rats*	*24*	*36*	*48*	*60*	*T.*
1	242 gm.	10 mg.	2	—	—	—	—	—
2	240 gm.	20 mg.	2	—	1	—	1	2
3	238 gm.	30 mg.	2	—	2	—	—	2
4	238 gm.	40 mg.	2	—	2	—	—	2
5	248 gm.	50 mg.	2	—	2	—	—	2
6	227 gm.	55 mg.	2	—	2	—	—	2
			12	—	9	—	1	10

Castrated Males

				Mortality interval in hours				
Gr. No.	*Av. Weight*	*Dose*	*No. of rats*	*24*	*36*	*48*	*60*	*T.*
1	240 gm.	10 mg.	2	—	—	—	—	—
2	240 gm.	20 mg.	2	—	—	—	—	—
3	235 gm.	30 mg.	2	—	—	—	—	—
4	225 gm.	40 mg.	2	—	—	1	1	2
5	222 gm.	50 mg.	2	—	1	1	—	2
6	220 gm.	55 mg.	2	—	1	1	—	2
			12	—	2	3	1	6

Castrated Males + Stilboestrol

				Mortality interval in hours				
Gr. No.	*Av. Weight*	*Dose*	*No. of rats*	*24*	*36*	*48*	*60*	*T.*
1	218 gm.	10 mg.	2	—	—	—	—	—
2	215 gm.	20 mg.	2	—	—	—	—	—
3	215 gm.	30 mg.	2	—	—	—	—	—
4	210 gm.	40 mg.	2	—	—	—	—	—
5	190 gm.	50 mg.	2	—	—	1	—	1
6	190 gm.	55 mg.	2	—	1	1	—	2
			12	—	1	2	—	3

Castrated Males + Estradiol

				Mortality interval in hours				
Gr. No.	*Av. Weight*	*Dose*	*No. of rats*	*24*	*36*	*48*	*60*	*T.*
1	208 gm.	10 mg.	2	—	—	—	—	—
2	205 gm.	20 mg.	2	—	—	—	—	—
3	200 gm.	30 mg.	2	—	—	—	—	—
4	200 gm.	40 mg.	2	—	—	—	—	—
5	200 gm.	50 mg.	2	—	—	—	—	—
6	195 gm.	55 mg.	2	—	—	1	—	1
			12	—	—	1	—	1

Normal Females

				Mortality interval in hours				
Gr. No.	*Av. Weight*	*Dose*	*No. of rats*	*24*	*36*	*48*	*60*	*T.*
1	218 gm.	10 mg.	2	—	—	—	—	—
2	202 gm.	20 mg.	2	—	—	—	—	—
3	200 gm.	30 mg.	2	—	—	—	—	—
4	205 gm.	40 mg.	2	—	—	—	—	—
5	200 gm.	50 mg.	2	—	—	—	—	—
6	200 gm.	55 mg.	2	—	—	1	—	1
			12	—	—	1	—	1

Castrated Females

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	T.
1	228 gm.	10 mg.	2	—	—	—	—	—
2	220 gm.	20 mg.	2	—	—	—	—	—
3	218 gm.	30 mg.	2	—	—	—	—	—
4	222 gm.	40 mg.	2	—	—	—	—	—
5	222 gm.	50 mg.	2	—	—	—	—	—
6	230 gm.	55 mg.	2	—	—	—	—	—
			12	—	—	—	—	—

Castrated Females + Testosterone

Gr. No.	Av. Weight	Dose	No. of rats	Mortality interval in hours 24	36	48	60	T.
1	222 gm.	10 mg.	2	—	—	—	—	—
2	220 gm.	20 mg.	2	—	1	—	—	1
3	220 gm.	30 mg.	2	1	1	—	—	2
4	218 gm.	40 mg.	2	1	—	—	1	2
5	210 gm.	50 mg.	2	1	1	—	—	2
6	207 gm.	55 mg.	2	1	1	—	—	2
			12	4	4	—	1	9

This experiment proved that by the implantation of stilboestrol and estradiol into castrated male rats the resistance to retrorsine could be increased almost to that of normal females. In this respect stilboestrol was slightly less effective than estradiol.

Conversely the implantation of testosterone into castrated female rats reduced their resistance to the same level as that of uncastrated males, although the interval before death was slightly longer.

Discussion

The marked sex difference in susceptibility to retrorsine and isatidine is most probably the explanation for the difficulties experienced by previous workers in correlating the interval of onset of symptoms, the degree of severity, the mortality and the dose of alkaloid administered.

Failure to note the sex of each individual experimental animal would result in what would appear to be entirely different results.

The difference in susceptibility between the two sexes to pteropherine was not so marked. If careful attention were not paid to the interval between administration and death as well as the total mortality it might easily escape notice.

No explanation can as yet be offered as to the mechanism whereby certain sex hormones influence the susceptibility to these poisons.

Summary

1. The toxicity of retrorsine, isatidine and pteropherine for white rats after subcutaneous injection was determined.
2. Sex was found to influence the susceptibility of rats to retrorsine and isatidine profoundly. In the case of these alkaloids males were approximately 3 times more susceptible than females. On the other hand pteropherine was slightly more toxic to females.
3. Removal of the gonads in both sexes had little influence on the susceptibility to retrorsine.
4. The implantation of testosterone into castrated females reduced their resistance to that of entire males.
5. Oestrogens (stilboestrol and estradiol) increased the resistance of castrated males to that of entire females.

ACKNOWLEDGEMENT

I wish to thank the members of the biochemical section for the isolation and purification of alkaloids used and the Director of Veterinary Services, Onderstepoort for the generous facilities provided.

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FACTORS CONTRIBUTING TOWARDS BLOAT IN RUMINANTS

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Introduction

Acute bloat in ruminants is still a major problem all over the world. Despite intensive investigation, the actual cause or causes are still unknown. One of us (K.E.W.) has just completed an intensive study into the eructation reflex, the results of which will appear shortly in the Onderstepoort Journal of Veterinary Research. The object of this paper is to bring his major findings, together with other recent observations, to the notice of our colleagues. Although the problem is far from solved, it is hoped that this information will be of assistance and also stimulate further interest.

The Mechanism of Bloating

Bloat is obviously the result of the rate of gas formation temporarily exceeding that of elimination. Although the modern consensus of opinion is that the main trouble lies in faulty elimination, not excessive formation, both factors must obviously play a rôle. Gas is eliminated by eructation and absorption. The latter route applies mainly to carbon dioxide. There is little doubt that when gas production is rapid, efficient eructation is essential to prevent accumulation. The study of bloat, therefore, turns largely on a study of the eructation reflex and the factors which effect it.

The Eructation Reflex

The eructation of gas is a specific, complex, co-ordinated reflex involving the recticulum, rumen, cardiac orifice and oesophagus. It consists essentially in the movement of free gas from the dorsal rumen forwards and **downwards** to the cardia. This is accomplished by :—

(a) A wave of contraction of the ruminal musculature which starts in the posterior sac and moves forward. This usually follows on, but is distinct from, the backward movement designed to mix the ingesta. An eructation contraction may follow each backward movement or only every second or third one.

(b) Clearing of the cardia by a sudden relaxation of the reticulum. The importance of this reticular function depends on the degree of filling of the rumen and the posture of the animal, both of which determine the relative positions of the free gas and the cardia. The well-known beneficial effect of standing the animal uphill is simply due to bringing the cardia nearer the free gas.

(c) Opening of the cardia and passage of the gas up the oesophagus.

The main stimulus for eructation is pressure of gas in the posterior dorsal sac of the rumen.

Factors Affecting the Reflex

A. Mechanical Interference

(a) *Frothing.* Frothing is probably the most potent factor in the aetiology of bloat, as only free gas can be expelled. The cause of frothing is unknown but it can be controlled by the use of agents affecting surface tension.

(b) *Overfilling.* As already explained, overfilling increases the difficulty of moving the gas over the cardia. The degree of overfilling which will prevent eructation depends on the efficiency of the rumino-reticular mechanism and on the degree of frothing.

(c) *Mechanical obstruction of the oesophagus.*

B. Reflex Inhibition

The following conditions have been proved to impair the efficiency of the rumino-reticular mechanism mainly by inhibition of the reticulum:—

(a) *Secretion of adrenalin due to psychic disturbance.* The injection of adrenalin has been found to cause marked depression of the eructation reflex. This hormone is well-known to be excreted under conditions of fear, anger, excitement and pain. The inhibition of the "milk let-down" reflex under similar circumstances has been proved to be brought about by the secretion of adrenalin.

A striking example of the rôle that emotional disturbance can play in the aetiology of bloat has been encountered. The herd in question was changed from hand- to machine-milking and mass outbreaks of bloating occurred during the first few days of the change. Careful investigation failed to reveal any other possible cause of the condition which was accompanied by a marked drop in the milk yield of many of the cows.

Psychic disturbances have not yet been listed under the possible causes of bloat but frequent references have

been made to the fact that **"any change"** is liable to to precipitate it. The possible importance of this factor is another argument for the importance of the good management of highly fed stock. Where disturbance is unavoidable, precautions, such as the reduction of the lucerne ration, should be taken.

(b) *Alkalosis* inhibits the reflex by a central action.

(c) *Distension of the abomasum or caecum* reflexly inhibits the fore-stomachs. This finding reintroduces the question of the use of purgatives such as salines to remove the cause of eructation inefficiency. Distension of the posterior tract would presumably more often arise in the presence of heavy concentrate feeding.

(d) *Damage to the right ventral branch of the vagus nerve* which supplies the reticulum and abomasum. This may occur as a sequel to traumatic reticulitis and may be partial or total. If total, the animal shows complete stenosis of the pylorus and chronic distension of the abomasum till death. If the nerve is partially severed intermittent bloating occurs when other contributing factors are operating.

C. Drugs and Poisons

(a) *Causing hypomotility*

(i) *Prussic acid.* Small doses impair the ruminoreticular mechanism of eructation before causing total ruminal paralysis. This effect is seen long before dyspnoea, cyanosis or other signs of general poisoning are seen. Sub-clinical doses of prussic acid may, therefore, cause bloat especially if present with other factors. Large doses of prussic acid cause total ruminal paralysis.

(ii) *Atropine and histamine* were also found to impair the eructation reflex even before total paralysis of the rumen set in. Subacute atropine poisoning from plants such as Datura spp. may, therefore, contribute towards bloat. The rôle of histamine is not yet known.

(b) *Causing hypermotility*

Violent ruminotories such as carbamylcholine and veratrine cause spastic contraction of the rumen which completely obliterates the rhythmic, co-ordinated movements essential for eructation. Acute bloat has frequently followed carbamylcholine administration. These drugs would, therefore, appear to be definitely contra-indicated.

Conclusions

It is evident from the above that bloat may be caused by numerous factors. Most cases are probably not due to any single cause but to a combination of factors acting simultaneously. A

moderate degree of frothing may not cause bloat *per se*, but, if combined with a certain amount of overfilling or an impaired reflex mechanism or both, acute bloat may result. This conception of a multiplicity of varying factors being responsible goes far to explain the baffling occurrence of the condition.

Evidence of a hereditary tendency to bloat has been obtained in both America and the Union. Further information from our colleagues on this point would be very welcome.

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THE URINARY EXCRETION OF ARSENIC IN THE HORSE

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The rate of elimination of arsenic was investigated after the administration of a single large dose and after repeated small doses of this drug. For this purpose mares were dosed by stomach tube with a one per cent solution of arsenic trioxide and urine samples collected by catheterization.

Method of Analysis

The method used for the determination of arsenic was a slight modification of the procedure of Levvy (1). It is described below.

Apparatus. The apparatus for digestion of the urine samples was a 250-ml. flask fitted with two necks to take a downward condenser and a separating funnel, all the unions being of ground glass. The fumes which did not condense were carried off with running water into the sink.

The apparatus for liberation of arsenic was of the conventional type used by Allcroft and Green (2), but on a smaller scale. It consisted of a generating flask (a 100-ml. Erlenmeyer fitted with 2-hole rubber stopper containing a separating funnel and a delivery tube), connected to a train of four 15-ml. tubes, the last a centrifuge tube. The first tube contained 10 N NaOH, the second and third 5% lead acetate, and the centrifuge tube 2 ml. of 0.02% $NAgNO_3$. In each tube the glass connecting tube leading from the preceding tube dipped below the surface of the liquid.

Procedure. To 50 ml. of urine in the digestion flask 20 ml. of concentrated HNO_3*, 10 ml. of concentrated H_2SO_4, 2.5 ml. of 60% $HClO_4$ and a glass bead were added, and the mixture was heated, at first gently until frothing subsided, and then to the boiling point. Charring of the contents was avoided as this might result in reduction of the As to the more volatile $AsCl_3$ and subsequent loss of As. Concentrated HNO_3 was added dropwise through the separating funnel until the digest remained clear. Heating was continued till fumes of H_2SO_4 appeared, and the contents were allowed to cool. Five ml. of a saturated solution of

ammonium oxalate was now added and the mixture heated till fumes of H_2SO_4 appeared, cooled, 5 ml. of water added, again heated to fuming of H_2SO_4 and cooled.

The digest was transferred to the generating flask, diluted to approximately 50 ml., cooled if too hot, 3 drops of 5% $CuSO_4$ and 10 drops of $SnCl_2$ (40% in concentrated HCl) added, 7g. to 8g. of granular, As-free zinc introduced, and the flask immediately connected to the absorption tubes. The reaction was allowed to carry on briskly for at least 30 minutes. If the reaction subsided, more dilute H_2SO_4 was added through the funnel.

When the liberation of the arsenic was complete, the $AgNO_3$ tube was removed, the delivery tube dipping in the $AgNO_3$ rinsed with a minimum amount of distilled water, KI added until the precipitated AgI was redissolved, and a little $NaHCO_3$ and three drops of starch solution added. The mixture was then centrifuged, giving a clear supernatant liquid which was titrated in the tube with 0.001 N iodine from a microburette until a reddish-brown colour persisted for at least 30 seconds.

*All the chemicals used should be arsenic-free.

Experimental Results

Good recoveries were obtained when varying amounts of arsenic were added to urine samples and determined by the above procedure. The results of this experiment are recorded in Table 1. They are the absolute values obtained, no upward corrections having been introduced.

Table I

Recovery of Arsenic added to Urine

As_2O_3	As_2O_3 Recovered	
mmg.	mmg.	%
49.45*	41.04	83
49.45	46.47	83
24.72	19.63	79
12.38	10.81	87

* 1.00 ml. of 0.001 N As_2O_3.

Experiment 1. A mare weighing about 800 lbs. was given 7.5 ml. of Fowler's solution (77.1 mg. As_2O_3) daily for 12 days, thus receiving a total of 925.2 mg. of As_2O_3. Urine samples were taken by catheter, starting the first day after dosing was discontinued. The results are given in Table II.

TABLE II

Days*	As_2O_3†	Days	As_2O_3	Days	As_2O_3	Days	As_2O_3
1	45	6	14	11	4	18	4
2	193	7	18	12	5	21	1
3	100	8	11	13	10	23	5
4	38	9	8	14	4	26	none
5	23	10	7	16	3		

* After last dose. † Micrograms per 100 ml. of urine.

Experiment 2. A mare weighing approximately 1,000 lbs., was given 25 ml. of Fowler's solution (257 mg. As_2O_3) *per os,* and urine samples were collected by catheterization. The results are given in Table III.

TABLE III

Time after Dosing	1 hour	4 hours	6 hours	5 days	8 days
mmg./100 ml. As_2O_3	11	355	546	34	none

Experiment 3. Experiment 2 was repeated and urine samples collected daily from the fourth day onwards to determine when the urine became free of arsenic. Table IV gives the results of this experiment.

TABLE IV

Days after Dosing	4	5	6	7	8
mmg./100 ml. As_2O_3	66	15	17	4	none

Summary

After oral administration of 257 mg. of arsenic trioxide to a horse, arsenic was detected in the urine in abnormal amounts very soon after dosing, and the urine became free of it only after eight days.

When a total of 925 mg. of arsenic trioxide was administered per os to a horse in daily doses of 77 mg. for 12 days, the arsenic was eliminated fairly rapidly in the urine during the first five days after the last dose. After five days the elimination tailed off rapidly until it could not be detected in the urine after 26 days.

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STUDIES ON THE HEAT STABILITY OF THE HAEMAGGLUTININ OF VARIOUS STRAINS OF NEWCASTLE DISEASE VIRUS

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Introduction

South Africa has experienced two epizootics of Newcastle disease (N.D.). The first outbreak, though attended by a heavy mortality, remained confined to the vicinity of Durban, Natal, and was eradicated by movement control and the slaughter of a few birds, without the use of vaccines (Kaschula, Canham, Diesel, Coles, 1946). In 1949–50 a fresh extensive epizootic, which originated in Cape Town, swept the country, so that preventive vaccination with inactivitated and live virus vaccines had to be resorted to (Kaschula, 1950). The live viruses utilized for field preventive vaccination were the American Roakin strain (Beaudette, Bivins and Miller, 1949) and the Haifa strain (Komaroff and Goldschmidt, 1946) from Israel.

The Roakin strain was first used in the field in August 1950 in block inoculation of all fowls in several districts north of the Umgeni River, Natal, where the virulent disease was active in several scattered localities. This had the effect of producing a zone of completely immunized fowls. Block inoculations were also done in the Cape Town and Witwatersrand areas. Later this virus was placed at the disposal of the public for general use.

The Haifa strain was not used in the field until November 1951, when it was made available to the public.

Following the extensive field use of the Roakin vaccine strain of virus, the disease was brought under control and since July 1951 no fresh outbreaks of the virulent form of the disease have ben reported. The extensive use of introduced viruses in South Africa has been attended by the fear that they might cause Newcastle disease to become enzootic. Such apprehension has fortunately not been substantiated by the experience with either the Roakin or the Haifa strain over a period of 20 months. However, when the Roakin strain was used on only a portion of a flock and the remaining fully susceptible birds were exposed to this virus by immediate contact and inadequate isolation measures, a spread

occasionally occurred to them. On clinical, epizootological and biological grounds, it appeared that the viruses isolated were of the Roakin strain, but it was impossible to make an absolutely definite indentification because of the lack of a satisfactory test for the purpose.

Whenever a virus was isolated, it was found desirable to determine whether it was a wild or a vaccine strain.

Various properties of N.D. viruses have been investigated by a number of workers. All strains are antigenically identical, but slight differences have been shown to be present in the host range (Hanson, Upton and Brandly, 1951), in the haemagglutination spectrum with different mammalian erythrocytes (Winslow, Hanson, Upton and Brandly, 1950) in the histo-pathological picture (Karzon and Bang, 1951) in the immunogenicity (Hanson, Crook and Brandly, 1951) and with regard to other properties. This information is of no assistance when the Roakin or the Haifa strains have to be indentified from local wild strains.

In South Africa all wild strains tested have proved highly pathogenic for the pigeon and fowl, while the Roakin and Haifa strains appear to be comparatively avirulent by subcutaneous and intramuscular injection. This wide difference in virulence has been made use of in differentiating the vaccine from the wild strains but in view of the wide range of virulence exhibited by American strains (Binns, Nielson and Miner, 1949), this test has obvious shortcomings.

The work by Hanson, Upton, Brandly and Winslow (1949) based on studies made previously on influenza virus by Salk (1946) and others, showed that the heat stability of various strains of N.D.V. varied considerably. They claimed that the sensitivity of each individual strain was apparently constant and characteristic for the particular strain. Moreover, strains recovered from a particular geographical area resembled one another. Among those tested by them was a New Jersey strain, presumbly the Roakin strain. This work by Hanson et alia (1949) showed that the New Jersey strains had a very labile haemagglutinin, while other strains had more resistant haemagglutinins. These findings provided the incentive to undertake studies on the Roakin and Haifa strains in comparison with several South African wild virulent strains, with the primary object of determining whether *in vitro* methods could be developed for their differentiation.

Francis (1946) described the phenomenon known to-day as the "Francis effect". He showed that when influenza A virus was heated at 56°C for 30 minutes, haemagglutination could then be inhibited by negative serum. It was also considered to be of interest to see whether this phenomenon could be obtained with N.D.V., and if so, whether there was a difference between a South African (Punt) strain and the Roakin strain.

Materials and Methods

A number of South African strains, isolated before vaccination was practised and which were regarded as representative, were collected. Their properties were compared with those of the Roakin and Haifa strains. The origin of these strains is detailed in Table No. 1.

Table No. 1

Description of N.D. Virus Strains

Name of Strain	*Code*	*Origin*	*Egg Generation*
Roakin	Ro	New Jersey, U.S.A.	4
"	R1	Batch 1, prepared from Ro	5
"	R2	Batch 2, prepared from Ro	5
"	R3	Batch 3, prepared from Ro	5
Haifa	Kom. 1	Haifa, Israel	Numerous
"	Kom. 2	Prepared from same antigen as Kom 1	"
"	Kom. 3	Prepared from same antigen as Kom 1	"
Le Seuer	LeS	Stikland, C.P.	3
Punt	P1	Ottery, C.P.	6
"	P2	Prepared from same antigen as P1	6
"	P3	Prepared from same antigen as P1	6
Watkins	W	Kuils River, C.P.	2
Chakaskraal	C.K.	Chakaskraal, Natal	3
Esperanza	Esp.	Esperanza, Natal	3
Verulam	Ver. 1	Verulam, Natal	4
"	Ver. 2	Prepared from same antigen as Ver 1	4
Transvaal	JHB. 1	Johannesburg, Transvaal	10
"	JHB. 2	Prepared from same antigen as JHB. 1	10
S.W.A.	WHK	Windhoek, S.W.A.	4

C.P.=Cape Province.
S.W.A.=South West Africa.
Tvl.=Transvaal.
U.S.A.=United States of America.

Virus Pools. Not less than twelve nine-day old embryonated eggs were used for the production of a pool of virus of each strain. The eggs were injected in the allantoic sac, incubated at 37°C, and only the allanto-amniotic fluids from embryos which died on the second or third day, depending on the strains, were harvested. The pooled fluids were then sealed in 1 c.c. amounts in glass tubes, labelled and stored in a dry ice cabinet. They were used within one month of harvesting. The stock antigens, one of which—Ro—was used in the experiment, were kept in a deep freeze cabinet (-20°C). The frozen tubes were thawed rapidly in water at 37°C, and they were then immersed in a constant temperature water bath at 56°C. Tubes were recovered at the selected intervals, and immediately chilled in ice water. Those not used immediately were returned to the dry ice cabinet.

In Table No. 1 it will be seen that, in the case of several strains, parallel tests with different batches were run. These samples from different batches of virus were prepared from the same stock antigen, e.g. Ver. 1 and Ver. 2 were prepared from the same batch of Verulam antigen. The following were prepared in a similar way from their respective antigens: JHB. 1 and JHB. 2; P1, P2 and P3; Kom. 1, Kom. 2 and Kom. 3; R1, R2 and R3.

The antigens themselves were not included in the tests except in the case of the Roakin strain, where Ro represents the antigen and R1, R2 and R3 three different batches of virus prepared from it.

Haemagglutination Tests (H.A.). The procedure followed was Fabricant's (1949) modification of the U.S. Bureau of Animal Industry method. The chicken erythrocytes were collected in Alsever's solution and in all cases they were used within 72 hours of collection. The red cells received a triple washing in saline and they were used in 0.5% mixture in the tests.

The H.A. tests were done at room temperature. Mammalian physiological saline (0.85% sod. chloride) was used for all dilution work.

The end point employed was the 2+, where 4+ represented complete haemagglutination.

Experimental Procedure I: *Tests on Heat Stability of Haemagglutinin.* Comparative tests were done on the heat stability of the haemagglutinins of the various strains of N.D. virus The same batch of chicken cells was used for all the comparative tests, which were completed within 72 hours, so that the same sample of red cells could be utilized.

The H.A. titres of the various samples are given in Table No. 2.

TABLE No. 2

Heat Stability of the Haemagglutinin of the various Strains of N.D.V. after heating at 56° for varying Periods

Strain	*Batch*	*Code*	*Haemagglutination Titre*						
			0 min.	*15 min.*	*30 min.*	*60 min.*	*120 min.*	*240 min.*	*480 min.*
Roakin	Antigen	Ro	1024	8	4	0	0	0	0
	1	R1	1024	0	0	0	0	0	0
	2	R2	1024	0	0	0	0	0	0
	3	R3	1024	128	128	32	2	0	0
Haifa	1	K1	1024	8	0	0	0	0	0
	2	K2	1024	8	8	8	0	0	0
	3	K3	1024	8	2	0	0	0	0
Le Seuer	1	L1	512	256	32	2	0	0	0
Watkins	1	W1	1024	512	128	8	0	0	0
Punt	1	P1	1024	512	256	8	0	0	0
	2	P2	1024	512	512	512	256	0	0
	3	P3	1024	0	0	0	0	0	0
Esperanza	1	E1	512	0	0	0	0	0	0
Verulam	1	V1	512	0	0	0	0	0	0
	2	V2	512	0	0	0	0	0	0
Chakas-kraal	1	CK1	1024	0	0	0	0	0	0
Windhoek	1	WH1	1024	256	256	8	0	0	0
Johannes-burg	1	JHB1	1024	256	256	128	0	0	0
	2	JHB2	1024	256	128	128	0	0	0

Results. While strains varied from one another in the stability of their haemagglutinin, different batches of the same strain also varied within wide limits. Batch R3 has a fairly stable

haemagglutinin, yet this batch was prepared in the same manner as R1 and R2 from the same antigen Ro. In the same way P1, P2 and P3 differed within wide limits in spite of having been prepared from the same stock antigen. The heat stability of the haemagglutinin thus differs from batch to batch, but the readings for any one batch are, however, easily reproducible. For instance, P2 and P3 were used in studies on the Francis effect and the readings of the haemagglutinin stability were always reproducible.

Experimental Procedure II: *The Action of Positive and Negative N.D. Sera on Heated and Unheated Haemagglutinin of N.D.V.* Two batches of virus, namely P2 and R3, which had a stable haemagglutinin were selected. A comparison was made of the inhibiting effect of known positive and negative N.D. sera on haemagglutination of both heated and unheated samples of these two batches.

The results are indicated in Table No. 3.

TABLE NO. 3

The Francis Effect on N.D. Virus.

Strain	*Heat Treatment at 56°C.*	*Serums Added*	½	¼	⅛	1/16	1/32	1/64	1/128	1/256	1/512
Punt P2	60 minutes	None	+	+	+	+	+	+	+	+	+
		+ Negative serum 1/40	+	+	+	0	0	0	0	0	0
		+ Positive serum 1/40	0	0	0	0	0	0	0	0	0
	None	None	+	+	+	+	+	+	+	+	+
		+ Negative serum 1/40	+	+	+	+	+	+	+	+	+
		+ Positive serum 1/40	0	0	0	0	0	0	0	0	0
Roakin R3	30 minutes	None	+	+	+	+	+	+	+	+	+
		+ Negative serum 1/40	+	+	+	0	0	0	0	0	0
		+ Positive serum 1/40	0	0	0	0	0	0	0	0	0
	None	None	+	+	+	+	+	+	+	+	+
		Negative serum 1/40	+	+	+	+	+	+	+	+	+
		Positive serum 1/40	0	0	0	0	0	0	0	0	0

+ = Haemagglutination 4+
0 = No haemagglutination

Result: The phenomenon known as the "Francis effect" of influenza virus is also exhibited by both the N.D.V. strains tested. As can be deduced from the above table, there is no difference in the degree of inhibition.

DISCUSSION AND CONCLUSIONS

The widespread use of introduced (American and Israeli) live virus N.D. vaccine strains in South Africa has posed the problem of recognizing and differentiating them from local strains whenever N.D. virus was isolated. Based on past experience in South Africa, it seemed safe to assume that these live virus vaccines would not perpetuate the disease in the country.

In determining whether a recovered virus was a natural wild strain or a vaccine one, up to the present the deciding factor has been the presence or absence of virulence after intramuscular injection of fowls and pigeons and by the supporting history.

However, natural diversity in virulence of various strains of N.D. virus has been described in the United States of America (Beaudette and Black 1946, Beach, 1948, Goldhaft and Wernicoff, 1948, Binns et alia, 1949). In America such naturally avirulent strains as the Blacksburg (Hitchner and Johnson, 1948) and the Roakin strains have been isolated, while at the other extreme, the California strain 11914 (Beach, 1944), is indistinguishable by virulence test from the most virulent Asiatic forms of the disease. In South Africa all wild strains tested have proved highly pathogenic for fowls and pigeons, while the Roakin and Haifa strains were always non-virulent by intramuscular injection. This virulence test has been a useful aid in differentiating the vaccine from the wild strains, but in view of the diversity in virulence that the virus has shown in America, where such a test would be valueless, it has its obvious shortcomings.

The results of this investigation revealed that the heat stability of the haemagglutinin of various batches of the same virus differed greatly in some instances, thus making readings unpredictable from batch to batch. Smith and Westwood (1949) observed similar variations with influenza virus. They found that various batches of influenza A, strain PR8, when heated at 56°C for 30 minutes, showed a variation in the loss of haemagglutinin from 10 to 70% and that the loss was unpredictable from batch to batch. Similar experiences are recorded in a later article (Smith, Westwood, Westwood and Belyavin, 1951).

Since the heat stability of the haemagglutinin is not a constant feature of different batches of a given strain of N.D. virus, this test has no value in differentiating strains.

Comparisons of the heated haemagglutinin of a typical South African strain, namely the Punt strain, batch P2 and the American Roakin strain, batch R3, showed that the "Francis effect" of influenza virus could be obtained with both strains, but no assistance was gained from a differential point of view.

Summary

The problem of differentiating and recognizing the introduced American Roakin and the Israeli Haifa N.D. virus strains from wild South African strains has arisen.

The difficulties of differentiating strains are discussed and a method in use, based on virulence for fowls and pigeons, is mentioned.

Comparisons of the heat stability of the haemagglutinin at 56°C of the two introduced strains and several typical South African strains were made.

The results show that the heat stability of different batches of virus vary considerably and as readings are not constant and therefore unpredictable, this test is of no value in differentiating strains.

The inhibition of haemagglutination of heated haemagglutinins by negative serum has been demonstrated. The phenomenon is similar to the "Francis effect" with influenza virus. This too, is of no value in differentiating strains of N.D. virus.

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CASE REPORT

PROLONGED LACTATION IN A SPAYED GOAT EWE TREATED WITH STILBOESTROL

R. CLARK

Onderstepoort

For the purposes of demonstration to students a goat ewe (boerbok) was spayed on the 30th of July, 1951. On the 21st of September, 1951, a 15 m.g. fused tablet of stilboestrol was inserted under the skin of the thigh. The animal started to form milk in about seven days and has been producing from 200 to 300 c.c. per day up to the time of writing (28.5.52).

UDDER DEVELOPMENT IN A SPAYED GOAT AFTER STILBOESTROL IMPLANTATION

The milk is normal in appearance and contains 7.5% fat and 9.8% solids not fat.

The accompanying photograph, showing the development of the udder, was taken on 16.3.52.

Another remarkable feature shown by this animal is that failure to withdraw the milk does not result in drying off. The goat was deliberately not milked for a period of 14 days on one occasion and 30 days on another. At the end of both these periods just over 900 c.c. of apparently normal milk was withdrawn and subsequent daily milking yielded the same amounts as before.

CASE REPORT

INTESTINAL RESECTION AND ANASTOMOSIS IN A PIGLET

D. IRWIN

Somerset West

On 24th November, 1951, a two-week-old Large White piglet, weighing 10 lbs. was presented for treatment. Inspection revealed an extensive swelling about 2½ cm. in diameter in the umbilical region. The skin had been reflected backwards off the swelling as far as the preputial pouch, and had undergone dry necrosis. The swelling was not reducible, fluctuation was minimal, and an 18 gauge needle puncture produced nothing.

The surgery assistant was off duty, and the only available help was the local kennel man, who was, however, only available for the first half hour of the proceedings. Nevertheless it was decided to operate in an effort to reduce the mass.

Two c.c. Nembutal was administered intraperitoneally. The piglet was placed between sand-bags in the dorsal position, and the operation site cleansed. Deep cracks prevented thorough asepsis. The site was draped.

Very soon it was apparent that the intestinal peritoneal and subjacent tissues were damaged beyond repair and that resection was necessary if the piglet was to live. The lack of bowel clamps and suitable premedication and the very small diameter of the intestine made the proceedings tedious and the prognosis grave. Several times it was decided to carry on only for practice in this surgical procedure. Anaesthesia was continued with ether. The lateral anastomosis method was adopted, but the small diameter of the intestine permitted only a single row of Lembert sutures. Fortunately the intestine was relatively empty, as sterile saline was not available. The hands were not rescrubbed after adjusting the ether intake and altogether surgical procedure was abused. Before finally closing the peritoneal cavity one tube of M. & B. Intra-mammary Penicillin (50,000 U.) was introduced. The skin was sutured with nylon mattress sutures and ordinary interrupted ones. The preputial sac was removed and also part of the prepuce. Castration was performed.

300,000 units of intra-muscular penicillin was administered and about 10 c.c. 25% Dextrose given sub-cutaneously. The piglet was delivered home after the operation with instructions to supply a warm water bottle, warm tea and to give 0.25 gm. sulfatriad three times per day. A very doubtful prognosis was given. Very surprisingly the

owner phoned about a week later to ask when the stitches were to be removed.

By December 15th, three weeks later, the piglet was similar in size and weight to his litter mates.

Success was attributed to the antibiotic and sulfa drugs, and to general body vigour.

Conclusion: Would it not be practical to advise surgical interrefence in the "acute abdomen" cases so commonly encountered in pigs, if they are of sufficient value ?

OBITUARY

DR. FRANK ARTHUR VERNEY, C.B.E., F.R.C.V.S. (1875—1952)

The passing of Dr. Frank Arthur Verney at the age of 77 has removed yet another of that great band of indefatigable veterinary surgeons who came to Southern Africa from Britain in the days when veterinary science in this country could be aptly described as being in the cradle stage. Verney was a man of great mental capacity and a man of great energy. He came to South Africa in 1897 to join the Natal Veterinary Service. In 1909 he became Principal Veterinary Officer of Basutoland, a post that he held with distinction for more than 30 years. For part of that period he took over the portfolio of Agriculture with the title of Principal Veterinary and Agricultural Officer. His most notable achievement in Basutoland was the total eradication of sheep scab under the most difficult conditions, considering that dips, cement and other building material for the erection of sheep tanks and structures incidental thereto, had to be transported into the mountainous hinterland of this territory on pack donkeys along rock-ledge trails. He concerned himself too with livestock improvement in the Territory, particularly that of horses. He was an ardent student and lover of the thoroughbred. By virtue of his knowledge of the subject his services were much sought after by the leading Agricultural Show Societies, both as judge and referee. He was also a successful breeder of thoroughbreds. Verney was also a great sportsman and in later years took up golf seriously. He served in the Anglo-Boer War and was with the Natal Carbineers. He was chairman of the local Hospital Board for some years.

In 1935 he settled in the Mount Currie district where he farmed successfully farmed and established a name for Jersey cattle breeding. A gentleman in the finest sense of the word, it was my privilege to know him during the past quarter of a century. His abounding humour and his sense of fair play were an example to all who came in contact with him and his passing marks a sad occasion for his many friends.

He had the highest honour men can confer upon a man — the universal respect of the community in which he lived.

While our thoughts go out to Mrs. Verney, his two sons and two daughters, we know and feel that their memories alone will comfort and sustain them. *Vale !*

Kokstad, G. T. H.
April, 1952.

WILLIAM MICHAEL POWER

William Michael Power was born at Waterford, Ireland, on 29th December, 1873, and was educated at Waterpark College, Waterford. He obtained his M.R.C.V.S. diploma in 1896 and practised as an assistant in Dublin until 1899. He obtained a professional appointment in the Natal Government Service in July, 1899.

During the Anglo-Boer War he served as a veterinarian until 1901. He went through the siege of Ladysmith, served during the Native Rebellion of 1906 and was eventually placed on the Reserve of Officers, retiring with the rank of Major. He was stationed as a Veterinary Officer at Ixopo after the war and in 1905 was transferred to Pietermaritzburg to act as Principal Veterinary Officer in the absence of the late S. B. Woollatt. On 1st November, 1907, he was promoted to Chief Veterinary Officer of the Natal Veterinary Division. At Union he was appointed Senior Veterinary Officer of Natal, a post he held until his retirement in 1928. He took an active part in agricultural affairs in Natal, and was President of the Royal Agricultural Society of Natal from 1930-1935 when he was elected an Hon. Life President.

In 1931 he turned his activities towards politics when he was elected a member of the Provincial Council. Two years later he became a member of the Executive Committee of the Province. In 1946 he resigned from the Executive, and in 1947 from the Provincial Council, on his appointment as a member of the Land Tenure Advisory Board. He retired from this office in 1951.

During his lifetime he held many important positions. Among the more important were membership of the Historical Monuments Commission, the Veterinary Services Commission and the Broome Commission on Natal Indians. As Chairman of the Natal Parks, Game and Fish Preservation Board, he played a most important and active part in bringing the Natal Game Reserves to the notice of South Africa; the camp at Hluhluwe might well be regarded as a monument to his untiring efforts. He never tired of doing good deeds and kindnesses to many less fortunate individuals. To Natal and the veterinary profession in South Africa his death on 7th November, 1951, came as a great loss. *Vale !*

A.S.C.

BOOK REVIEW

GRUNDRISS DER MEDIZINISCHEN ENTOMOLOGIE by F. Weyer and F. Zumpt.

The third edition of this book which has appeared in 1952 embodies no very radical alterations in the main text from the previous edition which appeared in 1948. The treatment of the Diptera has been the subject of the main revision. The classification in particular has been affected and the relationship between those arthropoda discussed. The morbid processes associated with them have been brought into line with recent advances in our knowledge. The chapter dealing with methods of control and treatment has been completely rewritten and modernized particularly in respect of the new synthetic insecticides.

The book represents an extremely concise treatment of the problems of medical and veterinary entomology but, as a guide for the medical and veterinary student, it is disappointing as the student is credited with a greater knowledge of the subject than he normally possesses, judging from the cursory manner in which the various parasitic groups are described and their relationships with disease transmission and causation treated. A greater number of illustrations, more descriptive in character than those provided, would have considerably added to the value of the volume and it is to be regretted that nowhere are keys for the recognition of genera or species, so necessary for the instruction of the medical entomologist, included.

As a brief review and compilation of current medical entomological literature the book is useful and contains a wealth of information. It is marred, unfortunately, by a few serious inaccuracies and omissions. Statements are made which may be misleading, particularly to the beginner. It is an open question whether the concepts in classification of certain of the parasitic and injurious orders held by the authors will be clear to the student and emphasise those forms which are of the greatest economic significance.

R. du T.

* * *

THE CLASSIFICATION OF WEST AFRICAN LIVESTOCK (1951), by I. L. Mason. Published for the Commonwealth Agricultural Bureaux by McCorquodale & Co. Ltd., Glasgow (10s. 6d.).

The position regarding indigenous livestock generally and cattle types in particular has always been somewhat obscure in West Africa and a debt is due to Mr. I. L. Mason for his clear analysis of the situation.

Whereas the cattle types in East, Central, North and South Africa were well-known a generation ago, it has taken much time and research to set down in print what the West African types are, along with their distribution and potentialities.

Fortunately owing to the observations of Sir Harry Johnston, Stewart, Pierre, Doutressoulle, Receveur and others it is now not only evident that the lateral horned and cervico-Moracic humped Afrikander (lateral horned Zebu) and its "relative", the Sanga, have not penetrated

into West Africa; but that the indigenous types in general fall into two main classes, the humpless and the humped. Further subdivision is:—

I *Humpless cattle,* distributed among the pagan tribes in the southern forest clad and tsetse-ridden portion of the West African "bulge" and on an "island" around Lake Chad in the Zebu area, where the purest forms of Kuri cattle are also without a hump.

II *Short-horned Zebus* "in the north up to the edges of the desert" where the nomadic tribes range;

III *Lyre-horned Zebus* in the intermediate zone and owned by the Fulani. As could be expected there are intermediate types of the 3 main groups.

The photographs both of cattle and other livestock selected by Mr. Mason are excellent, and it is hoped he will follow up his preliminary study by a comprehensive survey of at least the cattle, with data on anatomical features, *e.g.* nature of hump and vertebrae.

As in the case of cattle, Mason shows that the horses, sheep and goats also lend themselves to subdivision into 3 main classes, size being the main distinguishing feature.

H.H.C.

LETTERS TO THE EDITOR

Onderstepoort,
17th June, 1952.

The Editor,
Journal S.A.V.M.A.,
Onderstepoort.

Dear Sir,

Haemophilia in Dogs.

I should be most grateful if colleagues in the Union could give me any information on the occurrence of haemophilia in dogs. I refer of course to the familiar type as it occurs in human beings.

The inquiry is being made on behalf of a medical colleague who is doing work in this field and is very anxious to see if an example of this disease in South Africa can be obtained.

I am, etc.,

W. D. MALHERBE.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

Abstract of Minutes of a Council meeting of the South African Veterinary Medical Association held in the Office of the D.V.S., Victory Buildings on March 13, 1952.

Present : S. W. J. van Rensburg (President), G. D. Sutton (Honorary Treasurer), H. P. Steyn, M. C. Robinson, R. A. Alexander, W. D. Malherbe, G. Pfaff (Vice President), A. C. Kirkpatrick (Hon. Life Vice President), A. D. Thomas, P. S. Snyman, A. M. Diesel, J. G. Boswell, E. M. Robinson (Editor) and M. de Lange (Honorary Secretary).

1. Arising from the minutes of the previous meeting on October 11, 1951. Licence fees for spayed bitches. It had not been found possible to get the fee reduced after prolonged discussion with the Provincial authorities.
2. The S.P.C.A. has now appointed a full-time veterinarian, Dr. P. L. Louw.

Abstract of Minutes of a Council meeting of the South African Veterinary Medical Association held in the Office of the D.V.S., Victory Buildings on June 12, 1952.

Present : S. W. J. van Rensburg (President), G. D. Sutton (Hon. Treasurer), R. A. Alexander, A. M. Diesel, H. P. Steyn, J. G. Boswell, P. S. Snyman, G. Pfaff (Vice President), A. D. Thomas, P. J. du Toit (Hon. Life Vice President), W. D. Malherbe, E. M. Robinson (Editor), and M. de Lange (Honorary Secretary).

1. It was recommended that "seeing eye dogs" used by blind people should receive free veterinary treatment.
2. Dr. Zwarenstein has been elected as the Association's representative on the Natal Anti-tuberculosis Association.
3. Drs. P. J. du Toit and R. A. Alexander have been elected to Honorary Membership of the South African Medical Association.
4. Drs. A. D. Thomas and G. Pfaff were re-elected as members of the Veterinary Board.
5. Mr. S. P. A. Schoeman was prosecuted on two counts for contravention of Section 17 part 1 of the Veterinary Act of 1933. He was fined £10 on each count.

BRANCH MEMBERSHIP OF THE ASSOCIATION

Complaints have been received from some veterinarians in the Union that certain matters affecting them have been discussed in Council meetings and they have not been informed of the result of such discussions. Every individual member of the Association is not necessarily informed of all matters which are dealt with at these meetings but full details are given to the Branch Associations. Every member should therefore make it his duty to join his local one. Where such a branch does not exist, he should join the nearest one. An attempt should be made to found district branches in the interests of the individual veterinarian and the profession as a whole.

INTERNATIONAL VETERINARY CONGRESS IN STOCKHOLM

August 9—15, 1952.

The Organising Committee of the 15th International Veterinary Congress in Stockholm have pleasure in inviting colleagues in South Africa to take part in the Congress as sectional reporters.

The Sections are as follows :—

1. Infectious Diseases, including tropical ones.
2. Diseases caused by animal parasites.
3. Poisonings.
4. Metabolic disturbances, deficiency diseases and allergic ones.
5. The Physiology and Pathology of Reproduction and Lactation.
6. Animal Husbandry.
7. Diagnosis, Therapy and Surgery.
8. Food Hygiene and Public Health.
9. International Veterinary Co-ordination Problems.

The subjects chosen should be of current interest and suited to elucidating problems and questions that are economically far reaching.

Titles of reports for Sectional Meetings should be sent to the Secretary of the S.A. Veterinary Medical Association in time for them to reach the Committee of the Congress before September 1, 1952.

Plenary sessions will be held on various subjects of interest to the members of the Congress as a whole.

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Write for folder on AUREOMYCIN OINTMENT.

THE MARCH OF VETERINARY SCIENCE IN SOUTH AFRICA

S. W. J. VAN RENSBURG
Onderstepoort

Presidential address delivered at the 47th Annual Conference of the South African Veterinary Medical Association, 12th August, 1952.

The great pleasure of fully appreciating the tremendous progress and achievements of veterinary science in this country during the past 50 years falls to the relatively few of us who are old enough to remember the deplorable state of affairs of our animal health at the turn of the century, and who were able to follow the march of veterinary science during the intervening years.

If I may be permitted to lapse into a reminiscent mood for a few moments, I would like to relate some vivid memories here of my childhood days as a real son of the soil on a Karoo farm. My earliest recollections are of my elders engaged in serious discussions on the havoc wrought among cattle by the much dreaded disease, lungsickness (pleuro-pneumonia). Next I remember being held up as a young toddler by the old native nurse on the kraal wall to see the inoculation of cattle against rinderpest. This had practically decimated the herds in the northern provinces and was only prevented from extending its ravages to the Cape by the newly discovered method of inoculation. If memory serves me rightly, then that first sight of a needle being plunged under the skin of a beast and the witnessing of the use of that intriguing new instrument, the hypodermic syringe, kindled in me the first spark of desire to be an animal doctor.

The arresting of the spread and the eventual complete eradication of these two deadly diseases, provided the first shreds of evidence to a sceptical agricultural community of the necessity of the veterinarian to the livestock industry of this country.

A comparative lull followed during the three years' period of war, but in May, 1902, that most difficult and persistent of all animal diseases, East Coast Fever, made it appearance in the Transvaal and spread unchecked through the greater part of the Transvaal, Natal, Transkei and Eastern Cape. Other tick-transmitted diseases like heartwater, redwater and gallsickness at the same time spread far and wide. Further heavy toll was being exacted by anthrax, quarter evil, horsesickness, glanders, gallamsiekte, stywesiekte, blue tongue, bloedpens, sheep scab, mange and other ecto- and endo-parasites. Tsetse fly and nagana in Zululand and parts of the Transvaal rendered some of the best ranching areas in the country uninhabitable. Poisonous plants, many unknown and those that were known presenting a great complexity of problems in regard to their toxic principles and mode of

action, added their full quota to losses amongst all classes of livestock. More recently the list has been augmented by enterotoxaemia, lumpy skin disease, Rift Valley fever and epi-vaginitis. Even the poultry farmer had his headaches in the form of fowl pox, fowl typhoid, Newcastle disease, parasitic diseases and hereditary types of neoplasms.

Can any one visualise what the state of animal industry in this country would have been and how much animal life would have remained if our gallant predecessors had taken it into their heads to impose a rigid 50-year strike of veterinarians in the year 1900 ? Contemplation of what might have been compared with what is shows that the money spent on veterinary services is really insignificant when viewed in the light of the benefits that have accrued.

All these problems were tackled with a degree of determination and devotion which has never received full recognition. The result is that not one of the many diseases which struck terror into the hearts of the agricultural community 50 years ago is viewed with any degree of alarm to-day. They have all been brought under subjection and control as the result of the combined efforts of the veterinarians in the field and in the laboratory. Several have been completely eradicated, many can be effectively controlled by inoculation and other preventive measures, and suitable curative treatment has been devised for all those that cannot be controlled by other methods. The toxic principles of most poisonous plants have been isolated, and loss of stock through the ingestion of poisonous plants has been greatly reduced by properly devised systems of veld management and other methods of treatment. Losses from parasitic diseases have also been brought down to a minimum and can be effectively prevented by methods of treatment and management which have been devised as the result of research throughout the years.

This is a truly remarkable record for a profession which has constantly been handicapped by the smallness of its membership and the limitations of its resources. Our most severe critics and opponents cannot but admit that during the past half century veterinary science in South Africa has achieved results that are unparalleled in any other part of the world. The significance of this success is enhanced by the fact that the great majority of the conditions that have been brought under control are peculiar to the African continent. They do not occur in any other country, and those entrusted with the task of eradicating and controlling them could accordingly not follow the methods applied elsewhere, but had to depend to a large extent on their own resources and ingenuity to devise appropriate methods for combating each individual disease.

What of the future ? Notwithstanding the spectacular attainments of the past, we dare not lapse into complacency while disease and poverty still kill more animals every year than are slaughtered for human consumption, while our human population which has to be fed is rapidly increasing, and while malnutrition, due mainly to inadequate supplies of food of animal origin, is as prevalent with us as in any other civilised country.

Conditions and methods of farming are rapidly changing. The continual subdivision of farms with inevitable overstocking, loss of soil and loss of water means that large areas in this country are fast becoming unsuitable for ranching. The survival of our civilisation depends on the effective conservation of our soil and water, proper cultivation of the soil and the intensive development of pastures. Let me here remind all our members that next month (September) has been declared " conservation month " by those saddled with the enormous task of devising methods of stopping soil erosion. Although we are not expected actually to wield shovels in this campaign, the conservation of soil and water is nevertheless of paramount importance to the veterinary profession, since in future the welfare of our livestock will, in the first instance, be determined not so much by the prevalence of epidemic disease as in the past, but by the quantity and quality of feed that will be available. Every veterinarian should, therefore, cultivate and propagate the save-the-soil complex.

The veterinary problems that will arise and are even now coming to the forefront will be far more involved and complex than those of the past. They will demand more intensive and painstaking research in the laboratory and more assiduous attention on the farm.

While on the one hand we see our supplies of animal feeds dwindling, on the other hand attempts are being made to improve the quality of all classes of animals, in order to increase output by the application of more scientific methods. Cows have to produce more milk, beef animals have to mature at an earlier age and yield bigger carcasses, sheep have to grow more wool and better mutton, and hens are encouraged to lay more eggs. All this involves unnatural methods of breeding, feeding and management, and when the dictates of human greed clash with the laws of nature, trouble is inevitable. This will reveal itself in the form of an increase in the incidence of organic, metabolic and reproductive disorders. It means that veterinary attention will have to be applied not so much on a national basis but be concentrated more and more on the individual herds and on the individual animals themselves.

This switch-over is actually taking place already, having started 15 years ago with the commencement of the exodus of veterinarians from the state service to private practice. It is certainly the most rapid and revolutionary change that veterinary service in this country has yet undergone, and its intensity has been such that in this brief period the number of veterinarians in private practice has increased tenfold.

A great incentive to this quick change-over is the new attitude shown by the agricultural community. Even the most unobservant must have noticed the new spirit of independence and self help which has been rapidly developing among farmers during recent years. Amongst the great majority of them there is no longer that attitude that the state must provide the solution to all their problems. Impatience at waiting has apparently roused them to sudden realisation of the fact that they can accomplish far more by tackling most of

their difficulties on their own. In no other sphere is this marked change of attitude and this independent spirit shown to better advantage than in the readiness with which they have taken to the new forms of veterinary service.

Many of the sceptics said at first that this would be a passing phase, that farmers would not pay for veterinary service and that they would rather attempt to do their own doctoring. These critics overlooked the fact that, notwithstanding frequent gibes and severe criticism, mostly from uninformed sources, the average South African farmer displays as great a degree of intelligence, enterprise and initiative as his counterpart in any other country. When force of circumstances in the past obliged them to be their own veterinarians as far as possible, many farmers developed a high degree of proficiency — sufficient to make them realise their limitations. Therefore, they are only too ready to make full use of professional service as soon as this is placed at their disposal.

Apart from private practice, there is a rapidly growing demand for veterinary services by agricultural associations and co-operatives, and several farmers have even engaged veterinarians on a full-time basis as managers on their farms and ranches. An example of the success which can be attained by the latter was related by the farmer concerned within the past two weeks. On his ranch the conception rate among his beef cattle had dropped to about 40% on account of infectious venereal diseases and other causes. Mortality from calfhood diseases claimed a large percentage of the small number of calves born. Then he engaged a full-time veterinarian. By devising a proper system of management and applying artificial insemination, the latter has stepped up the conception rate to 80% in the past two years and has almost completely eliminated mortality amongst calves. The farmer considers he is thus able to double his contribution to the beef market. If more beef producers can do that, there will be no great danger of a meat shortage !

Any review of progress and past accomplishments will not be complete nor impartial if undesirable features and retarding influences are overlooked.

One of the most disturbing factors in our whole set-up is the undeniable fact that the two most important branches, namely veterinary research and education, which should form the very foundation of an efficient service, have not kept pace with other developments. On the contrary, they have been marching in reverse gear during the past decade or two. When we proudly recall the achievements of veterinary research during the past 50 years, we are in reality but basking in the reflected glory of a past generation.

For various reasons these two important facets in our set-up have lost all their old appeal. Whereas 25 years ago posts in the research and faculty divisions were regarded as the cynosure of the whole profession and provided the goal towards which all ambitious young veterinarians aspired, they are to-day looked at askance and avoided by the majority.

It is perhaps unfortunate that our research has established such a high reputation. Fame invariably involves publicity, and publicity for a service gratuitously given brings increasing demands. In this instance the demands have come in the form of a great variety of ancillary services which actually do not fall within the legitimate sphere of a research worker or veterinary educationist. Research work is accordingly being relegated more and more into the background, with the result that at the moment the number of people engaged on full-time veterinary research in South Africa can be counted on the fingers of one hand.

It has been rightly stated that, whereas in other countries an average of ten workers is engaged on the study of one disease, in South Africa one research worker has to tackle ten different problems. One not infrequently finds that in another country the number of research workers assigned to one major problem like tuberculosis or mastitis exceeds the total number of professional officers on the whole research staff in the Union.

The faculty of veterinary science, started 30 years ago on an experimental basis, on which the research staff also had to do the teaching, is still being maintained in that mongrel state, notwithstanding increasing demands for more training facilities. If nothing else, it affords our country an opportunity of boasting that it at least possesses the cheapest veterinary faculty in the world. Under the circumstances, a remarkably high standard of teaching has been maintained, but all those concerned with faculty affairs have the unpleasant suspicion that unless remedial measures are promptly applied, disintegration and collapse of the faculty cannot be avoided much longer. The ever-increasing demands made on the staff by departmental duties mean increasing neglect of the interests of the students. Under these conditions the standard of teaching will show rapid deterioration and this will have repercussions for years to come. One important post has been vacant for more than a year because no suitable candidate is available for it. With rumours of more resignations pending, the outlook is indeed bleak.

There is, however, one bright spark to lighten up this dismal picture. That is the recent announcement of a large sum having been made available for veterinary research by the three Control Boards (Meat, Dairy and Wool) that are most intimately concerned with the welfare of the animal industry. This is yet another expression of the new spirit of independence and self help which is now also revealing itself through organised agriculture.

The five scholarships that will soon be granted mark the most constructive step ever taken by the animal industry itself to assist in placing veterinary research on a proper and independent footing. Its full significance can be appreciated when it is realised that this will immediately double the number of workers engaged purely on veterinary research. Each of these scholarships may well establish the nucleus around which a big research department for that particular subject may ultimately be built up.

In addition, these three Boards are also making generous scholarships available for students taking the veterinary course. We do not want to look a gift horse in the mouth, but we, as a profession, do not like one of the conditions pertaining to the latter scholarships. that is, that the incumbent must undertake to enter the state service on completion of the course. This stipulation is apparently based on the old erroneous assumption that the livestock industry can only be served well by those in the employ of the state, whereas to-day equally good work is being done by men in many different spheres outside the service. Further, there is no guarantee given to the student that he will be employed, nor is his salary prescribed. We still have unpleasant recollections of the unhappy experience of a number of our members who accepted scholarships to study overseas more than 30 years ago. On their return they found that a differentiation in salary scales had been made. They were forced to accept the lower scales, with the result that some have been continually handicapped and are even to-day being penalised on that account.

Every veterinarian in whatever capacity he may be operating is an asset to the country. We welcome bursaries for veterinary training but would prefer to have them without these restrictions. No student can decide beforehand what particular branch he would ultimately like to take up, and forcing a person into a post which he may not fancy is merely putting a square peg into a round hole.

While the great majority of our practitioners have in a relatively short period raised the standard of veterinary practice to a level unsurpassed in any other country, there are unfortunately a few who, when judged by their methods and the disregard sometimes shown for the rules governing professional conduct, do not measure up to the standard expected of them.

Complaints by stock owners of wrong diagnosis are all too frequent. It appears that some consider that their reputation depends mainly on their ability to impress the farmer with a quick diagnosis. Frequently the guess is wrong and consequently the treatment too is wrong. Disregard of all the different diagnostic methods that are available to practitioners wrecks more reputations than are made by snap diagnosis. Treatment of disease has been so simplified in recent years by the many new and specific drugs that have become available, that it can in most cases be applied by the owner himself. His main reason therefore for consulting the veterinarian is to get a correct diagnosis.

The treatment of any disease, whether by a layman or professional, without a proper diagnosis, constitutes mere quackery. This has received great encouragement by the advent of the sulphonamides, antibiotics and hormones, and in probably no other branch of veterinary science is it indulged in more freely than in sterility work. Farmers not infrequently bring to notice cases in which veterinarians have applied sex hormones without any prior examiniation of the genitalia. This is tantamount to fraud, and if practitioners who take such pot

shots with the different remedies find themselves losing the support of their clients, they need not look far for the reason.

Another factor discrediting to the profession is the tendency amongst a small number of our practitioners to charge fees out of all proportion to the services rendered. In fact in some cases brought to light the veterinary fees were found to be far higher than those of the medical practitioners. These are however the exceptions.

While the Veterinary Board has been lenient in dealing with such cases in the past, more drastic action will have to be taken if many more similar complaints are received. All these transgressions suggest that there is a small number of our colleagues who are out to make the maximum profit in the minimum time.

To them I would say the veterinary profession is no place for gold diggers, and no veterinarian in any country has yet amassed a fortune by practising any branch of veterinary science.

This is all to the good, because it offers no attraction for those adventurers who merely follow a profession in order to exploit it for monetary gain. Ours is the poorest of all professions. Its recruits are derived only from the ranks of those who have no other motive than love for the work and whose greatest reward is the joy and satisfaction to be derived from a task well done. The primary and greatest obligation that everyone of us owes to the veterinary profession is to contribute our share in maintaining the good name and high reputation that it has gained for itself.

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RABIES IN SOUTH AFRICA

(A review of the present position)

R. A. ALEXANDER

Onderstepoort.

In this paper there is no intention of attempting to report anything new but merely to outline the position as it exists in Southern Africa today. It is hoped that some idea of the problem will be gained, so that an opinion as to its seriousness may be formed and that it will also be appreciated why the matter is viewed with such grave concern.

It should be realised that there is a large focus of rabies infection in the Union of South Africa, which is confined to the Free State, Western Transval and Northern Cape. This has been present there for very many years and it is known that the virus is present in the meercat family, which acts as a reservoir of infection. One characteristic of this particular virus is that, possibly through its association with the meercat for very many years, it has almost lost its infectivity for the dog and the disease is transmitted to this animal with difficulty. Meercats were infected with rabies under experimental conditions at Onderstepoort and, when rabid, were put into the same kennels with dogs that were muzzled. The meercats bit the dogs very severely indeed, yet no transmission of the disease occurred. It is, however, not claimed that the disease does not appear in the dog as numerous positive diagnoses have been made in this animal but, as a general rule, it remains in the meercat and is transmitted from it to other animals. The chief danger is that meercats lose their fear of man when they become infected and children in particular are able to catch them and get bitten, and in this way the disease is transmitted. Also cattle standing near a rabid animal may get bitten on the muzzle and heavy mortality be experienced, as also it may in pigs when the meercat gets into the pig-sty.

In September 1950 it was realised that something else was happening. In August of that year an Interterritorial Conference was held in Bulawayo and one of the items for discussion on the agenda was the rabies position in various countries. An outline of the position in the Union was given and it was stated that a number of cases of rabies had been encountered in the Northern Transvaal. South West Africa indicated that a few cases had been encountered there. Northern Rhodesia was of the opinion that the dog constituted the chief danger, and that the disease was con-

stantly present there. Southern Rhodesia was in the fortunate position to be able to submit a nil return. For the previous twelve years there had been no rabies cases recorded. Unfortunately, the dog (a Sealyham) belonging to the pump-keeper at Beit Bridge was involved in a fight with five kaffir dogs and the last seen of these kaffir dogs was that they were heading in the direction of Salisbury ! Three days later the Sealyham died, the brain was submitted for examination and rabies was diagnosed. Southern Rhodesia was then informed that it was known that there were five possible cases in their territory. A detailed investigation was carried out and revealed the fact that rabies was very wide-spread in Southern Rhodesia. Bechuanaland is also infected.

In South West Africa the infection started in the north, generally spreading in a southerly direction. It is claimed that the disease is spreading somewhat like a wave and is not leaving any cases behind. It is exceedingly difficult to state precisely what is happening there. However, it is known that the disease has come down to the Letaba area and rabid dogs have been encountered in the Kruger National Park at Punda Maria. In the Transvaal an area north of a line through Potgietersrust may be regarded as rabies-infected or in danger of becoming so.

It can be seen that there is a difference between these two viruses. Very little research work has been carried out. However, there is this fundamental difference: whereas the majority of dogs with the meercat strain of virus go down with dumb rabies, the vast majority of dogs in Northern and Southern Rhodesia, Bechuanaland and South West Africa go down with the furious form — the typical classical form of rabies in European countries.

After the Interterritorial Conference, it was found that before September 1950 every single specimen which had been submitted for histological examination and found to be positive was also confirmed biologically. There are, however, numerous cases on record here where the histological diagnosis was found to be negative but where the biological test was positive. The animals had died or been destroyed before Negri bodies had had a chance of forming and in consequence the pathologist was not able to make a diagnosis. In every case where the diagnosis was positive histologically it was subsequently confirmed biologically.

After September 1950, the state of affairs was not the same, and at least seven cases were diagnosed here as rabies by histological examination of stained sections — and some of these sections were actually classical examples of what a rabies section should be. The biological test, however, was found to be negative. It could not now be said that in every instance where the disease had been diagnosed histologically, it was confirmed biologically. It was found, when going into the history of the specimens sent in, that in every instance there was a history of considerable delay

up to more than a week from the collection of the brain specimens and their being received for examination. It was apparent that the virus had died, particularly during hot weather, in transit to the laboratory. However, some of the specimens from the Free State area, sent under similar conditions with just as much delay, were found to contain viable virus. There thus seems to be a difference in the keeping qualities of this latter virus, but there is reason to believe that antigenically both viruses are identical. From the immunological point of view, the vaccine controlling the one infection will also control the other.

Having given a summary of the position as it is at the present moment, methods of control should now be considered. Over the last 22 months, that is from 8.6.50 to 11.4.52, 522 specimens were submitted to Onderstepoort for rabies diagnosis. Of these 190 were positive. In Southern Rhodesia, 250 confirmed cases were recorded, 207 in dogs, 18 in jackals and 7 in badgers. Some of these cases were diagnosed at Onderstepoort, while others were examined at the laboratory at Mazabuka. From these figures it will be realised that the position is serious. From a medical point of view, the matter is also one of considerable concern, and at present may be said to constitute a major public health problem.

Regarding control measures in the Northern Transvaal, it was found that there were large numbers of stray and ownerless dogs in that area. In collaboration with the municipal and provincial authorities and the South African Police, approximately 30,000 of these dogs have been destroyed. No great difficulty was experienced in this campaign, in fact the natives in some kraals actually came along and invited destruction of their dogs as they had begun to realise that the infection passed to their cattle and they complained that their cattle became mad. In Bechuanaland the infection is prevalent in but not confined to jackals. It will be realised, of course, that the destruction of all stray and ownerless dogs will not eliminate the disease entirely, and the application of ordinary Police measures, consisting of a tie-up and muzzling order, is satisfactory only when it is to be carried out for a matter of a month or so, as people get tired of having to keep their dogs on a leash or lead for periods up to a year. It is thus difficult to control the infection and obviate it's being taken across to man. A method of immunisation is therefore necessary.

In the meantime, Lederle's of America have come out with the Fleury type of vaccine. As a great deal has been written about and references made in the press to this vaccine, an indication of what it is is given here. Johnson in America isolated rabies from the brain of a child, who had died after being bitten by a rabid dog. The rabies virus was passed directly from the human brain to the chick embryo and has been maintained by serial passage in the developing chick embryo. This was the first virus which had had no contact with mammalian tissue from the time of isolation.

The Fleury strain of rabies vaccine used is, therefore, Lederle's avianised egg-adapted rabies vaccine, "avianised" being a trade mark. It was found that by repeated passage in chick embryos, the virus lost its infectivity for dogs, and this antigenic strain of virus, issued in freeze-dried form, is used as a vaccine for the protection of dogs against rabies. Its use in cats and other animals is not advocated. When injected into dogs, no symptoms are produced at all; no virus is excreted in the saliva and a durable immunity, which lasts for about eight to twelve months, is produced.

Some of this Fleury vaccine was imported from America. Unfortunately, although it was stipulated that the vaccine should be shipped under refrigerated conditions, this was not done and on arrival here it was found that 5,000 out of the 10,000 doses received could not be used for immunisation purposes. The vaccine was used for the immunisation of dogs in the Northern Transvaal, particularly in Louis Trichardt.

Southern Rhodesia has gone over to immunisation in a very big way and up to the present about 200,000 dogs have been immunised, which is estimated to be about 70% of the dog population. In some areas over 95% of dogs have been immunised. Northern Rhodesia is using a vaccine of the Semple type which is being produced in the laboratory at Mazabuka and consists of a 10% sheep brain emulsion in 1% phenol.

For immunisation purposes a single injection of this vaccine is not entirely safe. There are on record five cases which are attributable to it. There is also a record of 18 cases which were vaccinated and subsequently broke down. In the 200,000 vaccinated dogs in Southern Rhodesia, there were 17 breakdowns. Of these 17, nine had undoubtedly contracted infection before treatment and can consequently be ruled out. There is thus a possibility that eight of these animals were inadequately protected by the vaccine which may possibly have been inert at the time of injection.

It is anticipated that Onderstepoort will go into production of the Fleury vaccine almost immediately. The necessary freeze-drying apparatus for this vaccine is already on the water. At the moment, the country is entirely dependant upon importation from America and this is a very unsatisfactory state of affairs, as it took nearly six months before the first order was executed and, when the vaccine did arrive here, half of it was of no value for immunisation purposes.

From this account it will be seen how the disease has spread and that, at the present moment, it is constituting a very real menace to the thickly canine-populated area in the south. It is, however, advisable to mention one difficulty encountered in the use of the vaccine in the Union. Some time ago a number of Police dogs were immunised, with results that were fortunately not disastrous but were certainly alarming at the time. All Police dogs are immunised against distemper with the Onderstepoort

egg-attenuated virus vaccine. Accurate details of the history of immunisation are kept. 27 dogs were treated with the Fleury rabies vaccine. Within five hours 22 were showing alarming symptoms of shock; five were comatose but fortunately recovered. From control experiments, it appeared that the dogs had developed a variable sensitisation to one of the proteins contained in the avianised distemper vaccine and intramuscular injection of the rabies vaccine produced the symptons of allergy — these symptons being indeed alarming. Fortunately, no deaths occurred. In spite of this observation the campaign for the mass immunisation of dogs in the Northern Transvaal is being proceded with and it is hoped that in the not too distant future a rabies-immune canine population will be built up.

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A DISEASE OF CATTLE ASSOCIATED WITH STOMATITIS AND STIFFNESS

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Introduction

In the presentation of this paper under the above heading, the title is intentionally descriptive rather than specific. The symptom complex observed is an extremely important one in a country like South Africa which is so subject to recurrent outbreaks of Foot and Mouth disease, requiring expensive and stringent state control for its eradication.

From the differential diagnosis point of view it is of importance to focus attention on all diseases having similar symptoms. The disease complex to which attention is being drawn is a distinct and recognizable entity and there is no doubt in the author's mind that the different forms under which it appears are all associated with one specific infectious disease.

The designation " infectious disease " must be qualified as it must be mentioned that so far no causal organism has been isolated and all attempts at subinoculation experiments in calves and sheep were singularly unsuccessful. Serum virus neutralization tests carried out at Onderstepoort proved negative for Rift Valley Fever and blue tongue.

It is only possible therefore to give a clinical picture of the disease, illustrated by photos of actual cases.

Incidence

The first time the author's attention was drawn to the disease was during March, 1949, when its appearance was reported on two farms adjoining Grootfontein College. The disease was mild except in one case, that of a cow which had been fly struck and whose mouth was a seething mass of maggots, resulting in the death of the animal.

No further reports were received during 1950 and 1951, but during the period January to March of this year the disease reappeared in a truly epizootic form.

It was encountered in the following Districts: Middelburg (Cape), Colesberg, Steynsburg, Hanover, Richmond, Cradock and it was very noticeable that it occurred on farms along rivers, or those with big vleis and dams. The rainfall had been excellent and alternated with hot, dry weather. On many of these farms a few odd cases of bluetongue occurred in sheep.

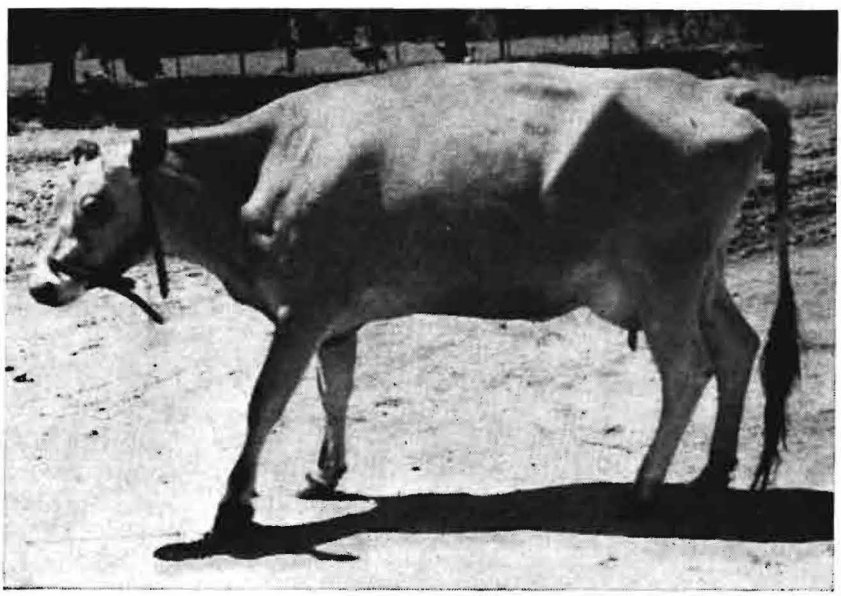
Symptoms: The disease made its appearance in several distinct forms which may be briefly described as follows:

A. THE MILD FORM. This was encountered in several small dairies no doubt on account of the good supervision. The first symptom noticed was the refusal to feed and a drop in the milk yield which might be considerable, and a cessation of rumination. The temperature varied from 105-106 F. lasting only for 1-3 days after which it dropped and the animal commenced to feed again, recovering without any other symptoms developing.

B. THE STIFF FORM. The affected cattle showed a marked disinclination to move. The stiffness was confined almost exclusively to the forequarters, particularly the head, neck and shoulders. The animals stood with lowered head and the front limbs were extended forwards. Progression was difficult and performed with a reluctant shuffling gait of the forelegs. The impression one got was that the entire trouble was located around the shoulder blades.

Many preferred to lie down, particularly under a shady tree or bush. The appetite was usually unimpaired, in fact it was astonishing

Fig. 1



Case showing stiffness in forelegs.

to see the ravenous appetite exhibited by a calf that could only move about on its knees.

More commonly the pain appeared so severe that unless forced, the animal refused to move and rapidly lost condition. This was mainly due to dehydration and starvation and can well be understood if it be remembered that the only water obtainable in the Karroo is from

a few scattered windpumps and that animals have to graze extensively to obtain their food.

The temperatures of these cases were invariably normal and this fact plus the localisation of the stiffness in the front quarters and neck assisted in distinguishing it from " Three Day Sickness ".

The period of the stiffness was extremely variable. Many recovered completely within 3-5 days, others again retained traces of anterior locomotory disturbance, recognized by shortened steps of the front limbs when chased, for weeks and even months. This form, although encountered in adult cattle, was observed predominantly in calves and young cattle from the ages of 6 months to 2 years old.

Fig. 2

Case showing lesions of the muzzle.

C. THE NASAL AND BUCCAL FORM. This form may or may not be accompanied by stiffness. Most of the cases were encountered in older cattle and the most severe forms occurred in mature milkcows of about 6-8 years old. Whether this particular form was perhaps only a complication, the result of photosensitisation,, is not known.

In comparatively mild cases the muzzle was dry, took on a peculiar brownish hue, started cracking and eventually commenced to peel off leaving a clean fresh healthy surface.

In more severe cases there was a muco-purulent discharge from the nose which was constantly licked off if the mouth was only affected to a slight degree or not at all.

Where the mouth cavity was affected the first noticeable symptom was salivation and frothing. The animal appeared unable to swallow and merely opened and closed its mouth with a distinct smacking sound at periodic intervals and in this manner formed the fine foam, which might occasionally be bloodstained, around the lips.

When the mouth was opened necrosis of the buccal mucous membrane was evident. This might be localised to a few small circumscribed areas under the lips, dental pad, or under the tongue or might coalesce to form irregular patches.

In typical cases however the lesions were confined to the dental pad and in very severe cases might be so extensive as to involve the inside and borders of the upper lip, the hard palate and affect even the inside of the lower lip and gum behind the incisors and below the apical portion of the tongue.

These lesions were as a rule ill-defined and merged very irregularly with the surrounding healthy mucous membrane. The necrotic material was usually greyish in colour in pigmented areas but might be light yellow in breeds such as Jerseys and Guernseys. When the necrosis of the dental pad was extensive it usually involved the upper lip. In the early stages this necrotic layer had a distinct grooved appearance at the junction of lip and pad, but later on through injuries received from the incisor teeth or through roughage during feeding, portions become detached leaving an irregular reddened surface which bled easily. Where such extensive mouth changes were present the odour of the breath was very offensive.

These cases usually refused to feed for 1-3 days after which they slowly regained their appetites and recovered. A small percentage however refused to feed at all and unless assisted succumbed to the disease.

The dermatitis, eye catarrh, teat and udder lesions described by Bekker *et al* (1934) were not encountered. A case was however seen by Dr. du Plessis (personal communication) in a Friesland in the Cradock area where the skin over the white unpigmented area was completely shed.

One case was observed in a six-year-old cow where the lower portions of the front limbs, extending from the coronet to above the fetlock, were markedly swollen. The hind pasterns were affected to a slighter degree and the mouth showed the dental lesions so typical of this disease.

The disease in this area occurred predominantly in Red Polls, Jerseys, Guernseys, and their crosses, only a few cases being seen in Afrikanders and Friesland. The percentage affected in a herd rarely

exceeded 10, although in some outbreaks it did. The death rate was entirely dependent upon the management and the treatment accorded sick animals. Usually they were found dead in the veld or were merely put into green feed where they succumbed. It may be said that with early recognition of the appearance of the disease and adequate treatment of affected cases it should not be necessary to lose any.

COMPLICATIONS.

1. *Paralysis of the Tongue*

Two cases of this complication were reported. The one is described by Stock Inspector Parsons as follows:—

"Jersey heifer, 10 months old, stiff in frontlimbs, disinclination

Fig. 3

Case showing mouth lesions.

to move, the mouth and tongue swollen with the tongue protruding from the mouth. Sores on the inside of the lips and behind the incisor teeth. Mucous membrane light red, breath offensive, temperature normal. The animal attempted to feed but was incapable of manipulating

its tongue for that purpose". The owner later reported the death of the calf.

2. *Paralysis of the Oesophagus*

One case was seen in a Jersey calf about two months old. It was already in an emaciated condition, stiff in the forequarters and inclined to lie down. The animal was reared on the bottle but periodically it discharged all the milk again through its mouth and nose when the head was lowered. After about a month of careful nursing it suddenly recovered its ability to retain food and made an uninterrupted recovery.

3. *Complete Anorexia.*

In all outbreaks a small percentage of affected animals consistently refused to start feeding again. These were the animals that died of dehydration and starvation. Although several calves died, the greatest number of deaths was in adult cattle, particularly those that had to fend for themselves in the veld. Artificial feeding for 2-3 days was usually sufficient to carry the animal over this period until it commenced to feed by itself. The loss of condition was very marked, but once the animal commenced to feed and drink, recovery followed rapidly.

TREATMENT.

Penicillin, Sulfapyridine, Soluseptasine and Salicylates were all tested out without any appreciable effect on the course of the disease. The only treatment used eventually was rinsing of the mouth with strong salt solution, after which grease or vaseline was applied over the dental pad to provide relief.

Daily inspection of all camps became an urgent necessity to see if any cattle were affected in such a way that they could not reach food or water.

Those that reached the anorexic state required to be carefully drenched with a few gallons of water containing sugar and mealiemeal. Where the value of the animal justified expense it was given ½-1 gallon of milk. The following mixture was made:

2 pints milk
6-12 eggs
1 cup brandy
6 tablespoonsful sugar.

This was given every morning and evening, and at 10 a.m. and 2 p.m. 1 pint of strong coffee plus 6 tablespoonsful sugar was administered. It was not found necessary to carry on for more than 2-3 days with this treatment. Usually the animal commenced to feed and drink water without any further complications ensuing.

ACKNOWLEDGEMENT.

I wish to thank Dr. C. M. van Wyk, Assistent Regional Director

for placing the photographic equipment of Grootfontein College at my disposal and to Mr. N. H. van der Westhuizen, Technical Assistant, for developing, printing and enlarging the photos made.

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Addendum

Subinoculations.

On 18.2.52 jugular blood was taken from a very stiff Jersey heifer at the Grootfontein School of Agriculture and inoculated subcutaneously in 5 c.c. doses in three Friesland Calves (Nos. 65-66-67) and one Jersey Calf (J 28). The temperature reactions were as follows:—

	Date							
	20/2		21/2		22/2		23/2	
No.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
65		102	100.4	102.6	102	103.6	101.7	102.9
66		102	101	103	101.2	103.7	101.8	103
67		104	102	103.8	102.2	105.2	103	103.8
J28		103.2	101.2	102.6	101.8	103.2	102.4	102.6

	Date							
	24/2		25/2		26/2		27/2	
No.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
65	101.4	104.3	102	102	101	102.2	101	102.2
66	102.2	103.7	102.6	102.2	101.8	101.8	101.4	102.2
67	103.8	103.8	102	102	102	101.6	101.6	102.2
J28	102.2	102.3	102.2	102	101.8	102	101.8	102.4

	Date							
	28/2		29/2		1/3		3/3	
No.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
65	101.8	103	101.4	102.8	101	101	101	discharged
66	103.7	104.4	103.3	103	101.2	101.3	100	discharged
67	102.2	103	102.3	102.2	102	101.6	100.8	discharged
J28	102	102.4	102	102.2	101.6	101.2	101	discharged

On 25.2.52 blood was obtained from another affected heifer at Grootfontein College and four DORPER sheep inoculated subcutaneously in the thigh. These sheep developed no symptoms.

On 10.3.52 O.C.G. blood collected from a cow that died from the disease on Mr. E. M. Bowker's farm "Suiferkuil" was inoculated intravenously in 1-2 c.c. doses into the same four Dorper sheep without any symptoms developing subsequently.

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BRUCELLA ABORTUS STRAIN 19 VACCINE MORE READILY AVAILABLE

G. C. VAN DRIMMELEN

Onderstepoort

Brucella vaccine prepared from bouillon cultures has been used in some European countries for many years (Bosgra, 1951). Bendixen (1940) reported that a better imunity was obtained from bouillon culture than from an equal number of organisms grown on agar. The nutritional requirements of *Brucella abortus* in liquid culture have been reviewed by Hoyer (1951).

To meet the demand for contagious abortion vaccine with inadequate laboratory accommodation larger flasks were obtained. The standard Roux flasks take about 150 ml. potato agar each and the surface culture supplies approximately 50 doses. The larger flasks could take 400 ml. agar giving about 150 doses.

It has now been found possible to increase the output to about 400 doses per flask by using an aerated liquid medium instead of the conventional agar. Aeration is accomplished on a shaker giving 64 excursions of 12 cm. each per minute. For this purpose a small shaker designed by Dr. M. P. Sterne measuring 56 × 165 × 107 cm. was modified to carry 20 to 30 flasks each measuring 38 × 16 × 7 cm.

The medium used was :—

Peptone	3 parts
Glycerine	3 parts
Glucose	3 parts
Marmite	1 part (yeast extract)
$Na_2HPO_4.12H_2O$	0.6 parts (C.P.)
NaCl	0.3 parts (C.P.)
H_2OpH6.3	100 parts

This solution is sterilized by Seitz filtration. The bulk is seeded in the proportion of one 48 hour, Roux flask, agar surface culture to ten litres and distributed through a bell filling device into gauze capped flasks containing anti foam 1/6000. The culture containing $\pm 100 \times 10^9$ organisms per ml. is harvested at 65 hours or earlier by syphoning into a 2 litre vaccine flask and bottled after purity and density tests. Viability counts, safety tests and immunity tests are regularly carried out as a check on quality. Variation is controlled on a tryptose agar plate with numerous single colonies examined at 4, 7 and 10 days old. Every seed flask is a first subculture from a single smooth colony of Strain 19. The method was used

to augment the potential supply of vaccine with about 24,000 doses per week i.e. more than one million per annum and reduces the percentage discards as the result of contamination.

Th aeration technique was developed by Dr. M. P. Sterne and Mr. L. M. Wentzel at Onderstepoort. Miss F. Gilchrist of the C.S.I.R. assisted in devising the medium used.

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A NOTE ON THE VALUE OF ALDRIN AND DIELDRIN FOR THE CONTROL OF PSOROPTIC SCAB IN SHEEP

by

O. G. H. Fiedler and R. du Toit

Onderstepoort

Among the many synthetic insecticides which possess pronounced acaricidal properties Benzene hexachloride (B.H.C.) has proved to be outstanding. Its potency is such that it is now accepted in some countries that sheep scab, caused by **Psoroptes communis ovis,** Railliet, can be completely controlled by a single dipping in a concentration of 0.0125% gamma.

Two of the more recently produced insecticides, Aldrin and Dieldrin, have become available for test purposes in the Union and will, no doubt, shortly be released in large quantities. In America particularly, extremely good insecticidal properties are claimed for these substances at fairly low concentrations against a variety of noxious insects and their use on livestock for ecto-parasitic control is being investigated.

Experiments conducted at Onderstepoort have revealed that the larvicidal properties of Aldrin and Dieldrin for blowfly larvae are excellent and even slightly surpass those of B.H.C. Furthermore, they are retained in the wool of sheep in an active state for lengthy periods, which favours their use as protecting agents against blowfly strike. Their high larvicidal potency coupled with extremely durable residual action suggested the determination of their value in the control of sheep scab.

A limited number of heavily scab infested sheep were available and dipping tests conducted with these two insecticides produced the following results after a single application in each case.

Dieldrin in the form of a wettable powder suspended in water at concentrations of 0.05% and 0.03% gave complete control even in very advanced cases of the disease. Its action was extremely rapid and all signs of irritation ceased immediately after a single immersion of the animals. A rapid improvement in condition followed and complete recovery resulted in all seven animals comprising these two tests. At 0.05 and 0.03% Dieldrin is at least as effective as gamma B.H.C. at 0.02%.

The results obtained with Aldrin were not so favourable. An emulsion of Aldrin at a concentration of 0.05% of the active ingredient prevented the continued spread of comparatively mild cases

of scab for a period of about 6 weeks and one cure resulted out of 4 sheep dipped. In heavy infestations Aldrin failed to effect a cure. In the form of a wettable powder this insecticide was even less effective at this concentration and failed in all cases to bring about a cure.

Dieldrin at a concentration of 0.03% may be regarded as safe to use for dipping purposes and is highly effective for the control of sheep scab with a single dipping. Aldrin, on the other hand, must be regarded as ineffective in curing psoroptic scab even at a concentration of 0.05%, above which both these insecticides should not be used for dipping purposes as their toxicity for warm blooded animals is somewhat greater than B.H.C. and D.D.T.

IDENTIFICATION OF A STRAIN OF BLUETONGUE VIRUS ISOLATED IN ISRAEL

A. KOMAROV(1) AND D. A. HAIG(2)

(1) Director of Virus Diseases Laboratory, Haifa, Israel.

(2) Onderstepoort Laboratories, South Africa.

In an earlier publication an outbreak of a disease among sheep and cattle in Israel was reported. From both sheep and cattle a virus was isolated which appeared to be identical with that of bluetongue (Komarov and Goldsmit 1951).

To confirm the identity of the virus isolated in Israel, a strain which had been adapted to growth in fertile hen eggs was brought to the Onderstepoort laboratories by one of us (A.K.) and a number of experiments were made to compare this strain with known strains of bluetongue.

METHOD AND MATERIALS

Virus Strains

Egg-adapted strains

Israel D. The origin and behaviour of the Israel D strain has been described (Komarov and Goldsmit 1951).

In this series of experiments material from the 12th to the 22nd egg generation was used.

Schoeman. The Schoeman strain was obtained from a natural outbreak of bluetongue among a flock of sheep in the Dundee district of Natal, South Africa. The strain was passaged twice in susceptible sheep, in which typical severe bluetongue developed clinically, and was then adapted to growth in developing hen eggs after the method of Alexander (1947). Freshly harvested material from the 50th to the 60th egg generation was used in these experiments.

Field strains

Jansen. The Jansen strain was isolated from a natural case of bluetongue which occurred among some sheep at Onderstepoort. After one passage in a susceptible sheep blood drawn on the seventh day after injection was collected in O.C.G. and stored at 6°C. This blood has been used frequently to infect sheep and regularly has produced clinical bluetongue of moderate severity.

Cyprus. The origin and behaviour of the Cyprus strain has been described (Neitz 1948). Blood from the third sheep passage stored in O.C.G. at 6°C. was used in these experiments. This strain produces severe bluetongue in sheep, the majority of which die.

Estantia. This strain was isolated from an outbreak of bluetongue in sheep in the Transvaal, South Africa. Blood from the third sheep

passage stored in O.C.G. at 6°C. was used. This strain regularly produces severe clinical symptoms and the percentage mortality is high.

All egg injections were made into the yolk-sac of eight-day-old embryos. Each egg received 0.15 c.c. of suitably diluted material and re-incubation was at 33.5°C. which has been shown to be approximately the optimum temperature for the propagation of bluetongue virus in eggs (Alexander 1947). Special mention is made of instances where other temperatures were used.

The sheep used were from the bluetongue susceptible flock maintained at the Institute for experimental work in connection with this disease. During the experiments the animals were maintained continuously under stabled conditions. They were temperatured twice daily. Each individual sheep was examined clinically every morning, and an assessment made of the severity of the reaction.

EXPERIMENTAL WORK

A. *Behaviour in Eggs*

The Israel " D " strain was obtained in its eleventh egg generation and was passed another twelve generations. Specific deaths commenced on the second day after injection, with the greatest mortality on the third day. The appearance of the embryos was macroscopically similar to that of embryos infected with known strains of bluetongue.

When infected eggs were incubated at 37°C deaths were irregular and there were a number of survivors seven days after injection.

B. *Filtration through Gradocol Membranes*

A number of filtrations through gradocol membranes of varying average pore diameter were made with material obtained from macerated embryos infected with the Israel D strain and, at the same time, similar filtrations were made with material infected with the egg-adapted Schoeman strain.

Macerated embryos were centrifuged at 3,000 r.p.m. for one hour in an angle-head centrifuge. The supernatant fluid was diluted 1 in 50 in ordinary broth and clarified by passage through asbestos pulp. This filtrate was passed under pressure through gradocol membranes of 234$\mu\mu$, 207$\mu\mu$, 172$\mu\mu$ and 144$\mu\mu$ A.P.D.

Each filtrate was injected into a group of six eggs.

In two separate trials activity could be demonstrated in filtrates of either strain that had been passed through membranes of 207$\mu\mu$ A.P.D. On one occasion only was active material obtained when the Israel D strain was passed through a 172$\mu\mu$ membrane.

C. *Cross-Immunity Tests*

Six sheep were injected intravenously each with 1.0 ml. of undiluted supernatant fluid obtained by light centrifugation of macerated embryos infected with the Israel D strain in its twelfth egg generation.

The animals showed mild fluctuating rises in temperature from about the sixth to the 13th day after injection, during which time their lips appeared slightly hyperaemic; one sheep showed a slight coronitis. At no time were they visibly sick.

Three weeks later they again received freshly harvested embryos infected with Israel D. No apparent reaction was noticed.

After a further twelve days these sheep, together with six untreated controls were challenged with different known strains of virulent bluetongue virus. The results of this experiment are shown in Table I.

Table I

Cross-Immunity Tests on Sheep Immunised with Israel D Strain

Sheep No.	Immunised with Israel D	Challenged with	Reaction
84759	Yes	Jansen	No reaction
84767	Yes	Jansen	No reaction
83939	No	Jansen	Moderately severe reaction
83839	No	Jansen	Moderately severe reaction
84713	Yes	Estantia	No reaction
84701	Yes	Estantia	Mild reaction
83837	No	Estantia	Severe reaction; died
83806	No	Estantia	Severe reaction; died
83802	Yes	Cyprus	Moderately severe reaction
84802	Yes	Cyprus	Moderately severe reaction
83842	No	Cyprus	Severe reaction; died
83804	No	Cyprus	Severe reaction; died

From this table it can be seen that of the sheep immune to Israel D those challenged with Jansen showed no apparent reaction; of the two challenged with Estantia one showed no apparent reaction and one a very mild thermal reaction, while those challenged with Cyprus showed marked thermal reactions with mild buccal lesions.

The non-immune control sheep showed the typical severe reactions to the particular virus strains concerned.

DISCUSSION

The results of the experiments described showed that Israel D is a strain of bluetongue virus.

The behaviour in eggs of this strain, however, resembled that of South African strains at a higher passage level, since it was seldom that they produced more than an occasional specific death as early as the second day before the 30th egg generation.

Although the particle size of the Israel strain was not determined with accuracy, the findings were in general agreement with those of Polson (1948) for bluetongue virus.

Cross-immunity tests indicated that the strain was closely related to the South African strains Jansen and Estantia, but that there were some differences between this strain and Cyprus. A considerable degree of basic immunity against this strain was however, apparent.

Because the reactions produced by Israel D were so mild, it was not possible to carry out the reverse immunity tests on sheep known to be immune to other strains of bluetongue.

SUMMARY

A virus isolated from sheep in Israel was compared with known strains of bluetongue. Its behaviour in eggs, its particle size and the degree of immunity which this strain conferred on sheep against two South African and a Cyprus strain of bluetongue, indicated that this was a strain of bluetongue.

ACKNOWLEDGEMENT

It is desired to express our thanks to Mr. van Rooy for his ready assistance with the gradocol membrane filtration experiments.

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AN OUTBREAK OF ANTHRAX AT THE MUNICIPAL ABATTOIR—BLOEMFONTEIN

D. H. PFEIFFER and A. J. LOUW
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Bloemfontein

On 31/10/51 at 5 p.m. a consignment of twenty-four Shorthorn steers arrived at the Bloemfontein Abattoir from Postmasburg by rail, and were put in the lairage for slaughter the next morning. One of the animals died overnight and the slaughter of the remaining twenty-three was commenced by the slaughtering authority, the Bloemfontein Municipality, early the following morning. A further two parcels of local oxen, totalling fifty head, arrived later on in the morning and the killing of these was undertaken as soon as the first batch of twenty-three was disposed of.

The overnight death was reported to one of the authors (A.J.L.) by the Superintendent of the abattoir and a microscopical diagnosis of anthrax was made. By the time the post mortem diagnosis of anthrax was made, the slaughtering of all the oxen from Postmasburg as well as most of the others had already taken place and the carcasses, after inspection, placed in the chillrooms. The offal contractors had already commenced distributing the offal from the slaughtered animals to the meat trade in the City. The further slaughtering of animals as well as any further distribution of meat and offal to the trade was immediately stopped as soon as the diagnosis was made.

Acting in terms of Section 10(1) of Act 36 of 1919, the Medical Officer of Health ordered that smears be taken from the remaining twenty-three carcasses ex the Postmasburg consignment, and one of them was found to be infected with anthrax. Apart from the incriminating microscopical picture, there were no visible signs of septicaemia or fever and the carcass had set well with the lymph glands and musculature apparently normal. Material for microscopical examination from all the carcasses was taken from the congealed blood and serum usually found at the distal end of a hanging side and also from the red bone marrow of the split vertebrae. No further carcasses were found to be infected.

As we were satisfied that only this one particular carcass was infected, it was decided, in consultation with the Deputy Chief Health Officer for the Orange Free State that, although there existed a possibility that some of the other carcasses might have become contaminated in the process of slaughtering, by knives and handling, they should be passed as fit for human consumption. The fact that intestinal anthrax is extremely rare in humans and the

acute meat shortage at the time were also factors which had to be taken into consideration in coming to this decision.

By checking offal issue cards, it was ascertained that about 40% of the morning's offal had been issued to the trade. All available health inspectors were summoned into the City with instruction to recover as much of the issued offal as possible. In some instances portions such as tongues and tails were traced to individual householders and in one case a cooked tongue was surrendered. The fact that offal, comprising crude (abdominal fat and viscera) and red (Pluck, liver, head, tail and tongue) have such a diversity of uses in the trade, such as for native consumption, dog's meat, processing and ordinary household cooking, meant that our quarry was very widely distributed over both the City and the Locations. Through some very commendable work on the part of these health inspectors and the co-operation of the meat trade, about 80% of the issued offal was recovered by the evening of that day.

Wherever possible smears were taken from the recovered organs and the following were found to be positive for anthrax : one tongue, one tail, one liver, one head, and one spleen. As only one carcass and not more than one organ of the same type was found to be infected, it was argued that only one animal of the twenty-three slaughtered had subclinical anthrax and the examination of smears from the remaining mixed offal at the abattoir was considered unnecessary. Because of mixing and therefore possible contamination, all the offal remaining at the abattoir was condemned, and destroyed. In all probability the missing heart, lungs and viscera from the infected carcass were destroyed with this offal. So too all the hides, which in the handling had become mixed, were condemned in terms of the Stock Diseases Act on instructions by the Sub-director of Veterinary Services for the Orange Free State.

All smears were taken in duplicate, stained with Giemsa and Gram respectively, the latter being of value where spore formation had taken place.

Although a sharp lookout was kept for any human cases amongst the abattoir staff, none occurred, but at the butchery where most of the infected offal was found, an employee, who had an abrasion on his hand, due to an injury sustained the previous day, was found the following morning, i.e. within twenty-four hours, to have a marked oedema of the dorsum of this hand and B.anthracis was isolated from the wound. He was accordingly removed to the Isolation Hospital where, after treatment with N.A.B., he made an uneventful recovery. All slaughtering of animals had come to an abrupt standstill, until it was possible to dispose of all infective and contaminated meat and offal, so as not to endanger health, and to sterilize as far as possible used instruments and disinfect the premises. It was imperative to do this as soon as possible.

Our digesters, being too small to cope with the enormous quantity of material, reliance had to be placed upon burning and burying. Inclement weather also interfered with the burning operations. Two large graves were dug and into these went the two infected carcasses, one which was fortunately never opened, the blood and the charred remains from the open fires in which the hides, fleshings, horns, hooves, offal, wiping clothes, knife scabbards, etc. were burnt. All material buried was liberally sprinkled with quick lime before being covered. The area where the beast had died in the lairage was dug up, covered with quick lime and fenced off.

Intensive fly spraying on the premises was commenced immediately after the diagnosis was made. All the overalls were boiled and thereafter left, with all the topboots, in a strong Jeyes solution for twenty-four hours. All the knives and steels were likewise sterilized. The metal utensils, hooks, table tops, contaminated floors and walls were either sterilized with blowlamps or sprayed with petrol and fired. Strong formalin was also used liberally on the floors and wooden structures.

The premises where infected meat was found in the City and Locations were disinfected also. Within forty-eight hours of the discovery of the outbreak all the abovementioned measures had been effected and the daily abattoir routine had reverted to normal.

By some quick action on the part of the Sub-director for Veterinary Services for the Orange Free State and the State Veterinarian for Kimberley, the source of the outbreak was traced and the necessary precautionary methods taken there. A further consignment of twenty-four oxen from the same consigner was discovered en route to Bloemfontein, stopped and railed back to Postmasburg.

DISCUSSION

There are several interesting aspects in connection with this outbreak that might be mentioned.

Although the occurrence of a death in an abattoir is by no means an uncommon event, it is extremely rare for the cause of the death to be anthrax. The existing regulations in connection with the slaughtering and meat inspection do not make provision for any specific line of action to be adopted when a death occurs in an abattoir lairage. In many instances, especially due to the absence of laboratory facilities or the immediate availability of a medical or veterinary officer, it is not possible to ascertain the cause of death or exclude any conditions that might endanger public health. It is also possible that the real cause of death might be masked by an obvious condition such as emaciation or an injury and, if the situation was left in the hands of a layman, serious consequences might follow.

Pfeiffer described an outbreak of anthrax in 1940 amongst natives in the Bochabela Location, Bloemfontein. Six cases of

anthrax, four of them resulting in death, were encountered. The source of the infection was traced to the eating of anthrax infected meat. Of note in this outbreak is the fact that every case was attended by one or more medical practitioners, and in some instances hospitalized, without anthrax being diagnosed, or even suspected in any of them initially.

The fact that a beast suffering from anthrax, with every organ and tissue of its body teeming with anthrax bacilli, was slaughtered, shows how easy it is for the untrained to miss the obvious signs of some pathological conditions. Although the dressed and set carcass appeared perfectly normal to the naked eye, the spleen, when discovered twelve hours later, showed the classical "black currant jam" appearance on incision, although not markedly enlarged. It was not the practice for meat inspectors to incise all spleens as the Regulations only state that "the surface and substance of the spleen shall be examined", and does not specifically make the routine incision of the spleen compulsory. An amendment to this effect seems desirable.

None of the organs, found to be positive in the subsequent tracing of infected material, showed any marked pathological changes, which would have aroused the suspicion of a meat inspector. It is therefore quite possible that the diseased animal might have had the infection in a subclinical form at the time of slaughter. According to Hutyra and Marek it is feasible for the blood to be swarming with bacilli a short period before symptons are noticed and marked pathological changes encountered.

Although the above described outbreak is something of a unique occurrence there is no reason why it should not happen again with probably more serious effects on public health, especially in a large City. On the contrary, it is rather amazing that it is such a rare occurrence when it is considered that, judging by the amount of anthrax vaccine sold annually, anthrax is by no means an uncommon disease in South Africa. There are also many beef raising areas that are very poorly supplied with veterinary services and a diagnosis of the cause of an outbreak is sometimes only possible after a considerable number of animals have died and some time has elapsed. The tendency for some owners to hide an outbreak from the authorities or possibly to get rid of some infected animals when something wrong is noticed, must also be considered.

It is therefore considered opportune to sound a warning to all professional officers, whose duties are related to public health, in particular the issue of sound meat, to tighten up on their supervision.

The following measures are considered by us to narrow down the possibilities of the re-occurrence of a similar outbreak:

(1) Laboratory facilities at the abattoir, especially for microscopical examination. Laymen can be trained to prepare and stain slides.

(2) The enforcement of a compulsory rest period for all animals to be slaughtered. This will facilitate the finding of diseased animals that arrive at the abattoir with the infections, especially of the septicaemic group like anthrax and quarter evil, in a latent form. This rest period is also conducive to better bleeding, setting and keeping qualities.

(3) Instructing the meat inspectors that the spleens of all animals slaughtered be incised. It is also felt that the existing Regulations should be amended accordingly.

(4) The importance of the ante-mortal examination of animals prior to slaughter, by experienced veterinarians cannot be over-emphasised. According to Young "the responsibility for the freedom from disease of all meat and meat products rests solely with veterinary officers" in most European and overseas countries. The opinion is also expressed that the 'veterinary surgeon is alone fitted by his training and knowledge of animal pathology to supervise the production of milk and a wholesome meat supply."

It would appear that South Africa is still lagging far behind most other countries as regards the supervision of its meat production. At the moment there are only six local authorities that have full-time veterinarians in their employment.

SUMMARY

An outbreak of anthrax in the Bloemfontein Municipal abattoir has been described. The tracing of infective material, the disposal thereof, the disinfection and sterilization measures have been dealt with. The possibility of a re-occurrence has been discussed, as well as certain recommendations made.

ACKNOWLEDGEMENTS

We wish to acknowledge with thanks the assistance received from Dr. A. L. Ferguson, Deputy Chief Health Officer for the Orange Free State, and Capt. J. L. Dickson, Sub-director of Veterinary Services, Orange Free State, during the outbreak.

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Jl. S.A.V.M.A. 23(3), 1952.

REFLEX SALIVATION IN SHEEP AND GOATS INITIATED BY MECHANICAL STIMULATION OF THE CARDIAC AREA OF THE FORE STOMACHS

by

R. CLARK and K. E. WEISS

Onderstepoort

INTRODUCTION

During observations on the consistency of the ruminal contents of sheep with ruminal fistulae, it was noted that the ingesta became markedly more watery after the feeding of hay. As this occurred in the absence of available drinking water, it could only ge explained by increased salivation. As little work appears to have been done on the reflex regulation of salivary secretion in ruminants, it was decided to investigate the matter further.

It might reasonably be supposed that the act of chewing and swallowing, aided by the sense of taste, would produce accelerated salivation, but this did not provide the full explanation as the water content of the ruminal ingesta continued to rise for some time after feeding had ceased. It therefore appeared that the presence of the newly ingested hay in the fore stomachs in some way stimulated salivary secretion. This might occur through chemical or mechanical stimuli.

METHOD

Sheep and goats under chloral hydrate anaesthesia were used. Both parotid ducts were canulized from the buccal orifices and the number of drops of saliva produced per minute was counted under various conditions.

RESULTS

In a preliminary experiment 10 ml. of glacial acetic acid and 10 ml. of lactic acid were diluted with 500 ml. of water and the mixture injected into the rumen. This was done to ascertain whether the absorption of organic acids from the rumen had an influence on salivary secretion. No such effect could, however, be demonstrated.

The left vagus nerve was then isolated in the neck region and severed. Electrical stimulation of the distal stump caused no

change in salivary flow but stimulation of the proximal stump immediately resulted in a profuse secretion. This observation proved the presence of a reflex of which the afferent arc was situated in the vagus nerve.

A rumenotomy was then performed and a hand inserted into the cavity. Manipulation of the reticulum again caused an increased flow of saliva.

Owing to the use of canulas of too small a bore, these results could not be expressed in figures but direct observation left no doubt as to their validity.

A second experiment was, therefore, planned with more suitable canulas. It was decided to sever the oesophagus and stimulate the throat and cardiac region successively by the introduction of a suitable soft bottle brush inserted first up and then down the oesophagus. The results are tabulated below.

Treatment	Drops saliva per minute from both parotids
Nil	43
Brush in throat	86
1 minute after removal	52
4 minutes after removal	40
Brush in cardiac region	208
5 minutes after removal	48
Both Vagi severed.	
5 minutes later	26
Brush in cardiac region	22
Stimulation of central end of right vagus	156
5 minutes later	28
Stimulation of central end of left vagus	176

The above results can be summarized as follows:—

(i) Mechanical stimulation of the throat caused a twofold increase in parotid secretion.

(ii) Mechanical stimulation of the cardiac region produced a four- to fivefold increase provided the vagi were intact.

(iii) Division of the vagi abolished this reflex and reduced the resting flow.

(iv) Electrical stimulation of the central end of the cut vagus nerve on either side producd an effect comparable to that produced by stimulation of the cardiac region.

Judging by the saliva which dripped from the mouth the other salivary glands were affected in a similar manner to the parotids.

DISCUSSION

The above results prove the presence of a salivary reflex initiated by mechanical irritation of the cardiac region of the fore stomachs. The afferent paths lie in the vagi nerves.

This finding may explain the well-known necessity for roughage in the maintenance of normal ruminal digestion. A copious salivary flow not only controls the reaction of the fore-stomachs but also supplies phosphate and the necessary water. Animals on succulent green food do not tend to drink water despite the presence of a thick, tenacious ruminal ingesta which cannot be conducive of rapid absorption or passage.

The significance of this salivary reflex in relation to froth formation and bloat will be discussed in a separate communication.

SUMMARY

A salivary reflex has been demonstrated in sheep and goats which is initiated by mechanical irritation of the cardiac region of fore stomachs. The afferent fibres lie in the vagi nerves.

LETTER TO THE EDITOR

ISOLATION OF VIRUSES ASSOCIATED WITH EPIDIDYMITIS AND VAGINITIS OF CATTLE

Infectious epididymitis and vaginitis (epivag) was first described in Kenya (Daubney, Hudson and Anderson, 1938) and has since been recognised in the Union (van Rensburg, 1949).

Vaginitis, apparently of viral aetiology, has been reported from England (Blakemore, 1952).

From infected material obtained from various herds where a clinical diagnosis of epivag had been made, a virus has been isolated in several instances in developing hen eggs and in one instance also in mice. The strain which could be propagated in both mice and eggs was obtained from the macerated vaginal mucosa of an infected heifer. In mice it was taken 25 generations by intracerebral passage of brain material. For the first three generations day-old mice were used. In the first generation deaths commenced on the seventh day and in the next two generations the incubation period shortened to 48 hours. Subsequent passage was made in adult mice and in these mice mortality occurred regularly after 3 to 4 days. The LD50 of infected mouse brains at the 25th passage was 10^{-6}.

Infectivity could be demonstrated in filtrates from gradocol membranes of 207 m.u. A.P.D. and it was thus estimated that the particle size was less than 100 m.u.

The same material as that used to infect mice was injected on to the chorio-allantoic mebranes of eight day old hen embryos. After 5 days

incubation at 35° C the membranes were found to be oedematous and opaque. The strain was taken 12 generations by serial passage of infected membranes. At this stage many of the embryos died and passage was continued by the injection of infected embryo material into the yolk sac. In this way the strain was readily carried a further 10 generations when it killed all embryos 3 to 4 days after injection. This egg-propagated strain was lethal for suckling mice by the intracerebral route.

Cows and heifers infected with material from both the mouse- and egg-propagated strains of virus showed definite though mild symptoms of vaginitis. With the mouse passage strain 4th and 5th generation brain material was used to infect the heifers and cows and with the egg passage strain 3rd and 5th generation chorio-allantoic membrane material was used. The cattle were infected by leaving a swab soaked in the infective material overnight in the vagina.

The diagnosis of epivag is at present most uncertain since it is based entirely on clinical lesions which are extremely variable and indefinite and it has been suggested that more than one aetiological factor might be involved (Daubney, Hudson and Anderson, 1938). The relationship of this virus to those which have not proved fatal to mice or egg embryos and their relationship to the disease in cattle is now being investigated.

B. M. McIntosh.
D. A. Haig.
R. A. Alexander.

Onderstepoort,
4th July, 1952.

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NOTE ON THE USE OF THE WHITE MOUSE FOR THE TRANSPORT OF STRAINS OF HEARTWATER

D. A. HAIG

Onderstepoort

Following on the work of Neitz and Alexander (1941) immunisation of cattle against heartwater is now practised on a fairly extensive scale in the Union of South Africa. To correlate the work done at the different sub-stations which have been established for the maintenance of virus donors, it is occasionally necessary to transport strains of heartwater from one part of the country to another.

The causal organism of this disease, Rickettsia ruminantium, is very labile and infected blood cannot be relied upon to remain infective for more than a few hours after it is drawn.

Alexander (1951) found that the infective agent can be stored for periods up to two years in a dry ice cabinet, and infected ticks (Amblyomma hebraeum) have been used to store and transport strains (Neitz, 1951). Utilisation of these methods of preservation for transport of virus strains offers numerous obvious difficulties.

Mason and Alexander (1940) made numerous attempts to infect small laboratory animals with heartwater but, apart from two occasions when there was apparently a survival of virus in a guinea-pig and in a rat, their efforts were unsuccessful in animals other than the ferret. Later Hudson and Henderson (1941) found that the agent could persist for fourteen days in albino rats fed a vitamin B_2 complex deficient diet, and in Rhabdomys pumilio kept on a normal diet.

During an attempt at Onderstepoort to adapt heartwater to mice, it was noticed that the agent could be demonstrated in spleen emulsions from white mice that had been injected up to 90 days previously. This observation has been used as the basis of an easy method of transporting heartwater virus.

METHOD AND MATERIALS

Three strains of heartwater fever were used in these experiments. They were Mara, Kaalplaas and Ball 3. These strains were originally obtained from natural cases in the field and have been

maintained by serial passage in sheep at the laboratory with occasional periods of storage in a dry ice cabinet.

Reactions in sheep were judged by temperature changes. In those animals that died, brain smears were examined, while those that recovered were subjected to immunity test with the homologous strain.

Albino mice six weeks or more old were used. They were fed the usual laboratory ration.

Sheep spleens or brains were emulsified in Waring blenders in approximately equal amounts of broth. After light centrifugation, the supernatant fluid was used for injection.

Mouse spleens were harvested directly into the barrel of a 5 c.c syringe, fitted wih a 15 gauge needle. The contents of the syringe were then forcibly ejected into a tube containing broth. About 10 c.c. of broth to six mouse spleens was used and the mixture was then titrated. Centrifugation of this mixture was seldom necessary.

EXPERIMENTAL

1. Attempts to adapt the agent of heartwater fever to growth in white mice

A group of twelve mice was injected intraperitoneally with 0.5 c.c. of sheep brain suspension infected with the Kaalplaas strain of heartwater. Eight days later all the mice appeared normal when the spleens of six were taken. After emulsification half the material was injected intravenously into a sheep, while the rest was used for intraperitoneal injection into mice. The sheep showed a typical heartwater reaction. It was killed and its spleen used to infect other mice. In this way a series of nine alternating passages between sheep and mice were made, when the experiment was abandoned. The period allowed in mice varied from 14 to 21 days.

Subinoculations made from the mice in the alternating series to other mice proved negative when the spleens of these mice were injected into sheep.

2. Time of survival of the heartwater organism in mice

The foregoing experiment indicated that, although it was not possible to make serial passages of heartwater in mice, the organism could survive some considerable time in these animals.

To determine the length of this period of survival a number of mice were injected intraperitoneally with sheep spleen suspension infected with the Kaalplaas strain. At intervals groups of 4 mice were killed and their spleens injected into sheep. The experiment was later repeated with Mara strain.

The results of these experiments are set out in the table.

Time of Survival of Strains of Heartwater in Mice

Strain	Number of days in mice	Reaction in sheep
Kaalplaas	12	R
	14	R
	24	R
	42	R
	58	NR
	64	R_+
	90	R
	100	NR
	106	NR
Mara	19	R
	26	R
	33	R_+
	60	R_+

NOTE : R_+ = Reacted and died.
NR = No reaction.

From the table it is seen that Kaalplaas strain of heartwater could be reclaimed from mice by the subinoculation of spleens up to 90 days after injection. The reason for the failure of the sheep injected with spleens taken from mice 58 days after injection is not known.

Similarly, Mara could be recovered up to 60 days after injection. This was the longest period tested.

3. Transport of strains of heartwater in mice

Twelve mice were sent to a State Veterinarian some 600 miles from Onderstepoort. They were injected intraperitoneally with 0.5 cc. citrated blood from an infected bovine. The mice were then returned to Onderstepoort.

On the sixth day after injection seven mice were killed and their spleens injected into a sheep. This animal showed no reaction, but a sheep injected with spleens taken from the remaining mice on the fourteenth day after injection showed a typical heartwater reaction.

Again mice were injected intraperitoneally with 0.5 c.c. citrated blood from another bovine in the same area. These mice were returned to Onderstepoort and on the 13th day after injection four were killed and their spleens used to inject a sheep. This animal, too, showed a typical heartwater fever reaction.

However, an attempt to transport the Ball 3 strain to Southern Rhodesia in mice failed. Twelve mice were injected intraperitoneally with 0.5 c.c. of infected blood. Six mice were kept at the laboratory and six were sent away. Ten days later both lots of mice were killed and their spleens injected into sheep. Neither sheep reacted.

To determine whether the Ball 3 strain differed from the other strains examined, an infected sheep was bled into citrate. It was then killed and its spleen removed.

Twelve mice were injected with the blood and twelve with spleen emulsion; each mouse received 0.5 c.c. i.p.

Thirteen days later six mice of each group were killed and their spleens used to inject sheep. That which received material from the mice injected with sheep spleen reacted, while the other showed no apparent reaction.

DISCUSSION AND SUMMARY

It has been shown that the causal organism of heartwater fever will survive for periods up to 90 days after injection intraperitoneally into mice. Nine serial alternating passages between sheep and mice were made, but in spite of numerous efforts, it was not found possible to carry the strain through two generations of mice. From this it would seem that the organism does not multiply in the mice but merely survives for long periods. On the other hand, however, it was found that there was apparently an incubation period in the mice during which time the organism could not be demonstrated by injection of mouse spleens into sheep.

Spleen from infected sheep was apparently a more satisfactory source of virus than blood.

The finding that the organism will survive long periods in mice has been used to transport strains of heartwater over long distances.

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THE CONTROL OF ECTO-PARASITES OF DOMESTIC STOCK WITH "TOXAPHENE"

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Introduction

A search for new insecticides carried out before the last World War was stimulated by the Western European shortage of the main plant insecticides — Nicotine, Pyrethrum and Rotenone — during that war and the development of " Tolerance " by a number of agricultural and livestock parasites to many of the more commonly used pesticides.

This search received a tremendous impetus when British, French and American workers investigated and recognised the outstanding insecticidal properties of D.D.T. and B.H.C. for the control of agricultural, human and livestock parasites in the comprehensive tests carried out on these synthetic compounds in 1942-44. (1) & (2)

Since then, many thousands of inorganic, plant and synthetic compounds have been screened for insecticidal activity and in America considerable effort and money have been expended in the preparation and development of new synthetic compounds of high activity.

Of these, " Toxaphene " has proved itself to be one of the most versatile and effective insecticides for use against a variety of the more serious parasites that infest livestock and agricultural crops.

Physical Characteristics and Chemical Properties of " Toxaphene "

This compound was developed by the Hercules Powder Company, Inc., of Wilmington, Delaware, U.S.A. It is a chlorinated camphene with the approximate empirical formula $C_{10}H_{10}Cl_8$. The technical grade is an amber, waxy solid, possessing a mild pleasant piney smell. It contains from 67% to 69% chlorine and melts in the range of 70° to 95°C. Toxaphene is insoluble in water but soluble in a number of inexpensive commercial solvents and is practically non-volatile. Like other chlorinated hydrocarbons of this type, Toxaphene slowly evolves HCl upon heating, the rate depending upon temperature and the presence of catalytic impurities such as iron compounds. Highly alkaline conditions can cause dehydrohalogenation. The technical grade material and fluid preparations containing Toxaphene in high concentration have corrosive action on all metals except aluminium. Thus only glass, glass lined or metal drums with special protective coating are suitable for containing such products.

Commercially, it can be formulated as dusts, wettable powders and emulsion concentrates and such commercial products have been on the American market since 1947.(3)

Experience has shown that careful formulation is essential for the production of safe and efficient Toxaphene preparations. Especially is this so with emulsion type mayonnaise and miscible oil products. These should premix easily with water before addition to dip or spray tanks and be stable when used with any type of water.

The importance of this was not fully appreciated when "Toxaphene" preparations were first marketed. Knowledge of these facts was in some cases acquired in the hard way. For instance faulty premixing and/or the influence of soft waters resulted in broken emulsion in dip tanks in Florida and Mexico, with consequent scum formation of high Toxaphene content, which caused mortality in dipped calves.(4)

Toxaphene wettable powder products can vary in their insecticidal activity according to their method of manufacture and the diluent or filler used.(5) The sedimentation rate of these powders has a determining influence on the exhaustion rate factor of the washes containing them. More important still, Toxaphene Wettable Powder dips, like other powder dips containing B.H.C. and D.D.T. used in dipping tanks, have shown indications of a loss of biological efficiency as the dipwashes become progressively fouled. This was commented on by McHardy and Blomefield last year. (6), (7) and (8)

Testing of Toxaphene Preparations and Washes

Laboratory analytical methods have been perfected for the determination of the Toxaphene content of both Toxaphene concentrates and washes.(9)

In addition, research work by private enterprise in both America and the Union has provided an accurate and rapid vatside test for Toxaphene dip and spraywashes.

Laboratory and Field Tests

Since its appearance, Toxaphene has been given extensive laboratory and field tests all over the world and has been tried out against a host of livestock and agricultural pests. This work has shown that this insecticide possesses similar characteristics to the other well known synthetic chlorinated compounds D.D.T., B.H.C. and Chlordane, being an active contact poison with a good residual persistency.

The earlier work was done in the States followed by work in Great Britain and South America, and later, 1948, by work in East Africa and the Union.

The results of all these tests have indicated that for some of the more serious livestock parasitic problems in Southern Africa, Toxaphene has a specificity and persistency superior to the other synthetic insecticides when evaluated at comparable concentrations. This was very apparent in the comparable field trials on ticks and it is worthy of special mention that this acaricide proved particularly effective against the species of the Ixodidae that form clusters and are deep feeders.

In the days of the arsenical dips, it was these vicious ticks that were the most difficult to combat.

(a) *Three Host Ticks*

Genus Amblyomma

In America, against infestations on cattle of the Lone Star Tick — *Amblyomma americanum* (Linnaeus) and the Gulf Coast Tick — *Amblyomma maculatum* (Koch), Toxaphene proved superior to D.D.T. and B.H.C., gave good control of all stages and provided protection against reinfestation for up to 14-days when used at the 0.5 to 0.75% concentration in dip and spray washes.(10)

In East Africa, Evans found that dip and spray washes used at the 0.5% Toxaphene concentration, effected similar good control of the Tropical Bont Tick — *Amblyomma variegatum* (Fabricius) and provided positive protection against larval and adult reinfestation for 14 and 10 days respectively.(11)

In South Africa, this acaricide has generally been used in dip and spray washes at the 0.20% to 0.25% Toxaphene concentrations, though McHardy has done some work with washes at the 0.5% Toxaphene concentration. Against the South African Bont Tick — *Amblyomma hebraeum* (Koch), these first two concentrations have provided positive protection against larval, nymphal and adult reinfestation for 7 and 5 days respectively. In addition, careful observation on thrown cattle has shown that a single application of a 0.25% Toxaphene wash will break up bont tick clusters and that routine 7-day applications of this strength, will keep cattle virtually free from adult female reinfestation and only allow reinfestation by the odd adult male Bont tick. This routine 7-day application has also effected a marked reduction in the bont tick population in camps grazed by cattle so treated and on many farms has all but eliminated the incidence of heartwater.

It must be mentioned that for absolute control, tail site infestation may have to be hand dressed at times of peak infestation by this tick. (6), (7) and (8)

Genus Rhipicephalus

Observations carried out in the Union on the main Brown tick species that infest cattle, have revealed that weekly applications of washes containing 0.25% Toxaphene have effected complete body control of all stages, at the 7-day interval of application. There has been, however, some degree of adult tick reinfestation and engorgement under the tail and in the ears during peak infestation, so that at times, hand dressing of these sites is still a necessary supplementary measure for maximum results. (6), (7) and (8)

(b) *Two Host Ticks*

Rhipicephalus and Hyalomma Genera

Since the main infestation site of the adult stage of the 2-host ticks, the red-legged tick — *Rhipicephalus evertsi* (Neumann) and the bont-legged ticks—*Hyalomma transiens* and *Hyalomma rufipes* (Koch), is the tail region, hand dressing of this site must be done as the need

arises but regular 7-day applications of 0.25% Toxaphene washes do have a 3-4 day controlling influence on the ticks attached to this site, as well as preventing body infestation of the adult stage of these ticks and larval-nymphal infestation of the red-legged tick in the ears and elsewhere. (6), (7) and (8)

(c) *One Host Tick*

Boophilus genus

Work done in South America on their cattle tick — *Boophilus annulatus* (Say) has shown that a 0.5% Toxaphene wash effected a complete control of all stages of this tick besides providing protection for nearly 3 weeks.(10) So outstanding was the effect of this tickicide on this tick that in the Argentine, where several weekly dippings with other acaricides are required to cleanse cattle moving into tick-free zones, a Toxaphene emulsion dip has been officially approved for cleansing in a single dipping.

In Australia, Legg has reported that Toxaphene emulsion wash concentrations of 0.55% and 0.65% effected a 100% kill of all stages of their cattle tick — *Boophilus microplus* (Canestrini) even on heavily infested cattle.(12)

The control of the Blue Tick — *Boophilus decoloratus* (Koch) is a special problem of its own in Southern Africa due to its development of tolerance to both arsenic and BHC. (13), (14), (15), (16), (17) and (18)

Against the non-resistant strains of this tick, weekly applications of 0.25% Toxaphene washes have proved completely satisfactory. This unfortunately is not the case against the B.H.C.-Arsenic resistant strains, though it does provide a fair degree of control and markedly reduces the severity of infestation. (7), (8) and (18)

Lice Control

Experience in the Union has indicated that two dippings or sprayings with a 0.25% Toxaphene wash will effect complete control over biting and sucking louse infestations of cattle and equines.

In America the indications are that Toxaphene gave results comparable with those obtained with D.D.T. and B.H.C. for the control of the hog louse — *Haematopinus adventicus* (Neumann), the short-nosed cattle louse — *Haematopinus eurysternus* (Nitzsch), the long nosed cattle louse — *Linognathus vituli* (Linne) and the tail louse — *Haematopinus quadripertusus* (Fahr.) Against the red and yellow goat lice species *Bovicalo* sp., however, Toxaphene appeared to be most suitable and Toxaphene concentrations of 0.2% have effected 100% control over goat lice at a single application.(10)

Fly Control

Evidence is accumulating to indicate that Toxaphene has a comparable efficiency to both D.D.T. and B.H.C. against the common biting flies that worry cattle and equines. It certainly effects positive

control over infestations of the hornfly — *Lyperosia irritans* (Linne), the stable fly — *Stomoxys calcitrans* (Geoffrey) and the horse fly — *Hippobosca rufipes* (Olfers), when used every 7 days in sprays and dips at the 0.25% Toxaphene concentration. In America this insecticide is generally used at the 0.5% Toxaphene concentration and has provided positive protection for up to 30 days in some states and 42 days in others against infestation of the horn and buffalo flies of stock.(10)

Very little work has been done in the field with Toxaphene for the control of the maggot flies of sheep and cattle, so no views founded on experimental work can as yet be expressed as to its possible value against maggot flies. Field observations carried out in the Union and America have revealed that the routine application of Toxaphene washes at the 0.25% (Union) and 0.5% (America) Toxaphene concentrations has certainly reduced the incidence of screw worm infestation in cattle by virtue of its control effected over those tick species that predispose these animals to screw worm attack.(10)

Other Parasitic Problems

Until just recently, the main investigational field work with Toxaphene on livestock ecto-parasite problems, has been devoted to its control of Ticks, Lice and Flies. Odd unpublished reports received have indicated that Toxaphene at 0.25% and 0.5% concentrations has proved successful for the control of sheep Scab but only effected similar curative and preventative control to that given by the lower B.H.C. concentrations of 0.1% and 0.125%.(19)

American reports state that against the Sheep Ked — *Melophagus ovinus* (Linne), Toxaphene was superior to D.D.T. but although less effective than B.H.C., concentrations of 0.05%, 0.2% and 0.5% Toxaphene gave complete control by dipping.(10)

Toxicology of "Toxaphene"

"Toxaphene" has an irregular toxicity range which may vary with the species and age of the domestic animal. In order of susceptibility to poisoning are fish, dogs, cats, poultry and calves, especially Jersey calves. Mature sheep, goats, horses, mules and swine show a high degree of tolerance to "Toxaphene" and it is of interest to record that in a toxicity trial carried out in the States, these adult stock species showed no adverse effects from eight external applications at 4-day intervals of a wash containing 1.5% Toxaphene. (10), (20)

Toxicity can be induced by absorption, ingestion and inhalation. In general the effects are those of a neurotoxin. They are characterised by salivation, a diffuse stimulation of the brain and spinal cord, congestion and oedema of the lungs, resulting in generalised convulsions and death due to respiratory failure.

The first evidence of toxic effect is usually shown within 24 hours after administration or application. With the higher dosages, however, symptoms will be evident within a few hours. The typical chain of symptoms begins with restlessness of the animal, walking, stretching and

yawning. Salivation soon appears and may persist during the period of disturbance. Muscular spasms appear, at first in the muscles of the head and face, later extending over the whole body. In convulsive fits, the affected animal may suddenly run with a stiff gait and throw itself about wildly or whirl around rapidly; grinding of the teeth and piteous outcries or murmurs may accompany these symptoms.

These fits may be followed by periods when the animal may appear almost normal. Often after such a fit, the animal may take up a peculiar stance and maintain it for some time. One convulsion may be all the animal suffers, recovery occurring without any other outward symptoms. On the other hand, many convulsions may occur with either death or recovery. Death, when it does occur, is generally one of extreme agony.

Post mortem lesions depend on whether poisoning is of the acute or chronic type. Typically, there is congestion of the meninges, brain and spinal cord, petechial haemorrhages of the heart, especially along the course of the coronary vessels. Pulmonary oedema and congestion, hepatitis with necrosis in chronic poisoning, may occur. Gastro-enteritis may be seen in the case of sheep and goats, but is rare in calves. ([20]) and ([21])

Treatment of affected animals, to be successful, must be undertaken early. Strong black coffee and sugar ($\frac{1}{2}$ lb. coffee and sugar to quart of water dosed hot, dregs and all, is a most useful first aid treatment). If absorption is through the application of washes, then wash the animal thoroughly with soap and warm water to remove any toxaphene residue on the coat. If due to accidental ingestion in the case of the pig, dog and cat, administer an emetic. Follow this by injections of " Nembutal " supported by Methylamphetamine to prevent or control convulsions and respiratory failure.

Certain of the symptoms shown can be mistaken for those of heartwater and differential diagnosis may at first be difficult, especially in heartwater areas where Toxaphene dips have been used for the specific control of the Bont Tick.

In the human being too, Toxaphene can be far more toxic than either BHC or DDT. For this reason, persons must exercise care in the handling of preparations containing Toxaphene. Always use a stick for stirring and the hands and any other parts of the body accidentally contaminated should be washed with soap and water to remove any Toxaphene concentrate present. If these simple precautions be carried out, no adverse effects need be feared.

Summary

In summary it can be said that the addition of Toxaphene to the range of insecticides has come at a most opportune time to provide a really outstanding acaricide for the control of the Bont and Brown ticks, against which the other insecticides have often failed to give the desired control at the 7-day interval of application. By virtue of this control alone, its intelligent use will solve many of the more

serious problems associated directly and indirectly with infestations by these species of ticks.

In South Africa, dips and sprays containing Toxaphene are prescribed only for the control of ticks, lice and flies infesting cattle, horses and mules. Its range of uses, may be extended later to include control of the ecto-parasites of sheep, goats and swine.

The high susceptibility of dogs, cats and poultry to Toxaphene poisoning naturally excludes the use of this insecticide on these animals.

To-day the wonderful range of insecticides available, many of which are highly specific in their curative and protective properties against certain of the more serious ecto-parasites infesting domestic stock, should encourage their selective use. Furthermore, many of these insecticides also effect a high degree of control over a number of parasites. Therefore a policy of selective and rotational use of these parasitic toxicants becomes possible and should be practised, especially now that mechanical spraying equipment has been developed which allows any insecticide to be used at will. Such a policy should assist in limiting the development of "Tolerance" by parasites as some authorities consider the continuous use of one insecticide against a given parasite is conducive to this development, particularly when it is used at low concentrations which are often sub-lethal.

It is the duty of all scientific workers to give full consideration to this aspect of parasitic control as the number of livestock and agricultural pests that have acquired this tolerance to many of the well known and widely used insecticides is increasing annually and has become a problem of world-wide concern.

The Veterinary profession in South Africa should give this matter very careful thought at their deliberations and in their research work and should indicate a policy to the farmer that will ensure the timely rotational use of selective insecticides at their most effective safe concentration and formulation. "Toxaphene" should certainly be one of the acaricides chosen and its outstanding insecticidal properties will be found to be most useful in such a programe.

Acknowledgements

The Author wishes to record his thanks to Messrs. Cooper & Nephews S.Af. (Pty.) Ltd. and Messrs. Cooper, McDougall and Robertson, Ltd., Berkhamsted, Herts, U.K., for permission to publish and quote from the results of field research work and also to acknowledge the help received from African Explosives and Chemical Industries, Limited, Research Department, Modderfontein, who were responsible for the development of the Toxaphene Vatside Test Method.

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CASE REPORT

PLACENTA PRAEVIA IN A HANUMAN MONKEY [PITHECUS ENTELLUS (DUF.)]

C. F. B. HOFMEYR

Pretoria

Placenta praevia is the condition seen when the internal uterine os is covered, partly or completely, with placental tissue.

The only type of placentation lending itself to such an abnormality is the *discoidal,* which is only found in man and primates. As the name indicates, the area of placental attachment resembles a disc; it is limited and clearly defined. The endometrium at the fundus is most favourable for placental attachment. Where this attachment develops lower down, it is referred to as a low insertion, whereas if whole or part of the internal os is covered by the insertion, it constitutes *placenta praevia,* which is divided into:

(a) *Marginal* insertion, when the edge of the disc overlies the mouth of the uterus,

(b) *Lateral insertion,* when the disc is placed eccentrically, but covers the whole os,

(c) *Central insertion,* which is self explanatory.

The above classification is according to Bumm (1922), and de Snoo (1933).

Further, according to the latter, in man *placenta praevia* occurs once in every 500 pregnancies. It is of great significance in that it leads to serious metrorrhagia as soon as the cervix dilates.

The same author mentions the methods of treatment as listed below as being generally accepted:

(a) Caesarian section — if possible only when the foetus is over 8 months, as the viability of the foetus is prejudiced if done earlier.

(b) With cranial presentation an opening is made in the placenta and a wrinkle of skin is grasped with vulsellum forceps. To this is attached a weight, which is allowed to hang over the end of the bed. The pressure of the head then reapproximates the placenta and uterine wall and the haemorrhage is arrested.

(c) With breech presentation one leg is delivered and the weight attached to this with similar effect.

This, very schematically, is the position in man.

The Subject of this report was a multiparous Hanuman monkey at full term [Pithecus entellus (Duf.)] kept at the National Zoological Gardens, Pretoria. She was in good general physical condition and shared a roomy cage with several of her own species of both sexes and various ages. When last seen by the keeper, it was when they were

being locked in the night quarters. She then appeared normal. The next morning she was found dead, her hindquarters soiled with blood, and blood all over the floor of the night house.

Post mortem examination

Autopsy revealed that death was due to massive haemorrhage from the uterus. *Placenta praevia centralis* was present and the bleeding started as soon as the os uteri dilated. The foetus was in cranial presentation.

The specimen was donated to the embryological museum of the Onderstepoort Veterinary Research Institute.

Discussion

No previous reference to this condition in any species other than man has been encountered.

Taking into consideration the methods of treatment employed in man, it is quite clear that, because of the inability of the patient to co-operate, as well as supportive measures, Caesarian hysterotomy would have been indicated, had the animal been found alive.

The comparatively high incidence of this abnormal placentation in man makes it probable that primates are more often affected than is generally believed.

RESUMÉ

(1) A brief mention is made of the classification in man of *placenta praevia,* and methods of treatment.

(2) A case of *placenta praevia centralis* is reported in a monkey *Pithecus entellus* (Duf.).

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CASE REPORT

TETANUS IN A CAPE CHACMA BABOON [PAPIO URSINUS URSINUS (KERR)]

C. F. B. HOFMEYR
Pretoria

The subject of this note was a young female chacma baboon approaching sexual maturity.

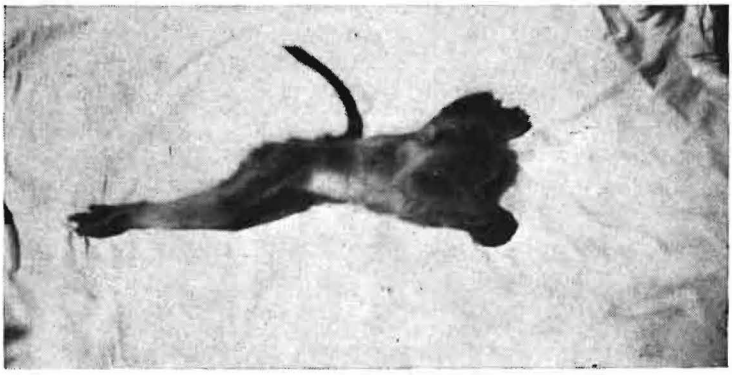
At the request of the owner the writer performed an oophorectomy. It may be mentioned in passing, that the technique employed proved to be very convenient and was the same as described by Hofmeyr (1951) with the exception that the site of the incision was approximately halfway between the umbilicus and the pelvis.

The anaesthetic used was Nembutal Veterinary (Abbott) intravenously.

The anaesthesia and operation were uneventful, and the case was sent home while still somnolent, as there were no suitable facilities for hospitalizing baboons.

The wound healed by primary intention and the sutures were removed on the 6th day. Throughout convalescence the patient was in excellent spirits.

Fig. 1



On the 28th post-operative day the author was summoned as the animal had been taken ill a few hours previously, although, at the time of the visit, the symptoms had already progressed so far as to make the diagnosis of tetanus an easy one. The clinical picture of tetanus is too well known to veterinarians to need recapitulation. There was one difference however. In domesticated animals all the limbs are in rigid extension in a tetanus spasm, while in this case it was only true of the hindlimbs, all the joints

of the thoracic limbs being in full flexion. (See fig.) This is also the case in man.

At the time no antitoxin could be obtained, so that the only therapy was nembutal intravenously as a relaxant. Death occurred within 72 hours after the onset of symptoms.

DISCUSSION

As far as the author could determine, all mammals, whose resistance to tetanus has been tested, have been found to be susceptible. However, no reference has been encountered of tetanus in the Cape chacma baboon. The main purpose of this note is thus to formally record the susceptibility of the above species to tetanus.

Henning (1949) and Hutyra, Marek and Manninger (1938) refer to the fact that tetanus spores, when toxin free, are not actively pathogenic and only become so when associated with a suitable accessory factor like dirt or other foreign material. They also point out, that the length of the incubation period and duration of illness are governed by the virulence of the particular strain as well as by the important factor of species resistance.

At the operation on the baboon the skin sutures were of silk, but all buried sutures were of chromic catgut. Circumstantial evidence tends to suggest that the catgut may have been the source of infection in the present case. Chromic catgut takes about 3 weeks to be absorbed. If spores were released at about this time not only would the presence of some foreign material encourage toxin formation, but a likely time for clinical symptoms to become manifest would be about a week afterwards, an incubation period commonly mentioned by many authorities and as noted in the present case. The short illness indicated either marked susceptibility, or virulence or both, which in turn would lead one to anticipate a short incubation period. Seven days is the minimum average one mentioned by Hutyra *et al.* (1938).

It must be emphasized that the implication of the catgut is only very tentative. It is interesting to add that at about the same time there was a similar case in man in one of the local hospitals.

RESUMÉ

(1) Tetanus is reported in a Cape chacma baboon [Papio ursinus ursinus (Kerr)] apparently for the first time.

(2) Circumstantial evidence tended to implicate the catgut used at the operation on the baboon.

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TOXIC COXITIS IN A DOG

C. F. B. HOFMEYR

Pretoria

SUMMARY

(1) A case of coxitis, lasting 6 months, is reported in a Great Dane dog.

(2) Complete recovery took place soon after tonsillectomy.

Toxic arthritis has received scanty attention in veterinary publications. A search of the available veterinary literature revealed the following passage by Kirk (1951) as the reference most closely relevant to the present subject : "It is advisable in rheumatic conditions to examine the animal for some septic focus from which the attack might have originated such for instance as diseased teeth, septic sinuses, metritis, etc."

It is, therefore the intention of this communication to focus attention on the clinical entity of toxic arthritis.

Subject:

The patient was a two year old Great Dane dog.

History:

During the fortnight immediately before the consultation the dog had shown lameness in the left hindleg. There was no history of violence or any other cause to account for the lameness. Apart from it, the behaviour of the animal was normal.

Examination :

The dog was too lean in condition. Routine clinical examination revealed nothing abnormal, except that the tonsils appeared rather larger than usual, and that the lameness was due to pain in the left hip. There was no displacement of the bony parts and no deformity or crepitus. It was, therefore, concluded that the lameness was due to trauma of the soft tissues of the hip.

Ungt. iodex c methyl. sal. was prescribed for external application and gentle, controlled exercise was advised. In view of the animal's poor condition, the diet was adjusted and dicalcium phosphate as well as cod liver oil prescribed as supplements.

After a month the patient was seen again and the lameness was found to be unchanged. Careful clinical examination was made again with the result as previously. The faeces examination was negative for worm ova. Skiagraphs of the affected hip did not show any lesions.

Somewhat reluctantly the diagnosis of rheumatism was suggested. At various times the following drugs were used singly or in different combinations: Cinchophen, sod. sal. and other salicylates, tinct. gelsem. and tinct. colchic. There was no clinical response at all.

By this time the owner had become resigned to the dog's lameness.

Subsequently the animal was brought in with an attack of acute tonsillitis, which subsided after treatment with sulphamerazine. Some weeks later the same thing happened.

At this stage six months had elapsed since the first consultation. It was realized, that insufficient attention had been paid to the enlarged tonsils probably because, prior to the acute attacks, there never had been any symptoms directly incriminating them.

A smouldering infection could account for the poor condition despite correct diet and, generally speaking a good appetite. Similarly it could have been the cause of the coxitis as toxic arthritis can occur with such a condition in man.

The client was accordingly informed that, although there was no certainty, tonsillectomy might result in recovery. He willingly agreed to the operation.

After the acute tonsillitis had subsided, tonsillectomy was performed under general anaesthesia. The patient was allowed to go home 24 hours later. His appetite was unimpaired and he made a very satisfactory recovery from the operation.

The results were remarkable. Three days after the tonsillectomy his lameness had clearly improved. At the end of a week it had almost disappeared. The rate of improvement then slowed down, but he had fully recovered 3 weeks afterwards.

Remarks:

The dog was continuously lame (**not** intermittently) in the same limb for 6 months despite all medication. The wellmarked improvement so soon after the operation, therefore, cannot be taken as a coincidence. It follows then that the cause of the coxitis was almost certainly toxaemia from the infected tonsils i.e. this was a case of toxic coxitis.

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Jl. S.A.V.M.A. 23(3), 1952.

THE USE OF ENTEROTOXAEMIA VACCINE

G. D. SUTTON

Onderstepoort

Enterotoxaemia vaccine has now been made at Onderstepoort for just over two years. It is time to examine the evidence which has been obtained from veterinary surgeons and stock owners about its value and base our recommendations for the use of the vaccine on their experiences.

It appears that the vaccine takes from 10-14 days to produce an immunity. One injection is seldom enough to stop an outbreak, but may hold the disease in check for about a month, after which deaths start again. A second injection is essential. Sometimes three injections are necessary before an outbreak is brought under control, especially with lambs, which do not appear to respond as well to the vaccine as adult sheep. The longer the interval, up to six months, between successive injections the better the result. There are indications that sufficient protective immunity does not last for a full year after use of the vaccine but only for 7-9 months. Enterotoxaemia occurs throughout the year but is most prevalent in January, February and March when the grazing is green and again in June and July when sheep are grazing on green crops. Numerous stock owners have reported that since they have used the Enterotoxaemia vaccine "Geil-siekte" has disappeared from their farms. This may be due to its having been confused with enterotoxaemia.

Before drawing up recommendations for the use of the vaccine these factors as well as the types of sheep concerned, namely breeding ewes, rams, lambs and non-breeding stock have to be considered. In addition the usual management routine of a sheep farm including shearing, mating and lambing should not be disrupted. The general practice is to shear in October or November and mate the sheep in December and January so that the lambs are born in May, June or July. What should be done also depends on whether the sheep have been inoculated previously or not. Provision must be made for routine preventive inoculation and control of outbreaks or suspected outbreaks of the disease. No hard and fast rule can be laid down. Modifications should be made if necessary.

The following is recommended for routine preventive inoculation and should be done every year:

Breeding ewes not inoculated previously.

Give the first injection in November followed by a second one 4-6 weeks later. Give a third injection about 2 weeks before the ewe

is due to lamb which is usually in April, May or June. This third injection is to afford the lamb protection, which it obtains from the colostrum of the ewe.

Breeding ewes inoculated previously.

Inoculate in November and again two weeks before lambing, which is usually in April, May or June.

Rams not inoculated previously.

Give the first injection in September and the second one in November. This avoids incapacitating the ram during the breeding season as the vaccine may cause lameness. Inject again in April, May or June at the same time as the breeding ewes.

Rams inoculated previously.

Inoculate in November and again in April, May or June at the same time as the breeding ewes.

Lambs.

Give the first injection at 3 months of age and the second at 4-5 months. The second injection will then coincide with the inoculation of the other sheep in November. A third injection should be given in April, May or June at the same time as the breeding ewes are done, when the lambs are almost a year old.

Non-breeding stock not inoculated previously.

Inoculate in November, a second time 4-6 weeks later and then again in May, June or July of the following year.

Non-breeding stock inoculated previously.

Inoculate in November and again in May, June or July.

It will be seen that a general routine practice would be to inoculate all sheep in November and again in April, May or June every year. Extra inoculations for lambs and sheep which have not been inoculated previously would be fitted in as outlined above.

In the case of an outbreak of the disease, inoculate immediately, follow with a second injection four weeks later and a third one another four weeks later if necessary. If mortality is severe the first two injections could be given with an interval of two weeks between them followed by a third one a month after the second. If the interval between the first two injections is reduced the response is not so good and the third one is essential.

If a suspected outbreak of the disease occurs treat it as a definite one and inoculate immediately to save the owner possible further loss. Do not wait for a laboratory diagnosis to be made. The test does not detect all positive cases and a negative result has no significance as it does not exclude the disease. If the result is positive the sheep should have been inoculated and if the result is negative the man on the spot still has to decide whether to inoculate or not.

CLINICAL NOTE

THE TREATMENT OF OBSTINATE RETENTION OF MECONIUM IN THE FOAL BY LAPAROTOMY

J. Quinlan, G. Faull, D. Burgess and I. Banks

Cape Town

The subject was a colt foal born on October 2, 1951. It was apparently healthy at birth. No meconium however was passed. The foal became restless and developed colicky symptoms which became acute after twenty-four hours. After thirty-six hours professional assistance was sought. The foal was given an enema of liquid paraffin and castor oil was administered per os. Attempts to remove the meconium with the fingers failed.

The condition gradually deteriorated; colic became more acute and intestinal tympany was marked. At this stage, about 48 hours after birth, the foal was brought to hospital where examination showed that relief of the obstruction was urgently required. Mechanical means and enemata, with an injection of prostigmine, gave no relief. At this stage the general condition showed rapid deterioration. There was continuous acute pain, marked tympany, weak, rapid pulse, and rapid respiration. The general appearance was one of extreme anxiety. Consequently an immedate operation became imperative.

The usual aseptic technique was adopted. The foal was anaesthetised by intrajugular injection of 15 c.c. of Nembutal. Its weight was estimated to be approximately 95 lb.

Laparotomy was performed in the left flank. On introducing the hand into the abdomen firm balls of meconium could be felt extending from about six inches from the anus to about 15 inches up the colon. By pressure on the bowel each ball was pushed backwards into the rectum and towards the anus, from where it was removed with the finger by an assistant. Considerable difficulty was experienced with the first few balls of meconium. The rectum was kept lubricated with liquid paraffin. When the mass of meconium had been cleaned out the bowel was emptied voluntarily of a considerable amount of semi-liquid faeces.

The wound was closed in the usual way with catgut, and a few tension sutures of umbilical tape.

The foal was allowed to walk out with his mother on the following day and continued to have daily exercise. The skin sutures were removed on the seventh day. The operation did not appear to retard the foal's progress. He remained healthy, put on condition normally and was discharged on the ninth day.

OBITUARY

J. H. L. LYONS

It was with great regret that his old professional friends heard of the death of J. H. L. Lyons.

As a fellow student of Paddy's at the London Veterinary College, I consider it a privilege to testify to his very fine character and cheery disposition. He was always good company and often kept us entertained with his beautiful Irish brogue. We were a company of five veterinarians on the old Scot leaving Southampton on October 2nd, 1902, and on arrival at Cape Town, Paddy was stationed at Aliwal North to learn the technique of Rinderpest serum production. Later he was stationed for a long period at Cape Town, being engaged in the control of very extensive outbreaks of Glanders. This work was not without danger to the veterinarian, and required the utmost tact in conducting it.

Paddy was an outstanding clinician and was beloved by all who had the privilege of knowing him well.

R.P.

ERRATUM in Vol. 23, No. 2, Page 83.

The Efficacy of Methylamphetamine as an analeptic in pentobarbital sodium overdosage.

Summary

(2) The addition of 100 mg. should read 10 mg.

BOOK REVIEW

The *NATIONAL FORMULARY* 1952, published jointly by the British Medical Association and the Pharmaceutical Society of Great Britain, London, pp. 196, price 4/6 (postage 3d.) or interleaved 7/6 (postage 5d.).

By definition, a formulary is a collection of recipes, formulas and prescriptions. The first edition of this small but comprehensive handbook was compiled by a committee representative of the medical and pharmaceutical professions, and published in 1946. In the present revised edition good use has been made of many constructive criticisms received from interested persons.

It will be readily understood that this Formulary is intended primarily for pharmacists and medical practitioners, but veterinarians will find very nearly as much material to instruct and interest them. In format this book is definitely of "pocket" size. Under "notes for prescribers" are given first aid treatment of poisoning, analgesics (including pethidine and amidone), antacids, antibiotics, antihistamines, enemas, expectorants, haematinics, hormones, hynotics, purgatives, sulphonamides, tonics, vitamines and vitamin preparations. Other chapters follow with information and directions concerning so-called "dangerous drugs," the pharmacological classification of preparations and drugs and the formulary proper with a large number of prescriptions classified under English and Latin headings e.g. applications (applicationes), draughts (haustus), ear drops (auristellae), etc.

A most useful section for reference purposes is one in which the almost bewildering array of proprietary preparations today offered by the pharmaceutical manufacturers are listed against the equivalent B.P. or B.P.C. names and against preparations of reputed analagous therapeutic affect. This feature alone would already to a considerable extent justify the presence of the *FORMULARY* in the dispensary or consulting room of every veterinarian who wishes to be up to date with and well informed about the drugs he uses and prescribes.

W.D.M.

* * * *

THE INFECTIOUS DISEASES OF DOMESTIC ANIMALS: by W. A. Hagan and D. W. Bruner (Second Edition) 1951. Bailliere, Tindall & Cox, London.

The authors are to be complimented on the production of a volume which covers the whole field of infectious diseases and runs to 920 pages. It is unusual to attempt within the scope of a single book to deal with such a vast subject but the authors have done this very competently. The bacterial diseases and some of the virus diseases have been dealt with more fully than other sections which was to be expected in view of the fact that the book was written by two bacteriologists.

It is unusual to include a section on the mechanisms of infection and resistance in a text book of this type as they are usually dealt with in a bacteriology course. After reading the preface it is difficult to criticise the contents as the authors admit the limitations involved in producing a book of this type. They must have consulted a vast literature and the information is very up to date.

No mention is made of Theileria annulata and it is now generally accepted that Theileria mutans should be the name of the organism called Babesia mutans in the book. There are a number of minor errors in the text which do not in any way detract from the value of the book as it is difficult to avoid them. It can be recommended as a valuable text book for students studying infectious diseases of domesticated animals, the purpose for which it is intended.

E.M.R.

* * * *

A WORLD DICTIONARY OF BREEDS, TYPES AND VARIETIES OF LIVESTOCK (1951) by I. L. Mason. Published by the Commonwealth Agricultural Bureaux, Slough, England (30/-).

The above volume, being *Technical Communication No.* 8 *of the Commonwealth Bureaux of Annual Breeding and Genetics,* was printed in Holland. It is the most comprehensive work of its kind and deals, as the title indicates, with the names and distribution of all breeds of the horse, ass, buffalo, cattle, sheep, goats and pig.

It is an excellent work of reference and no agricultural station can afford to be without it. Great credit is due to Mr. I. L. Mason for his patient research and for his painstaking efforts which could not have been made during official hours.

The indigenous types of African livestock naturally occupy a prominent position in the Dictionary and it is somewhat comforting to realise that whereas a generation ago anyone interested in "kafir" sheep and goats or in "scrub" cattle was considered abnormal, today, throughout the Sub-continent there is a growing interest in indigenous livestock. It is now realised, thanks largely to the work of Bonsma (1940) that the influence of climate on livestock is fundamental.

Further, the fact that the Union, Swaziland and Mozambique administrations have set aside research stations for the study of native cattle is proof that indigenous livestock will no longer be neglected. Southern Rhodesia has gone a step further and tha institution of the Rhodesian Indigenous Cattle Society, with a constitution providing for a score card, inspection and registration, is evidence that the Mashona (Makalanga) breed will soon take its rightful place in the animal husbandry of our northern neighbour.

While Mason has omitted few breeds, types or varieties in Part I of his book (Alphabetical list of the farm species) — an example being the fighting Raca Brava of Portugal — his Part II (Countries and References) will require attention before the second edition is issued.

It is suggested that he takes each political territory and not the natural area and describes the types therein separately e.g. Union of South Africa. In this way each type of each species in the Union would be dealt with individually. At present the main heading (p.249) is *Eastern and Southern Africa* and under this the several species are

listed. No reference is made to woolled and non-woolled sheep, but the data are easily obtainable thus (1950):—

Woolled sheep

Merino	19.6	millions*
Crossbreds	2.0	„
Total	21.6	„

Non-woolled sheep (Starke)

Blackhead Persian	2.1	millions
Hottentot or Afrikaner	1.3	„
Karakul	1.47	„
Crossbreds	1.7	„
Total	6.57	„

The Hottentot or Afrikaner types are :—

(a) Namaqua, in North-West Cape Province
(b) Ronderib or Blinkhaar, about Britstown
} Short and fat tails.

There are also long fat tailed ("sweepstert") Afrikaner sheep (Lydekker p.168).

In the Native reserves e.g. Zululand long tailed haired sheep are to be found.

Similarly the Boer goat is not the only type in South Africa (p.251); but there are also the Angora and the Native goats, the latter a small animal which in Zululand is far more resistant to heartwater than the larger Boer goat.

In regard to literature it would be wise to be *au fait* with the researches of Portuguese veterinarians e.g. Da Costa, A. M. (1931) who has independent views on the origin of Afrikaner cattle, Martinho, J. (1948) who knows most about Landim cattle in Mozambique and Morgado, F. de P. (1949) who shows the existence of the Shorthorned Zebu in Angonia, Mozambique Province.

The next step as indicated by Mason (p.10) is illustrations of animal types along with maps of their distribution.

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SOME OBSERVATIONS ON THE APPLICATION OF ARTIFICIAL INSEMINATION IN COMMERCIAL DAIRY HERDS IN THE TRANSVAAL

J. S. VAN HEERDEN

Onderstepoort

The high incidence of conditions causing sterility and breeding difficulties in dairy cows, such as infections, nutritional factors or inefficient management, was responsible in so small measure for the introduction of artificial insemination in dairy cows in the Transvaal. Probably the most important single cause was the rapid spread and high incidence of the venereal disease called " Infectious Sterility of Cattle " — commonly referred to as " epivag ".

This disease was diagnosed in the Transvaal in April, 1949, and from many accounts it would appear that it had been present for some years. Its crippling effects and its rapid extension, due to the large scale movements of milk cows in and out of the dairy herds, had given cause for alarm. There was a hue and cry over the stability of the future supply of milk to the ever increasing urban population of the Witwatersrand. Many dairymen were in reality face to face with the grim prospects of an ever-dwindling milk gallonage.

Dairy farmers were confronted with four alternatives:—

(I) Continuing with their system of farming as they had done before and finding their source of income dwindling from say 300 gallons per day to 40 gallons or less, with consequent bankruptcy.

(II) Holding a dispersal sale of the herd and realising on a fast dwindling asset. The very large number of dispersal sales in the Transvaal over the past few wears is ample evidence that the dairymen concerned surrendered to the forces militating against their success, rather than attempt to conquer them by scientific means. These many dispersal sales disseminated the disease " Infectious Sterility of Cattle " at an ever increasing rate and merely perpetuated a vicious circle.

(III) Introducing cheap young Africander or scrub bulls into their herds in order to settle those cows which were in a condition to conceive. The resultant loss of the bulls within a period of several months due to a permanent sterility involved small financial loss.

Many dairymen were not in the least hesitant in resorting to this haphazard and shortsighted method of getting their cows in calf.

The question of raising the female scrub and crossbred calves did not arise, since the rearing of even good grade calves was an enterprise fraught with the danger of financial loss. Many thousands of female calves were, and still are, slaughtered at the abattoirs.

It is an unfortunate fact that the greater proportion of dairymen in the Transvaal resorted to this means of remaining in the dairy business, to the ultimate greater detriment of themselves and the dairy industry.

(IV) Practising artificial insemination of their fertile dairycows and

(a) maintaining their milk gallonage by regular calvings;

(b) reducing the number of their cows going sterile as a result of the effects of infectious forms of sterility, e.g. Infectious Sterility of Cattle, Trichomoniasis and Vibrio foetus Infection;

(c) eliminating the replacement cost of good grade bulls going sterile as result of infectious sterility.

A group of progressive dairy farmers formed the Transvaal Artificial Insemination Co-operative Ltd., which was registered in September, 1949, and had its head office and bull station in Johannesburg.

Insemination services were made available to members in May, 1950, and continued off and on until August, 1950, when the assistance of the Department of Agriculture was sought in order to keep the venture going. The imminent danger was not so much the failure of this newborn enterprise as such, but that this very modern method of breeding would have received a blow, recovery from which would possibly have taken many years. The Department entrusted the task of saving, nursing and guiding the growth of this new venture to the Division of Veterinary Services.

There was a crying need for an A.I. service and it had a most important role to fulfil in —

(i) the prevention of spread of venereal diseases;

(ii) providing quality female calves for future herd replacements;

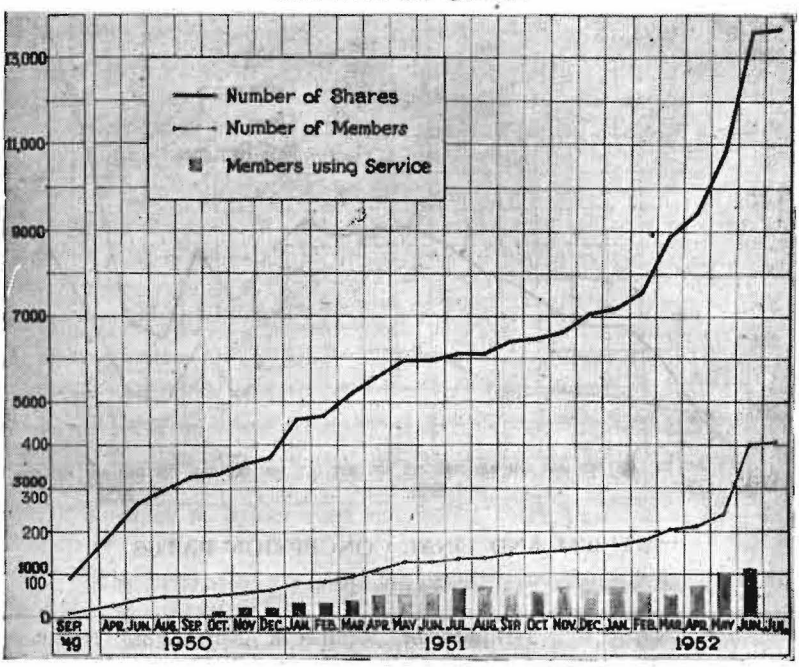
(iii) arresting the decline in milk supplies;

(iv) saving the majority of dairy farmers and the dairy industry from ruin and the population of the Reef from a milk shortage.

The growth of the Transvaal A.I. Co-op and the measure of support which it received from the dairy farmers in the Transvaal can readily be appreciated by reference to Table I and Graphs I, II and IV.

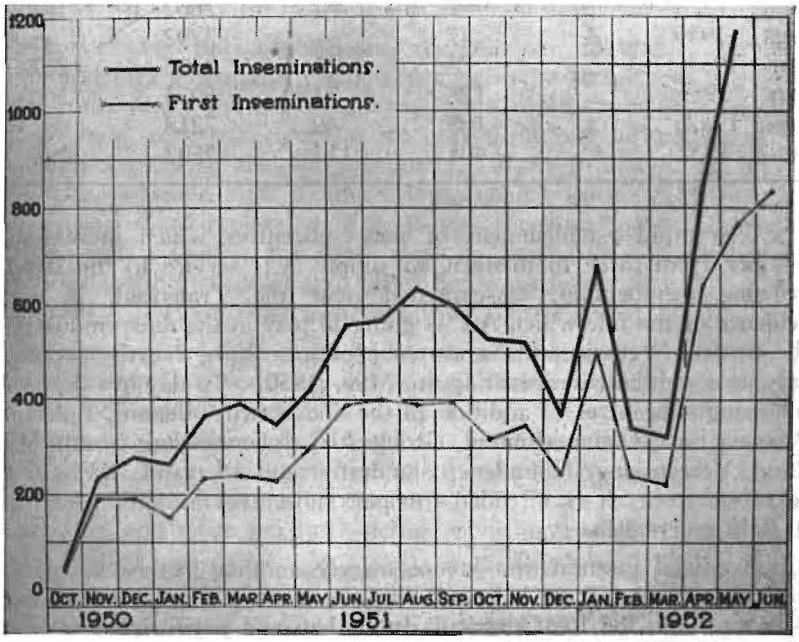
Graph I

GROWTH OF CO-OP.



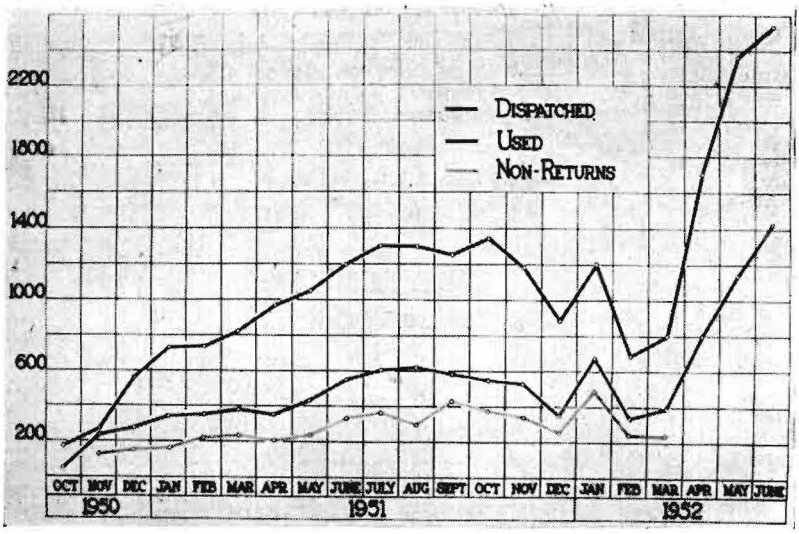
CORRELATION BETWEEN TOTAL AND FIRST INSEMINATIONS

Graph II



INTERIM AND FINAL CONCEPTION RATES

Graph III



INTERIM AND FINAL CONCEPTION RATES

TABLE I

Date	Number of members in Co-op.	Number of members using service	Number of shares subscribed	Number of Insemina-tions
Sept., 1949	10	—	900	—
June, 1950	41	—	2662	165
Sept., 1950	47	—	3292	—
Jan., 1951	78	31	4593	267
June, 1951	128	51	5973	560
Jan., 1952	168	69	7218	681
June, 1952	401	113	13592	1428

The rapid establishment of new subcentres which increased in number from three to thirteen, to supply A.I. service to the steadily growing membership, disseminated over the Transvaal, is ample evidence of the role which A.I. is going to play in the dairy industry in the future. Pretoria and Sandown (Johannesburg North) were the only two subcentres operating in May, 1950. To-day we have the following subcentres in addition to the above two: Benoni, Boksburg, Pretoria East, Olifantsfontein, Groblersdal, Johannesburg South, West Rand, Vereeniging, Holmdene, Standerton and Platrand. Within the next two weeks it is intended to open subcentres at Klerksdorp and at Balfour-Heidelberg.

Artificial insemination is not merely another method of getting cows into milk. It is believed that there are many so-called dairy farmers — on the Reef particularly (urban and peri-urban areas) — who would sacrifice, not only a sound long-term breeding policy in

their herds, but also the many advantages to be gained by practising A.I., if they could get their cows to lactate without being served, calved down, etc.

It was thought at first that the introduction of A.I. into the Transvaal would be of the greatest benefit to the urban and peri-urban producers of milk. It was in these areas, often with communal grazing and all the "privileges" of communal bulls, that A.I. was a dire necessity to control the sterility producing diseases.

It has however been found that more lasting support was obtained in the more rural milk-producing areas and probably for the following reasons:—

(1) There was an entirely different type of farmer with a more progressive outlook, amenable to advice and prepared to accept and introduce improved methods into his farming system.

(2) The economics of milk and feed production have a vital influence on the profitableness of rearing female dairy calves for replacements in the milk herd. Cheaper land and cheaper labour result in cheaper milk and feed and hence more economical raising of calves in rural areas.

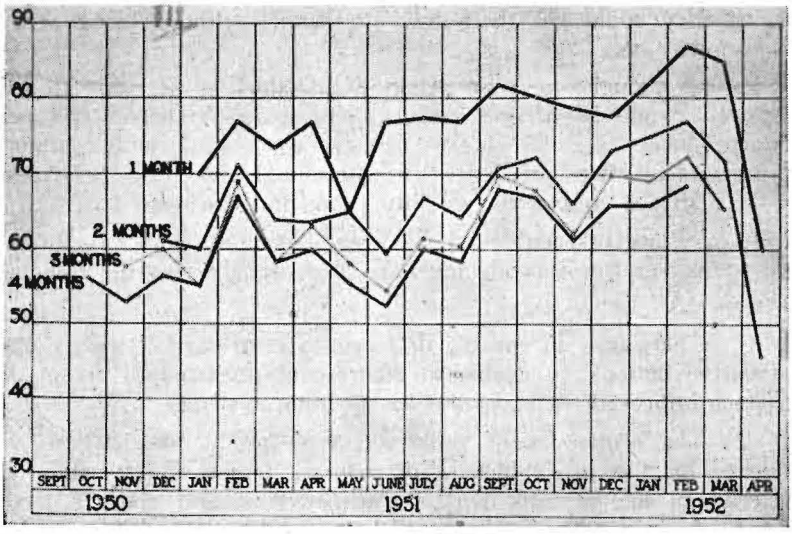
(3) The system of buying freshly calved cows and reselling them if not heavy in calf at the end of lactation, does not obtain to any extent in the rural areas. The conscientious and progressive dairy farmer is vitally concerned with the regularity of breeding of all his cows and also with the quality of the calves born. These two factors probably outweigh the importance of disease in retaining the continued support of the farmer for artificial insemination of his cows.

If we were to stimulate and increase the rearing of healthy, economical and potentially high producing dairy females in the rural areas, from where the urban milkproducers could draw their floating requirements and replacements, we would indeed be rendering an important service to the dairy industry. By this system the urban milkproducer would find it uneconomical and wasteful to breed and rear his own herd replacements or to buy them on "dispersal" sales on the Reef. This is the most common means of introduction of infectious sterility diseases into clean herds, as many members of the Transvaal A.I. Co-op. can testify to their sorrow.

Since control of the health and the establishment of freedom from disease of animals offered for sale at public auctions is impracticable, it can only be kept out of clean herds by making dairy farmers aware of the dangers of indiscriminate buying. Facilities should be provided for them to obtain or breed healthy cows, capable of regular reproduction and high milk and butterfat yield. There is no other more satisfactory and more practical method of achieving this than by A.I.

It will readily be appreciated that many dairy farmers who were having difficulty in getting their cows into calf and who were not prepared to sacrifice their breeding policy, or their entire dairying enterprise, joined the Transvaal A.I. Co-op. in the fervent hope that

Graph IV



SEMEN DESPATCHED USED AND NON-RETURNS

their troubles would be solved. Many cows were sterile and could not be settled by natural service, even with fertile bulls, yet, in many instances, it was expected to have them settled by artificial insemination. Many farmers in fact, retained the use of bulls for their fertile cows, while only those which proved to be sterile were presented for artificial insemination.

Notwithstanding the fact that many hopelessly sterile cows were presented for A.I. in this manner, the overall conception rates obtained compare very favourably with that of any other country. See Graph III.

It was suggested at one stage that any new member to the Co-op. should have those cows which they intended to present for A.I. examined and indelibly marked beforehand by a veterinarian in order to eliminate the sterile cows. Had this policy been adopted our conception rates would have been pushed up appreciably, but its practical application was found to be impossible.

In its stead members were advised to have a veterinary examination made of those cows which failed to " hold " after three inseminations. The number of " culls " in some herds was found to be alarmingly high. In addition, all members were sent monthly pregnancy lists of cows in their herds which had been inseminated four months previously, and had not shown oestrus since. They were asked to have veterinary pregnancy examinations made and to advise the Co-op. of the results of such examinations.

Many dairymen have made use of veterinary assistance in checking for pregnancy and to have cows treated that were found to be non-pregnant. Within a maximum period of four months after her last insemination a farmer would know whether a cow was in calf or not.

Summaries made of pregnancy lists returned to the Co-op. and completed by the farmers have shown that only approximately 70% of listed cows were actually in calf. 15% were not in calf and were suffering from functional sterility and no abnormality of the genitalia and/or reproductive organs could be established. 5% returned to oestrus after three full months had elapsed after the last insemination. Early foetal death and resorption of the foetus, early abortions, and the possibility of in-calf cows showing oestrus, may account for this figure. Approximately 5% of cows were sterile and recommendations were made for their elimination from the herd.

In the earlier stages of the Transvaal A.I. Co-op. very few of these pregnancy lists were completed and returned to us, whereas to-day a far greater percentage of members are having monthly veterinary examinations of their herds and are returning the pregnancy lists to us duly completed. The veterinarian has a most important but largely unrecognised role to fulfil in improving the breeding efficiency of milk producing herds.

Artificial insemination with all the relevant data concerning the cows affords an ideal opportunity for sterility investigations. These two services are complementary and this fact has been quickly recognised by both the farmers and the veterinarians. Our experience with the Transvaal A.I. Co-op. during the past two years has shown that this concerted attack on infectious and other forms of sterility has achieved far better results than any other attempt yet made in that direction.

The breeding efficiency in the herds of members of the Transvaal A.I. Co-op. has been improved considerably and this has been done:

(a) by eliminating the non-breeders and increasing the percentage of cows in the herd that calve down annually, and

(b) by improving the conception rates.

In considering some of the factors which influence the conception rates in the dairy herds practising A.I., it should be pointed out that unless the conception rates in A.I. herds were as good as they are in herds using natural service, this system of breeding would not be entertained by dairymen. Hence, our constant efforts are being concentrated on improving and increasing the conception rates so that we may gain the confidence of the unconverted and unenlightened, and retain the support and patronage of the members of the Co-op. and of the dairy industry generally. There is no doubt that A.I. is associated with an enlightened age and progressive spirit and it is completely incompatible with conservatism.

The more important factors which may be involved in effecting an improvement in the conception rates, are:

(1) Elimination of diseases affecting the reproductive organs or the unborn foetus. Prudent use of preventive measures such as vaccines, e.g. for Brucella infection, and the practice of sound sex hygiene in combating conditions which militate against regular breeding, are indicated.

(2) Fighting the incidence of functional sterility by means of judicious management. An advanced level of husbandry is essential with more highly bred stock. Prudent use of concentrates and balanced all round nutrition is a sine qua non. It has been established that by feeding a regular ration of greens throughout the winter months, cows could be brought into oestrus more qucikly.

(3) The time of insemination in relation to ovulation. In natural service a sufficient quantity of concentrated sperm is deposited in the vagina by the bull to ensure a constant supply of viable sperm for the next 48 hours to fertilize the ovum. In A.I. the number of sperms has been greatly reduced by virtue of the fact that the original ejaculate has been diluted twenty to fifty times and approximately only a hundredth or less of this volume is inseminated. Unless the cow is inseminated within ± 18 hours prior to ovulation, the chances of fertilization are reduced. In practice this means that cows must be inseminated late in the heat period or even after the cow has gone off heat, since ovulation occurs 8-14 hours after the cow goes off heat, or twenty to thirty hours after coming into oestrus.

(4) Length of time after calving before rebreeding. In many instances cows are re-bred within one month of calving. It has been found that in order to ensure maximum fertility, insemination should be performed 2-4 months after the previous calving.

It has also been found that if cows are allowed to run for six months or more before being re-bred difficulty is encountered in getting them to settle.

(5) Condition of the semen at the time of insemination. Since this is the only factor other than the insemination itself which is not under the control of the dairy farmer, it is our bounden duty to the dairyman to provide semen which has maximal fertilizing powers. This involves the careful examination of the ejaculate before dilution and the application of various tests in order to ensure that a high standard of quality is maintained. Recently the addition of antibiotics to the diluted semen has become standard practice and increases the conception rate appreciably.

Since the other factors influencing the conception rates are under the control of the dairy farmer, we must seek to enlighten and advise him in order that he may apply himself and his efforts along the right lines. No single person or agency could claim all credit for inseminations giving a high conception rate and a high standard of breeding efficiency in a herd. This is the result of teamwork — co-ordination and co-operation among the dairy farmer, the inseminator, the veterinarian in charge of the health of the herd, the technical direction of the insemination centre and the administrative machinery providing the A.I. services. In the harmonious collaboration of all these persons lies the best prospects for the future and prosperity of the dairy industry.

Apart from the great advantage of A.I. in any venereal disease control scheme it's potential value in the improvement of the quality

of dairy cows has been speedily recognised by dairy farmers. As a consequence there is a very high demand for heifer calves born from A.I. bulls and at birth they realise four or five pounds more than the daughters of the average herd grade bull. Many dairymen who never before reared heifer calves now consider it worth their while to do so, notwithstanding the high costs involved.

In judging or estimating the quality of dairy animals, the production figures of females for either —

(a) progeny of high market value and/or

(b) high milk yields,

are necessary ones upon which to base an estimate. It is appalling to see how few records of production and/or breeding have been kept by dairy farmers in the past. An astounding change has however been brought about by the A.I. movement within a very short space of time.

Formerly cows were introduced into dairy herds fresh in milk and were disposed of again several months later, unless they were heavy in calf. Many of the cows might never even have acquired a name or a number or been entered in any registers of the dairyman during their sojourn on his farm. A grade, or often a scrub bull would run with the herd and serve those cows which came into oestrus as best he could. Often he would be expected to settle 50 to 80 or even more cows.

Should it appear from inspection of the herd that many cows were failing to conceive the farmer might replace the bull by another and trust to providence that he was fertile. In many instances, providing the bull served zealously and vigorously he might be retained in the herd notwithstanding the fact that he might be completely sterile. In six to nine months time it would become obvious to the farmer that few if any of his cows were in calf. By then, many of the cows would be producing only small and unprofitable quantities of milk and they would then be sold on sales, and others, fresh in milk, would have to be brought in in order to maintain the farmer's quota of milk.

Let us consider the position when a dairy farmer such as the above resorts to breeding his cows by artificial insemination.

(I) As each cow is inseminated, she is eartagged by the inseminator with a distinctive serial number and the owner is provided with a certificate giving details regarding the insemination — cow's number, previous inseminations (if any) with dates and semen used, etc. Should the cow return to oestrus, a repeat insemination certificate is left with the farmer in respect of that insemination. Should the cow repeat more than twice, a further fee becomes due. It follows thus, that the farmer begins to take a live interest in the repeat inseminations and hence is involuntarily being taught to appreciate the value of records.

Very few dairymen have been met with who have been candid enough to admit that the conception rates obtained by the A.I. service

have been higher than those he obtained when using natural service. The fact of the matter is that records of services and repeat services were not kept previously and claims that 90% of cows in the herd settled to first services are not uncommon, but these claims cannot be substantiated by reliable records.

By the introduction of the keeping of records — instigated by the inseminator — and by the infrequent at first, but later frequent scrutiny thereof, the dairyman improves his breeding efficiency;

(a) by prompt culling and elimination of sterile cows and

(b) by obtaining the services of a veterinarian to diagnose and treat breeding irregularities in his cows.

The nett result is that cows which are drying off or dry, are not retained in the herd for extended periods before re-calving and hence there is a saving of costs of feeding and keeping.

In addition the keeping of records inculcates in the farmer —

(a) an interest in the breeding and records of the bulls used for the insemination of his cows;

(b) the pride of breeding better calves capable of producing more milk than their dams;*

(c) pride in the ownership of better, healthier and higher producing cows;

(d) an appreciation of the value of milk recording and the desire for its introduction in his herd;

(e) the desire to improve and advance and build up all the time.

(II) Detailed records of all cows inseminated are kept at the A.I. centre and the farmer has the advantage that trained technicians scrutinise these records regularly and the member obtains any advice relevant to his particular case.

Monthly figures are compiled showing (a) conception rates of the various bulls, (b) the different inseminators and (c) the individual herds. Any doubtful or unsatisfactory features are further examined.

A constant check is being kept on the breeding efficiency of the bulls and also of the members' herds, and such vigilance seems to be repaid by an increased interest shown by the dairyman. The monthly pregnancy lists which are sent to him by the A.I. centre remind him of the latest position with regard to possible pregnancies in his herd, and these constant and regular " reminders " can but have a beneficial influence on the dairyman and the milk industry indirectly.

Members are also kept up to date with the affairs of the Co-op. by means of a monthly newsletter, which reflects the number of inseminations performed the preceding month at all the sub-centres, the conception rates of all the bulls and subcentres, details regarding new bulls purchased and advice and technical guidance in the everyday problems of a dairy farmer.

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* This would provide him with a source from which to select his own herd replacements, thereby avoiding introductions.

Another very important effect the introduction of A.I. has had on the dairy industry is the marked reduction in the number of bulls required to settle the cows of farmers using the service. Only ten bulls are now being used to inseminate 15,000 cows per annum, thereby replacing approximately 400 bulls. If each bull were replaced by an average cow, the 400 cows would give an additional 200,000 gallons of milk per annum, which at 2/6 per gallon equals £25,000.

On an average bulls doing natural service are replaced every 3-3½ years. Actually replacements are far more frequent than this due to the high incidence of sterility diseases ! 150 bulls per annum at £100 each would cost £15,000.

The demand for Friesland bulls at the recent sales at the Rand Easter Show was very small and the prices offered for bulls low. Up to just recently only Frieslands were concerned, now Jerseys are as well. It is my submission that the demand for Friesland bull replacements has been reduced to the extent indicated above, by the introduction of A.I. services.

Let us assume that 40% of all calves born are heifers. Heifers obtained by A.I. are on an average worth £4 more per head. This would mean a saving af £24,000 and all their factors together give us a total saving of £64,000.

Let us deduct the 15,000 insemination fees of 30/- amounting to £22,500. This leaves us with an amount of £41,500 which is the nett annual gain for the 430 members of the Transvaal A.I. Co-op.

I have attempted to indicate only some of the more direct gains and would add some of the more important indirect ones:—

(i) Greater milk production of cows reared from A.I. bulls. It has been established in economic studies on fresh milk production that feed costs increase with higher milk production, but not nearly as rapidly as the value of the milk above the feed cost.

It has been estimated that 1 lb. butterfat increase per cow production in New Zealand at present prices, would mean a nett return to the Dairy Industry of over £200,000. Thus if stock could be improved to yield an increased butterfat average of only 16 lb. each the extra annual return would be £3,250,000.

(ii) The prevention of the spread of venereal diseases. By having cows in a fit and healthy condition to breed there is a saving of valuable time in getting them into calf.

In many herds the percentage of infected and sterile cows has been as high as 15, but if we consider the overall average, as obtained from the pregnancy lists returned by members, as only 5%, these cows could have been prevented from going sterile. Interpreted in terms of money this could give the following result:— 5% of 15,000= 750 at £50 = £37,500 less carcass value at £20 each = £15,000, a further saving of £22,000 per annum.

Before concluding these observations on the advantages of the application and the effects of artificial insemination, it would be

opportune to dwell for a few moments on the future possibilities, the potential improvements and advances which may be made in the dairy industry through a body such as the Transvaal A.I. Co-op.

(a) The provision of facilities for the buying up of heifer calves bred by members using A.I. services, and for the rearing of such calves. The calves could be inoculated against the various diseases including contagious abortion and heartwater. The heifers could be inseminated and be disposed of back to the members when on the point of calving or just after calving.

Many members of the Co-op. have made enquiries about purchasing heifer calves from the A.I. bulls out of high producing cows but all have had to be told that there is no supply to be had and that there is in fact a great demand for such heifers. Notwithstanding this fact, it is felt that members in peri-urban and urban areas should be encouraged to sell their calves to the Co-op., which agency would be responsible for and capable of rearing them at central depots and farms more economically.

(b) The establishment of a milk recording scheme amongst the members of the Co-op. is envisaged.

Indeed, as has been the case in England, such a scheme is complementary to A.I. and one cannot visualise the maximal advantages of A.I. being reaped if milk recording is not practised.

The question of progeny testing of the A.I. bulls, which is a most important aspect of the application of A.I., is one which cannot receive its due attention unless milk recording is done.

(c) The provision of a veterinary service for members. The fact that the place of the veterinarian in an A.I. service cannot successfully be taken by any other technician, and that the services of the veterinarian are in regular and constant demand is undisputed.

The appointment of one or more veterinarians by the Co-op., for the purpose of doing regular pregnancy examinations for members, and assisting in the diagnosis and treatment of breeding disorders is a matter which is foreseen in the not too distant future. It is a policy which could assist materially in keeping the cost structure of milk production down.

(d) Stimulate research work into the various aspects of infertility. The observations and findings of veterinarians doing regular clinical and other examinations of members' cows which breed irregularly or not at all, together with the valuable data kept by the Co-op. at its main centre, could be utilized to throw light on the many problems of infertility with which we are faced.

Research on certain aspects such as semen preservation and dissemination, which will aim at improving the conception rates for more cows over yet larger areas, should be an integral part of any A.I. organisation.

The rapid expansion of the activities and spheres of operation of the Co-op. require all the attention of the personnel of the staff at

present, so that the institution of several of these services has had to remain in obeyance for the time being. Yet it is considered that with the organisation that is being planned at present, the Co-op. will in the near future be able to inaugurate these one by one. It will thus be better equipped to serve the dairy industry and the community as a whole — to better advantage.

It is our considered opinion that this method of breeding and the influence which it has on the dairy industry, is the most potent factor so far introduced to improve the efficiency of production, and its impact on the dairy industry will be far reaching.

OBITUARY.

JAMES WALKER (1868-1952)

It is with regret that we have to record the death in Durban on October 5 of Dr. James Walker at the advanced age of 84. Dr. Walker, affectionately known to his colleagues as "Hooky," was born near Melbourne, Australia, on August 28, 1868. He took his M.R.C.V.S. diploma in Great Britain in 1896 and subsequently was in military service in South Africa until 1903 when he joined the veterinary department of the Transvaal and was stationed at Ermelo. He was appointed Assistant Government Bacteriologist at Daspoort in 1907 under Dr. Theiler as he then was, and later went to Onderstepoort where he remained until 1917. From June 1, 1918, he was Veterinary Pathologist at Kabete Laboratory, Kenya, until 1922 when he was appointed Chief Veterinary Research Officer. In 1932 he became Acting Deputy Director (Animal Industry) in Kenya and was honoured for his services by being made an O.B.E.

Dr. Walker returned to South Africa in 1933 and was temporarily occupied with research work on foot and mouth disease in Bechuanaland. Later he started a practice in Johannesburg with which he continued up to the time of his death. The writer was placed under him at Onderstepoort when he arrived there in 1913 and looks back with pleasure on a friendship with him lasting almost 40 years.

To his widow and children we extend our deepest sympathy in their sad bereavement.

E.M.R.

Jl. S.A.V.M.A. 23(4), 1952.

THE NEW ZEALAND CLUB VETERINARY SYSTEM

J. L. STEWART

Before going into the details of this system, it will be as well to give a brief description of veterinary matters in that country, with special reference to the livestock disease question.

New Zealand has few livestock diseases and no really severe epizootic disease. This is because New Zealand has no indigenous mammals of its own. All of these have been imported, even the common mouse and rat. Many imported mammals such as the rabbit, red deer and opossum, have become pests and the former two are responsible for considerable erosion. The pig was introduced from the South Sea Islands by Capt. Cook for food for his sailors, and it too has become a nuisance as it has reverted to the wild form. New Zealand is a long way from any large land area, Australia excepted, and that and good luck are responsible for the absence of many of the common stock diseases, while in later days much care has been taken to supervise the import of livestock of all kinds.

One of the few epizootic diseases which gained entry was sheep scab, and that was eradicated by farmers and lay livestock inspectors, owing to the fact that there was only a mere handful of veterinary surgeons in the country at the time.

Hence, while the New Zealand farmer has been very fortunate as regards the absence of epizootic diseases the veterinary profession has perhaps not been quite so fortunate. The absence of animal epizootics has tended to keep the veterinary surgeon in the background and the New Zealand farming community has not become veterinary minded, even nowadays. It is fantastic that a country, which produces more livestock to its area than any other, and which is the biggest exporter of meat and meat products to the United Kingdom, has no veterinary school. However, the Minister of Agriculture has recently signified his approval of the creation of such an institution and it has been rather surprising that there has been considerable opposition to a veterinary school by members of the profession, mainly Australian graduates, on the grounds that the country is too small, and cannot afford it. By the last mail, I received information that the Farmers' Federation of Manawatu, one of the biggest livestock producing districts, had stated publicly that it considered a veterinary school was unnecessary as Australia is so close by air. My own opinion is that New Zealand cannot afford to be without a veterinary school, especially as the Sydney one is grossly over-crowded. The fact that such colonies as Nigeria and Kenya have their own veterinary schools should bring home to New Zealanders their own grave omission to provide facilities

for the training of skilled professional men to tend the principal product of the country, its livestock. The present position is that while many New Zealanders would like to enter our profession, and they are very suitable people to do so, the opportunities are small. As there is no proper Veterinary Surgeons Act, many of these keen livestock men become quacks, who abound in the country, and who are nearly all native born New Zealanders, while the qualified men are mainly immigrants.

The standing of the profession in New Zealand, is thus on a lower plane than it is in this country. My own experience in South Africa is that if one meets strangers, and they find that you are a veterinary surgeon, their obvious impression is that you belong to a fine profession. They address you automatically as doctor and you go up in their estimation, but alas, in New Zealand, when meeting strangers and your profession is disclosed, your prestige seems to go down. In some cases, I was even asked " is that all you are, we thought you were something a bit better ". This unfortunate situation in New Zealand seems to be due to the absence of spectacular animal diseases, which give our profession the opportunity to show how valuable it is, to the lack of a veterinary school and hence the idea forms that the veterinary profession is not a skilled one, and to the absence of such an institution as Onderstepoort which is in such close touch with the farming community. Wallaceville laboratory in New Zealand does good work but does not seem to be in touch with the public. The average New Zealander simply has no idea as to the difference between a qualified man and a quack. If anything, he favours the quack, I think because the latter is usually a New Zealander too. Most farmers tell you that X, naming a qualified man, is not a bad chap you know, too much theory, but Y, naming a completely unqualified quack, is a really practical man.

While the absence of epizootic diseases has been beneficial to the farmer, and unfavourable to the veterinary profession, it is possibly gratifying, that the New Zealand farmer has contrived to produce for himself quite a fine crop of new metabolic diseases, mainly due to the lush growth of the highly treated grasslands of the North Island, and it is possible that he may continue to produce more such diseases. Bloat, red-water, facial eczema and sleepy sickness have cause severe losses, and the remedy is controlled grazing. This has been worked out as much, if not more, by the grassland research experts as by our veterinary colleagues.

Until recently, the qualified veterinary surgeons in New Zealand, were the moderate number of Government men and a few private practitioners, so that when listening to my remarks, and particularly my criticisms of the Veterinary Club system, that fact must be borne in mind. It perhaps may tend to counter my aversion to what seems to me to be a system of state socialism.

I hope I have not been too long in coming to the real subject of my talk, but I think that it is essential that you should know the background, before the club system is discussed.

Owing to the paucity of veterinary surgeons, and the need for adequate veterinary services for the farmer's animals, although the farmer did not then, and does not even now appreciate sufficiently its necessity, the Labour Government of New Zealand decided to introduce legislation in 1946, to make provision for the subsidising of veterinary services. I understand that the scheme was originally suggested to the Government as one in which state assisted clubs should be initiated. When farmers became accustomed to qualified veterinary assistance, and realised how essential it was, that the club veterinarian as he is called should then go on his own and become a private practitioner. However the Labour Government apparently seized the opportunity to socialise one profession, and I have myself heard Labour supporters quote the socialisation of the veterinary profession as being a start in getting all professions under state control.

One half of the necessary funds are produced by the various contributory boards, Meat, Wool and Dairy, and one half by a subsidy paid out of moneys appropriated by Parliament for this purpose. A Veterinary Services Council of 13 members was established, of which 5 members are veterinary surgeons. There is no private practitioner on this board.

The club veterinarian is paid a salary up to £1,200 per annum. The club is administered by a committee of farmers, with a president and a secretary, and the veterinarian is a member. All fees are paid to the club secretary and credited to the club. In the event of dissension between the veterinarian and the committee, the matter is referred to the council, and the Chief Executive Officer, who is a qualified veterinary surgeon, and who holds this office as a full time one, may come to the scene and adjudicate. Very often the veterinarian seems to be moved to another club in consequence, and I was surprised to find how often veterinarians move from club to club, which is not a healthy state of affairs. If the veterinarian works hard and competently and makes more money for the club than the amount of his own salary, he does not receive the extra sum. This is credited to the club movement, and helps to subsidise the poorer clubs. The Government subsidy amounts to £400 per club per annum, £200 capital expenditure is granted by the Government for pharmacies, and a £600 loan, free of interest, is available for the construction or purchase of veterinarians' residences.

At it's inception, the club must have a minimum of 300 members, membership being based on a membership fee of a minimum of £1, and a maximum of £3, irrespective of the value of the property. A charge of 15/- is made by the club for the veterinarian's first visit, 10/- for the second visit, and 7/6d. for the third and subsequent visits, irrespective of mileage. These charges and membership fees may vary according to the district, but this is about the usual. The charges I quote were taken from a Southland newspaper, which was advertising on behalf of the Veterinary Services Council, the proposed creation of a new club in that province.

According to its original Labour sponsors, one of the main objects of the scheme, was to "provide a cheap veterinary service", to quote from the original document. This has certainly been achieved, but the New Zealand farmer, of all people, is well able to afford to pay the usual fees to a private practitioner. With the present world shortage of meat New Zealand is assured for many years to come of a certain and even competitive market for her meat and meat products. In the first annual report of the Veterinary Club movement, for the period ending 31st March, 1948, it was stated that "the clubs will be farmer controlled, and the veterinarians will be salaried officers", that it is "the intention of the council not to allow it's policy to prove detrimental to the expansion of the club movement throughout the Dominion". Private practitioners aver that this means that they are to be squeezed out. From my own observations, including the remarks of the Chief Executive Officer of the Club Movement, I think that this interpretation is certainly correct. Those who are at the head of the club movement, have little time for the private practitioner, and they include members of our own profession.

The club system is a valuable organisation for promoting veterinary assistance to farmers who are not accustomed to it, until they realise that veterinary service is a necessity and not just a luxury. The abolition of the club should then come and the veterinary surgeon should emerge as a private practitioner. However I find that it is ruled that the club system shall remain a state veterinary service, with the veterinary surgeon controlled by local committees, and finally under the jurisdiction of the Veterinary Services Council, particularly of the Chief Executive Officer. It would seem that this tends to give excessive power to this one official. Such a contretemps as a dispute as to why the veterinarian went to case A first, instead of to case B, is apt to come up at a local committee meeting. It is not easy for farmers, who are not club members, to get veterinary assistance. The veterinarian is not master in his own house as a private practitioner is, or the genuine 100% state veterinary officer even, but is a cog in the wheel of the state machine, with committees of farmers, officials and the Veterinary Services Council, with its minority of veterinary members, all having their say about him, his work and how it is performed.

It is curious to note, that there does not seem to have been any attempt by the profession to amend this socialistic plan since the change of Government, with the exception of protests by the handful of private practitioners. Nevertheless, there is dissatisfaction among the rank and file of the club veterinarians, evinced by the high percentage of resignations, by frequent moves from club to club, and by the number of club veterinarians who enquired from me as to the prospects in the British Colonial Service.

It is interesting to read in the 4th annual report, that of 1951, that when the council tried to arrange an exchange system between club veterinarians in New Zealand and veterinary surgeons in Britain, that the British Veterinary Association "regretted that it was unable

to assist in the implementation of the scheme, as no organisation similar to the club movement in New Zealand, existed in Britain."

The club system is recruited from Britain and other European countries, particularly Holland, from Australia, and from the New Zealand students, who go to Sydney Veterinary School. I note that of 52 New Zealand students at Sydney, no fewer than 45 are sponsored by the Veterinary Services Council. These men, on graduation, are at the disposal of the council. The scales are weighted against the private practitioner, as power rests in the hands of members of the profession, who appear to think that the state should control the profession, and not that the profession should be master of its own destiny. For example, in a talk with a veterinary member of the council, when I remarked that our first loyalty should be to our profession, I was told "Surely our first loyalty should be to the Government which gives us our employment". With this remark, I disagree profoundly. I think that private enterprise, and the skill that this carries, in service to the farmer, should be the true aim of the profession, and that the club system should be restored to its original idea, a temporary transition from nothing at all, to genuine private practice, with the veterinary surgeon his own master, but at the same time, the willing servant of the public, but not "farmer controlled."

My opinion of this scheme may be biassed, because I do not approve of socialised state veterinary services of this nature, apart from the usual Government services, dealing with notifiable disease, public health, and research. Hence due allowance must be made for my private views but at the same time, I have spent my working years in Government service so hope I am being fair to the practitioner. It seems to me that this scheme falls between two stools. Take the usual state veterinary service anywhere. The officers are employed whole time by the state, under their own director. Broad policy is dictated by the Minister of State, but invariably professional matters and departmental organisation, are the concern of the directing staff. The average Director of Veterinary Services is well able to maintain the prestige, standing and policy of his profession, and seldom fails to get the support of the Government, whether that be the Minister as here, or the Governor, as in the British African colonies, where I did my service. In the club system, the veterinarian is de facto, a state official but he deals directly with the farmer and his work is mainly the treatment of the individual animal. If any epizootic disease appears the matter is referred to the proper authority, the Government Veterinary Department. While the veterinarian himself is socialised, the farmers he deals with represent pure private enterprise. In ordinary private practice, if the veterinary surgeon does not give satisfactory service, then his practice fails. He deals directly with his clients and is responsible to them. In the club system, if the veterinarian is not a success, he has no difficulty in getting himself moved to another club, and I know instances of veterinarians, who have been in several clubs in as many years. It is difficult for a young veterinarian to assert himself against a committee of the local

bigwigs, who have been accustomed to getting their own way for years in their small rural circles. Very often, an efficient and keen young man becomes so disgruntled at continual complaints of a petty nature, that he soon demands from the Chief Executive Officer that he be moved. In one area, which has only one club, but which has several veterinarians stationed in various villages and small towns, no veterinarian has stayed more than a few months, since the scheme started.

Several club veterinarians have broken away and have started on their own and some of them have done very well indeed. On the other hand, there are cases of men leaving, going into private practice, and then returning to the club movement.

One of the main objects of the scheme at its inception, was to provide a cheap veterinary service for the farmer. That has been done, but I am positive that the system cannot compare in efficiency, with the private practice. The New Zealand farmer is well able to afford the usual fees and the distances to be travelled by practitioners, who are mainly in the North Island, are not too great. When the farmer pays the veterinary practitioner his full fee, instead of just part of it, I think he appreciates his services much more. It is surprising that, in the parts of the South Island, where distances are long, and roads bad, as is so often the case in South Africa, the farmers are dependent on a few genuine private practitioners. The club system has not yet spread into the less productive areas. The great majority of the club veterinarians are in the Waikato, Taranaki, Manawatu and similar intensively farmed parts of the North Island.

One of the most successful and efficient veterinary surgeons in the South Island, is an old college friend of my own. He came to New Zealand originally, with his fare and expenses paid for him by a local farmers' society. But he was his own master from the beginning, as far as organising his own work, dealing with the farmers, and the carrying on of his practice was concerned. He had hard times in the 30's, when New Zealand farming was in the doldrums, owing to the failure of overseas markets, but he kept going, and saw it through successfully till better times came. As he said to me — "All I have to do is to give the farmers efficient service. If there is anything wrong, then it is between them and myself. Thank goodness, I have no local committee controlling my activities, a local secretary running my finances, and a bunch of officials and other 'jacks in office' having their say about me too."

My final opinion on the club system of New Zealand, is that it would have been an excellent and practical scheme, had it been run as originally planned, as a transition scheme, with its final objective, the establishment of private practitioners throughout the country. I do not think that the scheme would have been necessary at all, had there been an established veterinary school in existence. Whereas it is expensive to secure veterinary surgeons from abroad, and it is difficult for them to become established in a new country without some such scheme, it would not have been any more difficult for young

New Zealanders to establish themselves as private practitioners in New Zealand, than it is for young Britishers to establish themselves in Britain, and less difficult than for South African veterinary surgeons to establish themselves in this country, with its numerous disadvantages such as prodigious distances, which are not a problem in New Zealand. I noted how many native born New Zealanders without any qualifications, had established themselves as unqualified practitioners, and were doing very well indeed. Hence it would have been all the easier for the qualified man to establish himself. For this club scheme to be made a permanency, seems to me to be unwise, not in the interest of the profession nor of it's members, taking the long view. The stimulus came originally from Labour ideology, which changed a temporary scheme to suit its own ideas of state control. Now, quite a number of people have very lucrative administrative positions connected with the scheme, members of the Veterinary Services Council appreciate the powers they hold and there is now quite a vested interest which may have no connection with nor liking for Labour ideology but supports the scheme for personal ends. That there is much dissatisfaction among the club veterinarians is quite definite, and, apart from what I heard from many of them, is shown by the large number of resignations, over fifty in number, in the short time the scheme has been running. Finally, I have no doubt whatever that the scheme compares most unfavourably as far as efficiency is concerned with genuine private practice and furthermore, that the prestige and standing of the profession is not enhanced by it.

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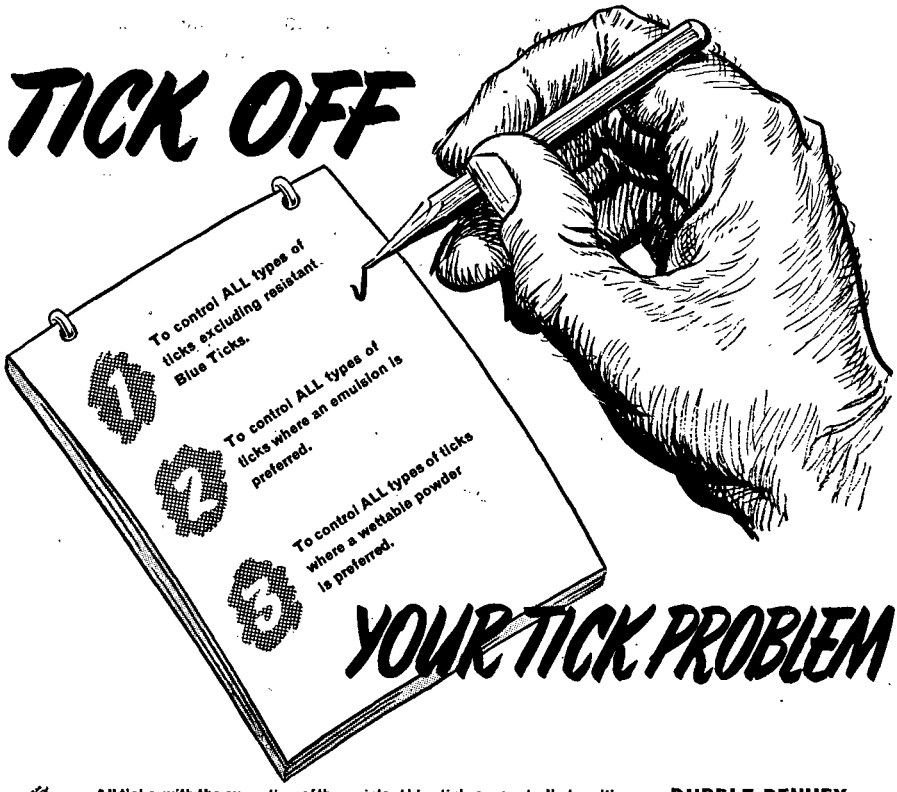

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THE PROPAGATION OF AFRICAN SWINE FEVER VIRUS IN THE EMBRYONATED HEN'S EGG

B. M. McINTOSH

Onderstepoort

Although swine fever was observed in Africa as early as 1900 (Henning, 1949) it was not until Montgomery (1921) published the results of his studies on the disease in Kenya that it became apparent that the classical European and American form might differ from the African one. The African disease proved to be more acute, was characterised by higher mortality and appeared to exhibit no reciprocal cross immunity with the other forms. This lack of antigenic relationship has been confirmed by several later workers (Walker, 1933, Geiger, 1937, Neitz and Burkhart, 1951). According to de Kock, Robinson and Keppel (1940) however, some slight relationship does exist.

Like the European and American viruses the African virus has a very narrow host range and early attempts to infect domestic and laboratory animals were unsuccessful. The only animals capable of being infected beside the domestic pig, were the warthog and the bushpig (Montgomery, 1921, Steyn, 1932, Walker, 1933, de Kock, Robinson and Keppel, 1940). Neitz and Alexander (personal communication) succeeded in maintaining the virus in rabbits for a limited number of serial passages. This work is as yet incomplete but in the rabbit only an inapparent infection is set up and the method of blind passage was used for maintenance.

In America hog cholera virus has been adapted to the rabbit (Baker, 1946, Kopkrowski, James and Cox, 1946). This virus, as well as the European virus, has been propagated in tissue culture using pig tissues (Hecke, 1932, Tenbroeck, 1941, Boynton, 1946).

Tenbroeck cultivated the hog cholera virus in pig testicular tissue placed on the chorio-allantoic membrane of developing chicken embryos. Although the virus was carried for 13 serial passages in this manner there was no evidence of adaptation to the chicken embryo. The eggs were incubated at 37°C. and transfers took place every 3 days.

In this article the propagation of African virus in the embryonated hen's egg is reported.

MATERIALS.

The strain of virus used in this work was the one used by Neitz and Alexander in their work in rabbits and it is referred to here as the "Spencer" strain. It was originally obtained from

an outbreak of swine fever in 1951 in the Heidelberg district of the Transvaal whence it had been introduced accidentally from South-West Africa.

The virus was passed by Neitz and Alexander through two alternating pig-rabbit passages followed by four consecutive transfers in the rabbit after which it was passed back to a pig which reacted on the 8th day after injection and was killed when in extremis on the 11th day. Spleen emulsion from this pig was used to infect eggs.

PROPAGATION IN THE DEVELOPING EGG.

The freshly harvested pig spleen was macerated with an equal volume of broth in a Waring blendor. The emulsion was lightly centrifuged and to the supernatant penicillin and streptomycin were added at a concentration of approximately 500 units/mgms respectively per ml. This was allowed to stand for one hour at room temperature before injection into the eggs.

Eight day embryonated eggs were injected with 0.2 mls. of this material by the yolk sac route. Re-incubation of the eggs was carried out at 33°C. On the 6th day after injection 6 embryos were found dead and on the following day 4. Embryos from both groups were harvested, pooled and after the addition of penicillin and streptomycin were injected into further eight day old eggs. In this manner as indicated in Table 1 the infection was carried through 12 generations. The material subinoculated at each passage was the undiluted fluid obtained from macerated dead embryos. After the 2nd generation the addition of antibiotics was discontinued.

TABLE 1.

EMBRYO MORTALITY DURING FIRST 12 PASSAGES

Passage	Embryos alive 3rd day after injection	Embryos dead on days after injection 4	5	6	7	8	9	Total dead
1	11			6*	4*			10
2	11	1	1		1	5*	3	11
3	9			1	3*†	4*†	1	9
4	7		1	1		2*	1	5
5	10	2	3*	3	1	1		10
6	11			7*†	2	2		11
7	13	1		10*	1	1		13
8	7			5*	2			7
9	9	1	1		7*			9
10	10		3*	2*	5			10
11	9			3*	5*		1	9
12	11		3*	7				10
Totals	118	5	12	45	31	15	6	114

* Indicates from which eggs embryos were harvested for passage.
† Indicates embryos injected into pigs.

From the table it will be seen that most embryos died on the 6th and 7th days after injection. In the later passages there was a tendency for the time of survival of the embryos to decrease by about one day.

Observations on a limited number of normal uninjected eight day eggs incubated at 33°C. in the same incubator showed that mortality in these eggs usually occurred from the 9th to 11th day. There were no survivors after the 11th day of incubation.

A pig was given 2 mls. subcutaneously of undiluted emulsion prepared from the 7th and 8th day dead embryos of the 3rd passage. This pig developed a febrile reaction on the 3rd day after injection and was destroyed in extremis on the 7th day. On post mortem examination typical lesions of swine fever were seen. The short incubation period probably indicated that there was multiplication of the virus in the egg and not mere survival of the original inoculum.

At the 6th egg passage undiluted material from embryos dead on the 6th day was injected into another pig. A febrile reaction commenced on the 3rd day after injection and this pig was slaughtered when in extremis on the 7th day. The lesions at post mortem were typical of swine fever. The possibility of contact or accidental infection of the pigs in these experiments can be excluded with certainty.

Before the first pig was destroyed blood was collected in citrate and with this blood, after the addition of penicillin and streptomycin, a group of 14 eggs was injected via the yolk sac. Reincubation was carried out at 33°C. Table 2 shows the mortality in this group of eggs.

TABLE 2.

MORTALITY IN EGGS INFECTED WITH INFECTIVE BLOOD.

4th day	5th	6th	7th	8th	9th
0/14*	2/12	3/9	2/7	3/4	4/0

* Embryos dead/embryos alive.

From the passage of dead embryo material into the yolk sac the injection was carried for 4 generations when passage was stopped. Although no attempt was made to indentify the virus in this series it is assumed from the similar mortality in the eggs that the virus had been re-isolated.

SUMMARY.

The propagation of African swine fever virus through 12 passages in embryonated hen's eggs is described.

Eight day old embryos were used and passage was carried out by injection of dead embryo material into the yolk sac. Re-incubation of the eggs was at 33° C.

The infection in eggs resulted in embryo mortality, usually on the 7th day after injection.

Typical virulent swine fever was produced in pigs with egg material of the 3rd and 6th passage.

The interest and advice of Dr. R. A. Alexander, Director of Veterinary Services, is gratefully acknowledged.

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A PRELIMINARY SURVEY OF THE ENDO- AND ECTOPARASITES OF THE IMPALA — AEPYCEROS MELAMPUS

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Lydenburg

The impala abounds in the South Eastern Transvaal and is the most common antelope in this area. Stevenson-Hamilton, late Warden of the Kruger National Park, describes the impala as follows: " The male impala has an average height of thirty-four inches at the withers. The horns are lyrate, having an approximate length of two feet around the curve. The female is slightly smaller and hornless. The general colour is a bright chestnut, paling to a delicate fawn along the sides, and becoming pure white below. The limbs are clean and slender, and the hind legs have attached to the lower back parts of the cannon bones very distinctive brushes of dark brown hairs, surrounding a gland containing an oily secretion. On either side of the tail, the underside of which is white, extends a narrow dark line."

During the past six years, mainly to aid in the control of the spread of infectious and contagious diseases, the Veterinary Division of the South African Government has maintained a Game Inspection Unit in the Eastern Transvaal. This unit operates in the districts of Barberton, Pilgrims Rest and Letaba. The unit consists of a Game Inspector under the supervision of a State Veterinarian.

While observations were being conducted in the Pilgrim's Rest district during the seasons of 1949 and 1950 it was noticed that impala were diseased and obviously dying in large numbers. No dead animals were available for examination, no doubt due to the activities of predatory animals and vultures. However, through the courtesy of the Warden of the Kruger National Park and the owners of the adjacent Sabie-Sand Game Reserve, a number of impala were shot for the purposes of investigation. This revealed both a pan-verminosis and a massive tick infestation.

Before describing the parasites found, a description of the symptoms as seen in live animals will not be amiss. Impala graze in flocks of various sizes. The numerical strength of a flock may vary from three to four to any number up to two thousand. In these flocks there were a number of apparently healthy and vigorous animals, others were listless and the rest either in poor condition or decidedly emaciated. The latter two groups more often than not showed a clearly visible oedematous swelling under the lower jaw. This mandibular oedema was most prominent in the lambs and yearling impala. Pregnant and nursing ewes suffered greatly and

losses were serious. A striking aspect of this infestation was the mortality observed in solitary grazing rams which were found to be heavily infested. This was regarded as remarkable as these rams hold themselves aloof from the main herds. They lead a solitary existence, rarely mixing with their compatriots and keeping to their own grazing grounds. It would appear that they became infested at the common watering pools. The above symptoms indicated that there was a striking similarity to what is seen in a flock of sheep similarly infested with endo- and ectoparasites.

Endoparasites were found in the lungs, liver, intestines and peritoneum. The peritoneum showed a single bladderworm. This cysticercus was about half an inch in diameter. In would appear to have been the cysticercoid stage of the tapeworm, *Taenia bubesi,* as described by Ortlepp.

The lungs, in all cases, were heavily infested with the lungworm *Pneumostrongylus calcaratus.* In South Africa this parasite has only been found previously in the impala in the Eastern Transvaal and Swaziland. *Pneumostrongylus calcaratus* is an extremely small, delicate parasite, blackish in colour and about a quarter of an inch in length. Infestation with this parasite sets up a catarrhal broncho-pneumonia of the lungs.

The liver showed the ubiquitous tapeworm — *Stilesia hepatica.* However, the most common parasite of the liver was the round worm, *Cooperia hepatica.* In all cases investigated a massive infestation of this parasite was present. It must be mentioned that this parasite is always present in the liver of impala in the Eastern Transvaal. *Cooperia hepatica* is a round worm, reddish in colour, about half an inch long and slightly thicker than the wireworm. The liver lesions set up by *C. hepatica* are a chronic cholangitis with adenomatous changes, a lymphocytic infiltration of Glisson's capsule and a focal proliferation of the bile ducts, showing increased fibrous tissue formation. In some instances aneurysms of the bile ducts were seen. These were filled with exudate, parasites and eggs.

The abomasum showed a massive infestation of *Haemonchus contortus,* the common wire worm, in all cases investigated. Other parasites of the abomasum were *Haemonchus bedfordi* and *Longistrongylus sabie.*

Moniezia expansa, the milk tape worm, was found in one instance in the small intestine. Trichostrongyloid parasites were found to be very numerous during the course of the investigations. Later on, i.e., during 1951 and 1952, when parasites were not rife, they were very much less in evidence. In some of the later cases examined none were found. The species present were *Cooperia hungi, Cooperiodes hamiltoni, Trichostrongylus colubriformis* and *Impalaia tuberculata.* An extremely interesting discovery was that of the common sheep hookworm — *Gaigeria pachyscelis.* This was the first time this parasite had been recorded in game in South Africa. It is interesting to record that it has not yet been recorded in sheep in these parts.

The common nodular worm — *Oesophagostomum columbianum* — was very prevalent in the large intestine. Infestation with *O. columbianum* was not associated with nodule formation in the intestines. Also present in large numbers was the whipworm, *Trichuris globulosa.*

With the exception of the two tapeworms, *Stilesia hepatica* and *Moniezia expansa,* all the parasites mentioned were present in very large numbers. There is no doubt that, concurrent with the extremely dry spells experienced during the 1949 and 1950 seasons, intestinal parasitism was responsible for heavy mortality in the impala.

The normal healthy and vigorous impala is rarely troubled by ectoparasites. In the emaciated or sick animal, however, a vastly different picture is seen. The chief ectoparasites were ticks and the predominant one was *Boophilus decoloratus.* In heavily infested animals *B. decoloratus* was found all over the body, e.g., ears, face, neck, body, genitalia and limbs. Next in order of predominance was the red tick, *Rhipicephalus evertsi.* It must be placed on record here that, contrary to what is seen in *R. evertsi* infestation in cattle, the red tick was found chiefly in the crural and genital regions. Very few *R. evertsi* specimens were found elsewhere on the body. Up to the present time *B. decoloratus* and *R. evertsi* have been the chief specimens of tick life found on most of the impala examined. On some of the impala examined within the confines of the Kruger National Park small numbers of *Rhipicephalus simus, Rhipicephalus appendiculatus* and *Amblyomma hebraeum* were found. The absence of the latter two specimens on impala outside the environs of the Kruger National Park was remarkable as the impala outside the Park have common grazing ground with cattle harbouring both types of ticks whereas the Kruger National Park has been cattle free since 1939.

Another ectoparasite of the impala was the ked, *Echestypus paradoxus.* This is a fairly common ectoparasite of this antelope.

Acknowledgements are due to Dr. R. J. Ortlepp who assisted with the identification of most of the lesser known parasites; Dr. G. Theiler for confirmatory diagnosis of tick life and Dr. K. Schulz for making the histo-pathological diagnosis.

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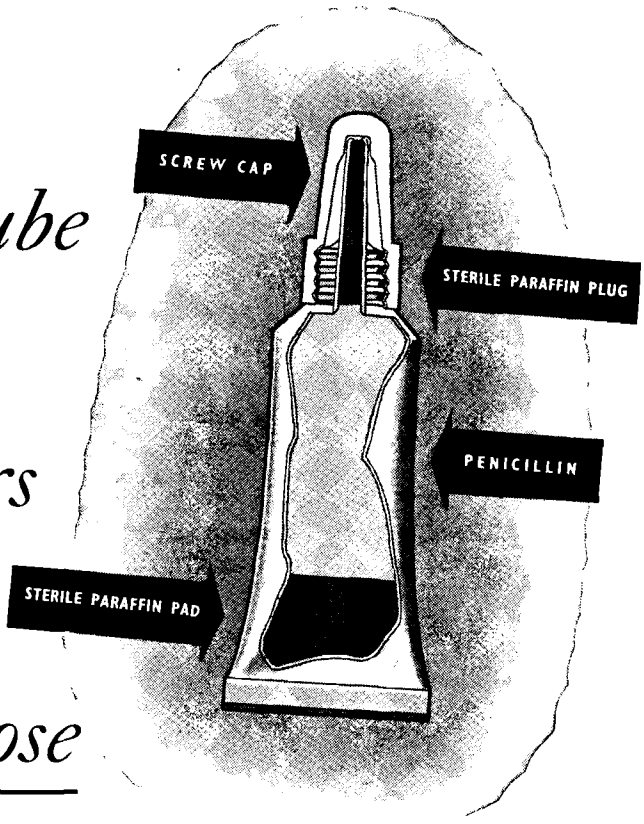

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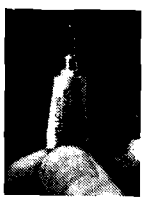

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THE USE OF THE MODERN SYNTHETIC INSECTICIDES IN BLOWFLY STRIKE OF SHEEP

O. G. H. FIEDLER and R. DU TOIT

Onderstepoort

The modern Merino sheep is to a marked degree subject to the attack of external parasites on account of the highly specialised and densely packed covering of wool over its whole body. Of these parasites, the sheep blowflies are by far the worst, as their maggots feed directly on the body substance of the living sheep, causing a condition known as cutaneous myiasis.

Wherever the wool producing industry has developed, sheep blowflies have become a serious menace. The reasons for this are not far to seek. The development of wool production itself is largely responsible for the damage caused by the flies. In the early days little fine wool was produced and a large proportion of the sheep kept in South Africa were low-grade Cape sheep, carrying very little actual wool. It is only in Merino sheep that this type of myiasis usually occurs. As far back as 1900, blowfly strikes were known in sheep but little notice was taken of the matter, and it was not until fairly recent years that the flies became a menace to sheep farming in many parts of the Union.

Due to continual selection within a comparatively short period Merino sheep have undergone marked changes. The wool has become finer and denser, and on a good Merino sheep today there is hardly a part that is not covered. The very characters deemed most desirable, such as long, fine wool covering the entire sheep, are most favourable for the development of cutaneous myiasis.

External parasites, like lice and keds, which are obligatory parasites, are comparatively easy to control. The blowflies, on the other hand, are not at all dependent on the sheep for their existence and, possessing prodigious powers of reproduction, their eradication is practically impossible and their control most difficult. Furthermore, adult blowflies play an important role in the pollination of certain plants like onions and stapelias and must be regarded as beneficial in this respect.

Since many years of experimental and practical work have clearly demonstrated the impossibility of exterminating blowflies

from sheep breeding countries, the only other alternative is to break the link between the woolled sheep and its aggressor.

The breeding of plain-bodied sheep seems to be the ultimate goal and the final solution to this problem. This would eliminate conditions like soiling of the wool and fleece-rot, which act as attractants for gravid blowfly females, but it is a slow process that gives no immediate answer in a critical emergency.

The so-called Mule's operation, whereby skin folds at both sides of the breech and a portion of wool-bearing skin on the tail stump are cut away in a simple procedure, represents the surgical approach to this problem. This operation, widely favoured in Australia, has been viewed unfavourably in South Africa, purely for ethical reasons. The mechanical removal of the seat of the trouble will obviously constitute protection satisfactory in normal years, but in the extremely wet year of 1950, the Mule's operation failed completely in Australia and the Australian sheep farmers were faced with the loss of thousands of animals, which demonstrated in a catastrophic but unmistakable fashion that this widely boosted operation by no means represents a panacea for this extremely intricate problem.

Until farmers are capable of breeding a type of Merino sheep that is immune to strike, it must be the aim of science to find a means of protecting the present-day type of sheep against the hazard of blowflies. For this purpose a substance is needed that can either repel gravid females or, alternatively, is able to destroy the first stage maggots before they commence feeding. Up to the present, however, there is no chemical agent known which repels blowflies for a period long enough to justify its application, and no substance was available up till the end of the last war possessing sufficiently residual larvicidal properties which did not cause damage to the wool fibre at the same time.

The discovery of the insecticidal properties of certain synthetic chlorinated hydrocarbons and other new compounds has opened up a new field of investigation into the blowfly problem. Tests were carried out at Onderstepoort in which sheep were sprayed with different formulations of these substances in such a way as to saturate the wool right down to the skin. The treated animals were then exposed to natural as well as artificial blowfly strikes.

D.D.T., the first to be tested, provided a high degree of protection, and it finally became clear that this or several of the ever-increasing number of new insecticides would provide a satisfactory and immediate solution to the pressing blowfly problem.

Other synthetic insecticides were subsequently tested and far better results than had been expected were obtained with B.H.C., which gave sheep immunity for considerably longer

periods than D.D.T. used at five or ten times the concentration. Chlordane, which possesses approximately the same insecticidal properties as D.D.T., and Toxaphene, known to be inferior in many ways, both surpassed D.D.T. in effectiveness by affording a longer period of protection in the fleece of living sheep. Under experimental conditions D.D.T. at 5% pp., for instance, gives protection for about three months, whereas B.H.C. at 0.5% gamma still protects after six months, provided that at the time of application the wool had a length of between 1 and 1½ inches. And yet D.D.T. was generally known to possess a considerably longer residual effect than B.H.C. when applied to exposed surfaces.

The differences in the behaviour of the two insecticides on the living sheep suggested that some factor in the wool of sheep, at the time still unknown, played an important part by either assisting the action of B.H.C. or retarding that of D.D.T.

It appeared that unlimited scope for research into the protective properties of the rapidly enlarging list of new insecticidal substances against blowfly strike existed. The guiding principle is to retain a high concentration of the larvicidal agent in the wool for as long as possible, especially in those parts which are normally attacked by the flies.

It was shown in preliminary experiments that the serous fluid exuding from the superficial wounds caused by larvae of the primary blowflies on the skin of sheep constitutes the principle food of these maggots. As the maggots of the primary flies tend to crawl about in the wet wool, it is obvious that the newly hatched larvae must remain in continuous contact with an insecticide, in order to achieve a complete kill, and for this reason the larvicidal agent must be evenly distributed in the wool to guarantee a lethal concentration at skin level.

In order to determine the minimum concentration of insecticide capable of destroying all first instar larvae when kept in constant contact with it, a series of in vitro tests were conducted, in which the insecticides were added to the nutritional medium and the following method was adopted :-

First stage larvae were placed in glass tubes, each containing a uniform sized pledget of cotton wool soaked in normal serum into which was suspended the insecticides in wettable powder form, over the range 1000 to 0.004 p.p.m. Approximately 100 freshly hatched maggots were put into each tube which was plugged with cotton wool and kept in an incubator at a constant temperature of 80°F. Observations were made at 1, 2, 6, 24, 48 and 72 hours, and the larvicidal effect recorded. It was not necessary to extend the observation beyond this limit, as the maggots become more resistant to insecticidal action with increasing age and, if not killed or injured within 72 hours, are no longer affected.

Eleven compounds were tested in this manner and showed marked differences in their effects. According to the minimum concentration required to achieve a complete kill, they can be divided into five groups :

(1) 0.25 p.p.m. — Parathion, E.P.N.-300.
(2) 1 p.p.m. — Dieldrin.
(3) 4 p.p.m. — Gamma B.H.C., D.D.T., Methoxychlor, Aldrin.
(4) 16 p.p.m. — Chlordane, D.F.D.T.
(5) 64 p.p.m. — Toxaphene, D.D.D.

According to their larvicidal properties, D.D.T. and gamma B.H.C., which now are most generally used for long-term protection of sheep, fall into the same category. Both are capable of killing first stage larvae at a concentration of 4 p.p.m. However, the results in many field trials have shown that B.H.C. consistently gave more durable protection than D.D.T.

As a next step a number of experiments was conducted to determine the fate of insecticides applied to the wool of living sheep with the ultimate aim of finding compounds capable of providing the greatest degree of protection. Only insecticides harmless to warm-blooded animals at the concentration applied were considered. The highly toxic organic phosphates (Parathion and E.P.N.-300) were excluded as their general use on livestock cannot be recommended.

Eight groups of Merino sheep were treated by thoroughly saturating the wool to skin level over a small area on the rump. Suspensions of the insecticide containing 0.5% of the active ingredient were used in each case. The fibre length of the wool varied from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches. Starting nine weeks after treatment, first instar larvae were implanted as artificial strikes weekly on to the treated areas. Death of the larvae on the third day after implantation served as the index of protection. Throughout the experiment the maggots implanted on an untreated sheep as a control succeeded in completing their larval development.

At the concentration used the compounds of the D.D.T. group (D.D.T., D.D.D. and Methoxychlor) afforded protection against strike for the shortest period of time, the average being about nine weeks. Next in sequence was Toxaphene with 13 weeks, followed by Chlordane with 19 weeks. Gamma B.H.C., Dieldrin and Aldrin, on the other hand, protected the sheep for extremely long periods, averaging 33, 37 and 39 weeks, respectively.

In order to confirm the results obtained by the implantation method and, at the same time, to ascertain the larvicidal properties of the wool staple at various intervals after treatment, samples of wool from the treated area were removed weekly for laboratory

tests from those sheep upon which artificial strikes had been made at the same time.

Under South African conditions wool grows at the fairly constant rate of about ¼ inch per month. At the time of commencement of testing, therefore, nine weeks after the application of insecticides, a new growth of at least ½ inch of wool could be expected below the treated portion of the staple. The important question now was: "Is the new growth wool still protected against strike?"

A new Bio-Assay method had to be evolved, in order to determine the larvicidal value of the insecticide remaining in the different zones of the wool staple.

For this purpose, wool samples were clipped from the treated area, care being taken to sever the fibres as close to the skin as possible. In the laboratory the samples were divided into two or more portions, depending on the time which had elapsed after the original treatment and the length of the staple.

The routine procedure was adopted in every case of measuring the half inches between cuts from skin level, so as to ensure that no portion of the wool zone originally treated would be included in any of the samples which would, therefore, consist of new growth only. Thus, a wool sample taken 18 weeks after treatment, was divided into three sections, the two half-inch portions, B and C, nearest to the skin, representing the new growth, while the third portion (A) on top consisted of the wool zone treated originally with the particular insecticide. This procedure ensured that any insecticide present in the severed sections of newly grown wool could only have been derived from that with which the original wool zone A had been saturated.

Each wool segment so divided from the staple was placed in a glass specimen tube and saturated with serum. Into each tube were then pipetted 50 to 100 first instar larvae and the tubes incubated at 80°F. for subsequent observation.

This new method actually represented the reverse of that previously used to determine the minimum lethal concentration, as the insecticide was now present in the wool instead of being suspended in the nutritional medium. The duration of survival of the larvae served as an index of the concentration of insecticide present in the different segments of the wool sample. A comparison of the time-mortality rates with those encountered in the previous test, when the minimum lethal dose was determined, provides an accurate means of estimating the insecticidal concentration in the particular portion of the fleece.

The new Bio-Assay method indicated clearly that sheep were no longer protected against strikes when the concentration of insecticide in the proximal portion of the new growth wool fell below the level capable of killing first stage larvae. In the

case of D.D.T., gamma B.H.C. and Aldrin this is 4 p.p.m. As soon as the larvae survive and develop normally in those tubes containing the half inch of new growth wool nearest the skin, strikes will develop simultaneously on the particular sheep when larvae are implanted on it.

The Bio-Assay method proved to be sufficiently sensitive to indicate even partial protection. So long as the half inch of wool nearest the skin contains sufficient insecticide to influence the normal growth of newly hatched maggots detrimentally, no strike will develop on sheep.

The insecticides under test, which were applied to sheep at the uniform strength of 0.5% of the active ingredients, may be divided into three groups, according to the duration of protection afforded :-

First group, up to ten weeks — D.D.T., D.D.D. and Methoxychlor;

second group, between ten and 20 weeks — Chlordane and Toxaphene;

and third group, over 30 weeks — gamma B.H.C., Dieldrin and Aldrin.

Furthermore, the newly developed Bio-Assay method has disclosed distinct differences in the behaviour of various insecticides in the fleece of living sheep and has also revealed the reason for their particular behaviour.

Compounds of group 1, i.e. D.D.T., D.D.D. and Methoxychlor, remain confined to the wool zone originally treated and show no tendency to diffuse into the new growth of wool. The result is that, as soon as insecticide-free growth of wool of about half inch in length has formed in about nine weeks after treatment, strikes can develop.

Compounds belonging to group 2, i.e. Chlordane and Toxaphene, on the other hand, and, to an even greater extent, those of group 3, i.e. gamma B.H.C., Dieldrin and Aldrin, demonstrate an entirely different behaviour in the wool. **These substances possess the newly discovered ability of diffusing along the wool fibres into the new growth of wool, namely, the zone which is constantly expanding at the rate of about one-quarter inch per month.** The diffusion power of the different compounds varies considerably. The value of this property may be expressed either in terms of the time necessary for the concentration near the growing end of the wool fibre to drop to 4 p.p.m. from the original 5000 p.p.m. of 0.5%, applied to the fleece, or by measuring the actual growth of new wool at this particular stage. The diffusion power of certain insecticides in terms of time and length of new growth wool until a concentration of 4 p.p.m. is reached at skin level is given in the following table.

Insecticide	*Time in weeks*	*Length of new wool in inches*
Toxaphene	14	0.8
Chlordane	22	1.2
Dieldrin	25	1.4
gamma-B.H.C.	27	1.6
Aldrin	32	1.8

Table 1. — Diffusion power of insecticides in wool based upon the concentration having reached 4 p.p.m. at skin level.

The greater the time required for an initial insecticidal concentration of 5000 p.p.m. to reach the level of 4 p.p.m. the greater is the length reached by the new wool beneath the treated zone. It follows, therefore, that the compound maintaining the highest concentration in the wool at skin level for the longest period would possess the greatest power of diffusion. Of the five compounds under discussion, Aldrin occupies first place in this respect, followed by gamma B.H.C., Dieldrin, Chlordane and finally Toxaphene.

The diffusion power alone does not determine the duration of protection, however. Dieldrin, for instance, diffuses more slowly than gamma B.H.C., yet affords longer protection against strikes for the reason that its toxic effect on larvae is greater and it produces a complete kill at 1 p.p.m.

The actual period of protection afforded by any larvicidal compound is dependent upon the combined effect of the two important properties, namely the diffusion power in wool and the larvicidal value. The greater these two factors are, the longer is the resulting period of protection.

Although a number of the synthetic insecticides have been used for the protection of sheep against blowfly strike in many countries of the world, no clear exposition of their specific mode of action seems to have appeared until this important factor was discovered.

D.D.T. and B.H.C., most commonly used in field trials, appear to have been equally favoured in the past but in the light of the evidence presented, the latter compound is vastly superior to the former.

It would appear advisable, therefore, to re-examine the new synthetic insecticides as a whole in terms of their behaviour in the wool, in order to determine their efficacy and economy. As far as our present knowledge goes, gamma B.H.C., Dieldrin and Aldrin are the larvicides of choice. Obviously, Chlordane may be included but the D.D.T. group and Toxaphene, which show little tendency to diffuse along the growing wool fibres, are inferior by comparison.

As a first step towards the solution of the blowfly problem an attempt has been made to evaluate and compare certain of the new synthetic insecticides. This is a line of research which it will also be necessary to pursue, in order to evaluate new insecticides which are brought to our knowledge.

Within limits it may be stated that the higher the concentration of active ingredients used, the longer the protection. As crutch strikes form over 90% of those normally encountered in the Union, prophylactic measures necessitate the treatment of only relatively limited areas of the body. This makes possible the economical application of high concentrations of insecticide which can be well tolerated by the sheep in view of the small area treated.

Evidence of the role played by the length of wool at the time of application indicates that this factor is of importance. This phase of the investigation, however, is being examined at the moment and the results so far show clearly that it is not advisable, from the point of view of economy, to treat freshly shorn sheep, as the amount of insecticide retained on the short wool fibres results in only a very short period of protection. The reason for this is very simple. The new insecticides readily dissolve in the wool grease; therefore the longer the wool, the more solvent material is present at the time of treatment and the greater will be the amount of insecticide that remains in the fleece.

Of equal importance to the selection of the most suitable insecticide is the way in which it is applied to the wool of sheep. The best method of application, or rather the most practical and economical way of applying the active principles to the wool, has yet to be discovered. It is customary in the Union to use the insecticides for this purpose in the form of wettable powders diluted with water to form suspensions. The milky suspension is thoroughly sprayed into the wool of sheep, by means of a high pressure pump, care being taken that the wool is saturated to skin level, and to ensure this it is desirable to open the staple with the fingers during the process of spraying. Altogether, it is a slow and time-consuming process, requiring about three minutes per sheep, and long-woolled sheep require a considerable quantity, which may be as high as three-quarter gallon, to thoroughly saturate them. This means that 8 to 9 pence worth of insecticide is used per animal in the case of B.H.C., and D.D.T. is even more expensive.

To improve this uneconomical method of application and, at the same time, to find a simple and speedy technique for large-scale treatment, trials are being carried out at the moment and have given most encouraging results to date. The preliminary tests at Onderstepoort seem to indicate that the use of insecticides in the form of a dust, which is forcibly blown

into the fleece by means of a current of air under high pressure, brings one nearer to the ideal mechanical method for dealing with the blowfly problem. This method reduces each treatment to about ten seconds, and the insecticide per sheep will amount to less than two pence per application.

An account of the present state of our knowledge of the use of insecticides against blowfly strike in sheep would not be complete, however, without a statement on the efficacy of some of these substances, and especially the gamma isomer of B.H.C., on fully grown blowfly maggots. B.H.C. as a wettable powder, at a concentration of 0.5% gamma, is strongly recommended as a dressing for strikes. It has many advantages over the widely used so-called blowfly sprays, which contain coal tar derivatives and cresol. A suspension of B.H.C. at the given strength is cheaper than any spray on the market. It kills slowly but surely, which is an advantage, as the maggots have time to drop off the sheep and do not rot in the wool. It does not stain the wool and does not interfere with the normal processes of healing and, last but not least, protects the wound and its surroundings against re-strike for a period of many months.

It was only a few years ago that the annual heavy losses suffered by the South African sheep farmer due to the depredations of the blowflies appeared to be inevitable and something which he was called upon to endure in spite of the various attempts aimed at reducing the incidence of these flies.

Investigation of the nature described here has thrown a new light upon the problem of determining the method by which the ever-increasing number of synthetic insecticides may be utilized to afford positive protection to sheep without interfering with the blowflies which actually fulfil many useful functions in our economic life.

THE USE OF ANTIBIOTICS IN ANIMAL NUTRITION

J. W. GROENEWALD

Onderstepoort

Since 1935 is has become evident to nutritionists that the incorporation of a small percentage of animal or marine protein in pig and poultry rations, results in an additional health and growth stimulus. It soon became evident that the added growth stimulus was due to something more than simply the superior biological value of animal proteins.

Bird and Marvel (1943) were the first to show that hatchability could be increased by adding 10% of dried fowl manure to the concentrated rations of hens.

This growth promoting factor was subsequently shown to be present in animal proteins such as meat meal, fish meal and especially liver. It was also found to be present in cow dung. This unknown growth factor was called the Animal Protein Factor (A.P.F.).

It was not until 1948 that vitamin B12 was isolated from liver. As vitamin B12 appeared to be able to replace animal protein in rations it was considered to be the so-called A-P-F. It was also known as the anti-pernicious anaemia factor as it was shown to be a million times as potent as the same weight of liver extract. The discovery of B12 was considered to be the most important contribution to nutrition during 1948 and Dr. Bird received the "Tom Newman Memorial Award" for this work.

Many workers now entered this interesting field and it was not long before Cunha (1949), Stockstad (1949) and others, suggested that there was still an additional factor of practical importance present in certain A-P-F products.

It was found that the broth residue skimmed off the vats in the biosynthesis of antibiotics, such as streptomycin, aureomycin, terramycin and penicillin contained a fair amount of vitamin B12. When these waste products were used in the rations of pigs and poultry, surprisingly good results were often recorded.

The use of Vitamin B12 and antibiotics has been adopted so rapidly by the United States farmers and feed manufacturers, that the Association of American Feed Control Officials have dropped the name "Animal Protein Factor" and accepted the term **Vitamin B12 and Antibiotic Feed Supplement.**

The label used in America on the bags containing dried aureomycin sludge specifies as follows :—

AUROFAC.

(Trade-Mark)

Vitamin B12 and Antibiotic Feed Supplement
(containing aureomycin).

For use in the
Manufacture of Feeds Only.

Guarantee.

Not less than 1.8 grams of aureomycin hydrochloride per pound.
Not less than 1.8 milligrams of Vitamin B12 activity per pound.

Crude Protein	Not less than 10%
Crude Fat	Not less than 1%
Crude Fibre	Not more than 7%

To be added to feed at a level not to exceed 28 pounds per ton.

Ingredients.

Drier extracted aureomycin meal and fermentation solubles, diatomaceous earth, and solvent extracted soybean oilmeal.

There are many natural sources of antibiotics in nature. A few familiar antibiotics which have become prominent in medical and animal nutritional fields are: penicillin, streptomycin, aureomycin, terramycin, chloromycetin, bacitracin, subtilin and others.

Various micro-organisms that produce antibiotics have also been isolated from the soil and green plants such as clover, cabbage and tomatoes.

Although many individual antibiotics have been tried in combination with Vitamin B12, Catron (1950) was the first to prove that the best results were obtained by the use of B12 plus aureomycin in rations. It was found that Vitamin B12 plus penicillin had no beneficial growth stimulus, probably due to its instability. Significantly beneficial results have also been reported by the supplementation of rations with Bi-Con, which consists of terramycin and streptomycin residues.

Animal proteins contain vitamin B12 factors in varying amounts, but no antibiotic factors. In addition to being present in animal products vitamin B12 is produced by certain micro organisms during fermentation. As one of the best sources of the vitamin B12 group of factors is aureomycin fermentation products, it is generally considered advantageous therefore to include these antibiotics in all rations for poultry and pigs, Louw (1951).

Several theories have been advanced to explain the possible way in which antibiotics benefit the animal:

(1) It is claimed that certain selective modifications of bacteria may be possible in the digestive tract, because aureomycin has been found effective as a growth stimulus when fed, but not when injected. In this way **Clostridium perfringens** may be suppressed in the digestive tract of chickens, and this may be beneficial to growth. Other micro-organisms such as **Vibrio coli** may be involved in pigs. This would suggest the use of a "wide spectrum" antibiotic.

(2) Another theory is that these mould residues supply certain nutrients normally utilized by the micro-flora of the gastro-intestinal tract, thus leaving more absorbable nutrients, such as amino acids available for the host animal.

(3) It is also considered possible that the antibiotics hasten the development of a type of micro-flora found normally at a later age. If such a flora were stimulated earlier in the animal's life, it would enable it to utilize it's feed more efficiently. This may be the reason for the greater growth response generally reported in very young animals.

(4) More recently (1952) it was found that aureomycin had the same influence as Ethomid, which is a non-ionic surface active agent used chiefly as a detergent and emulsifier. The reducing of surface tension aids the absorption of nutrients.

Regardless of whatever theory may ultimately prove correct, overseas nutritional authorities definitely confirm the additional benefit of using the antibiotics found in the fermentation solubles and which contains B12.

The demand for these waste products in animal nutrition has proved of great benefit in reducing the price of the expensive pure antibiotics for human use and the greater the demand for the waste products, the more readily availabie may the pure antibiotics be expected to become.

The B12 aureomycin supplement is not harmed by autoclaving and by prolonged storage at room temperature. No detectable quantities of aureomycin were found in the flesh of chickens and pigs which received the supplement at a high level.

Literature.

(1) **Poultry.**

A considerable amount of literature has become available on the growth and other beneficial values resulting from supplementing rations with a small quantity of B12 antibiotic. Carver (1950) reported that the eggs of birds on vegetable protein and which were kept on wire floors showed a hatchability of 76%, while from those on litter floors it was 88%. When 0.5% aureofac was added to the ration of hens on wire floors for 9 weeks, the hatchability of the eggs was 93%.

This work was later corroborated by Petersen (1950). Several other workers found varying degrees of growth stimulation by the use of antibiotics in poultry rations; Stockstad et al (1950), Matterson (1951), Reed (1950), Singsen (1950), Cravens (1950), Berg (1950), Couch et al (1950), Atkinson et al (1951), McGinnis et al (1949) and Biggs (1950).

(2) **Pigs.**

Although less work has been done on pigs, several references may be cited. Cunha et al (1950) conclude that "the animal protein factor" is of considerable value in enriching corn rations which contain plant protein concentrates for swine feeding. It is of interest that the A-P-F in this work is synonymous with B12.

Catron et al (1951) showed that B12 is needed by pigs for growth and for the prevention of mortality. Later Catron and co-workers (1951) indicated the greater benefit obtained by using B12 plus aureomycin in rations for pigs.

Vestal (1950) found that pigs reached 225 lbs. 10 days earlier when their feed contained 0.5% of aurofac. Carpenter (1950) fed 26 sows on a level of 0.5% aurofac for 60 days prior to parturition and during lactation. At weaning the litter weight was 11 lbs. higher in favour of the supplement for pigs.

The most spectacular results were obtained by Carpenter (1950) who used 32 runt pigs averaging 16.5 lbs. in weight. Four of the 16 runts fed the basal ration died, while only 1 of 16 fed aurofac died. At the end of 14 weeks the average weight of the supplemented group was 40% more than that of the control group (93 : 128 lbs.).

(3) **Calves.**

The use of aurofac is becoming popular in calf starter meals in America. Loosli and Wallace (1951) noted that diarrhoea was much less severe and of shorter duration in calves fed aurofac. Similar work is reported by Bartley et al (1950).

Bell (1950) found that in older steers the supplementation of aurofac resulted in diarrhoea and depressed digestion of crude fibre.

Experimental.

Twenty Large White weaners were divided at random into four groups of five pigs each. All pigs were housed in an open cement floored shed where they were kept in individual pens. The experimental rations consisted of the following concentrate mixtures:

Group 1 (Veg. Prot.)

70% Yellow maize meal
10% Lucerne meal
15% Peanut Cake meal
3% Bone meal
1% Calcium Carbonate
1% Salt.

Group 2 (Veg. Prot. plus Aurofac)

69% Yellow maize meal
10% Lucerne meal
15% Peanut Cake meal
3% Bone meal
1% Calcium Carbonate
1% Salt
1% Aurofac.

Group 3 (An. Prot.)

70% Yellow maize meal
10% Lucerne meal
10% Carcase meal
5% Peanut Cake meal
3% Bone meal
1% Calcium Carbonate
1% Salt.

Group 4 (An. Prot. plus Aurofac)

69% Yellow maize meal
10% Lucerne meal
10% Carcase meal
5% Peanut Cake meal
3% Bone meal
1% Calcium Carbonate
1% Salt
1% Aurofac.

In addition all pigs received green lucerne daily.

A protein level of 16% was maintained in every instance, although there is no doubt that a higher level would have resulted in their reaching baconer weight earlier. The chief consideration remains the comparative values of the different rations.

Results:

Group	Initial wt. lbs.	Final wt. lbs.	No. of days	Av. Feed consumed	Feed per lb. of grain	Cost of Feed	Days saved on Veg. Prot.
1	25.8	203	177	666	3.28	£5 6 6	0
2	25.8	204	162	667	3.28	£6 10 0	15
3	26.0	202	168	658	3.26	£5 0 4	9
4	25.8	203	171	684	3.37	£6 8 3	6

The aurofac was reckoned at 3/6 per pound. Feeds were taken at present day ruling market prices.

Although a saving of 15 days is in agreement with the reports in the literature and appears to be of considerable advantage, there was no saving on feed consumed. Appetite was stimulated on the vegetable protein ration to which aurofac had been added, but the actual advantage was saving of labour for 15 days. This amounts to a saving of 2/3 per pig. There was no advantage in the supplementation of an animal protein ration with aurofac.

It is conceded that 0.5% aurofac might have given an equally good result. This would have meant a saving of 11/9 in group 2, which would not have been of much benefit.

A statistical analysis confirmed the significant difference between the vegetable protein groups, but showed that the presence of aurofac made no difference in the animal protein groups, whether time or weight was taken as a measure.

A TABULATION OF VARIOUS BODY MEASUREMENTS AND DRESSED WEIGHT INDICATES NO SIGNIFICANT GROUP DIFFERENCE

	Vegetable Protein					Vegetable Protein + Aurofac No. of Pig				
	786	780	794	773	785	789	775	791	769	784
D	33.5	35.6	34.2	34.5	34.7	34.7	34.2	34.9	34.3	32.9
L	79.0	73.2	77.6	74.8	80.0	80.0	74.8	76.9	81.4	77.3
B	1.4	2.5	2.2	2.7	1.5	2.0	2.6	2.1	2.8	1.9
S	3.2	4.1	4.2	4.2	4.0	4.7	4.7	4.4	4.5	3.7
Eye Muscle A	7.5	7.8	7.7	7.9	7.6	7.6	7.5	7.8	7.6	7.7
Eye Muscle B	4.0	4.8	4.5	4.6	3.7	4.1	4.2	4.9	4.6	4.6
Eye Muscle C	1.5	3.2	2.1	3.0	2.4	3.0	2.9	2.1	3.1	1.9
Dressed weight	155	164	152	160	161	165	160	155	171	160
Live weight	200	204	205	203	203	205	200	203	210	201

	Animal Protein				Animal Protein + Aurofac				
	782	766	793	772	807	792	779	764	795
D	33.2	34.0	34.7	35.1	29.7	34.0	34.8	34.6	33.3
L	78.0	76.8	77.2	76.0	75.3	77.7	74.7	75.5	75.8
B	2.3	2.2	2.1	3.0	1.4	1.9	3.1	2.8	2.0
S	4.0	4.8	4.0	4.8	4.1	4.2	4.8	4.6	3.7
Eye Muscle A	7.6	8.4	8.3	7.4	8.6	8.3	8.0	8.9	7.5
Eye Muscle B	5.0	5.0	5.4	4.4	4.2	4.5	4.3	4.5	4.5
Eye Muscle C	2.2	2.3	2.0	3.4	1.6	1.8	3.3	2.4	1.9
Dressed weight	157	158	157	161	159	154	161	163	152
Live weight	200	200	202	204	201	204	203	206	200

D = Depth of chest.
L = Length of carcase.
B = Thickest back fat.
S = Thickest shoulder fat.

Experiment No. 2.

A farmer wished to test the supplementation of aurofac during the most critical period of a pig's life, which is immediately after weaning.

Three litters of identical age were weaned on the same day. They comprised 19 cross-breds and 10 Large Whites. Each litter was pooled between two styes, giving 10 cross-breds and 5 Whites and 9 cross-breds and 5 Whites.

The control ration was: 360 lbs. maize meal, 150 lbs. pollard, 60 lbs. white fish meal, 5 lbs. bone meal and 8 lbs. lime-stone flour. The experimental group received the same ration plus 1% aurofac.

Available supplies lasted for 24 days. By the end of this period it was found that the aurofac pigs were consuming 20% more feed daily than the controls.

The results may be tabulated as follows:

Aurofac.

	Initial Av. wt.	*Wt. at 24 Days.*	*Av. Daily Gain.*
C.Bs.	35.5 lbs.	58.0 lbs.	0.94 lbs.
Ws.	28.4 lbs.	46.6 lbs.	0.76 lbs.

Control.

	Initial Av. wt.	*Wt. at 24 Days.*	*Av. Daily Gain.*
C.Bs.	36.4 lbs.	54.6 lbs.	0.76 lbs.
Ws.	31.0 lbs.	47.4 lbs.	0.68 lbs.

From a statistical analysis of the results it is evident that:

(1) **Cross-breds** — There is a highly significant difference between the test and control groups.

(2) **Whites** — No significant difference between test and control groups could be noted.

This test is of special significance for the following reasons:

(a) The animals showed by their particularly good weaning weights that they were of good stock.

(b) The level of protein intake was only 14.5% so that the fish meal may have been inadequate to supply the required A-P-F'c.

(c) Aurofac stimulated appetite.

(d) Pigs having the latent hybrid vigour growth stimulus were able to benefit.

Discussion.

The preliminary experimental work clearly shows that the addition of small amounts of aurofac tends to stimulate appetite in young pigs. The result is that such animals may reach a predetermined weight up to two weeks earlier than those pigs that did not receive such a supplement. Although the daily weight gain was more per pig fed aurofac, the total feed consumed remained the same as in the control groups. Additional intake was, therefore, not used more economically by the pigs. Saving of labour did not justify the additional costs of aurofac supplement.

The dead mould ferments from certain antibiotics appear to be an ideal vehicle for vitamin B12. It is well known that the requirements of the B-Complex is high in the case of poultry

and pigs. Actually the requirement of B12 for pigs is estimated at 0.5 mg. daily. These animals are unable to synthesise or store their requirements and are dependent on a sufficiently high level of animal protein in their rations. In addition B12 as synthesised by mould growth contains as much as 4% of cobalt. If used singly the B12 or cobalt has not given good results, but in combination they are essential for stimulating the micro-flora of the digestive tract. It is doubtful, therefore, whether the antibiotic has a directly beneficial influence on growth. It must be admitted, however, that certain sulfa-drugs suppress the growth of organisms producing essential growth factors such as folic acid and biotin in the digestive tract. Whether aurofac possesses such selective germicidal action remains to be proved.

The same saving in time would probably have been attained by a properly balanced animal and vegetable protein ration fed at the 18% protein level. If 666 lbs. of concentrates had been consumed, the cost would have amounted to £6 per pig, or a saving of 10/- on aurofac in group 2.

Summary.

(1) A saving in animal protein is possible by supplementing vegetable protein in rations by vitamin B12 with antibiotic.

(2) Present cost structure is such that the use of vegetable protein rations and aurofac would not prove more economical.

(3) The chief function of aurofac supplement appeared to be the stimulation of appetite.

(4) Although remarkable results have been reported in some instances, it will be appreciated that the growth stimulus depends largely on the completeness and adequacy of the ration. The vitamin B12 appears to be of greatest importance as an animal protein supplement.

Recommendation.

Adequately balanced rations as well as good hygiene and management is advised in preference to the supplementation of antibiotics. The long range influence of these little known drugs is unknown and may prove deleterious. It is, therefore, recommended that they be used for specific cures rather than be included in rations.

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THE VETERINARY PROFESSION IN SOUTH AFRICA

E. M. ROBINSON

Onderstepoort.

From time to time it may serve a useful purpose to take stock of the position in which a profession finds itself. It should be of interest to the members of our profession in South Africa to review it's growth and it may perhaps be permitted to speculate to some extent on future developments. The information given refers only to the Union and South West Africa.

In the period before the Anglo Boer War of 1899-1902 there were very few veterinarians in South Africa, most of them being in the service of the Cape and Natal governments with an odd one or two in practice in a few of the larger towns. With the organization after the war of the various colonies which later became provinces at Union, more veterinarians were employed in the government services.

At the time of Union there were 52 veterinarians employed in the Field Division of the State Service. They were distributed as follows:—

TABLE 1.

Transvaal . .	1	Principal	veterinary	officer,	18	veterinary	officers
Cape Prov. .	1	„	„	„	17	„	„
O.F.S.	1	„	„	„	10	„	„
Natal	1	„	„	„	3	„	„

Private practice had made little headway at the time of Union and did not make much for some years afterwards. It was really only after 1936 that it developed rapidly until in most of the areas where a living could be made, practitioners were available.

Up to 1924 all veterinarians in South Africa were either men who had come to the country from overseas or were South Africans who had studied in other countries, and were predominantly members of the British Royal College of Veterinary Surgeons. The term M.R.C.V.S. will be used to denote members of the college. After 1924, when the first South African students graduated locally, the proportion of them in the profession gradually increased until at the present time they preponderate very greatly. It is not possible to give absolutely accurate figures

unless one calculates from some particular date but as near as can be determined the proportion is 73 M.R.C.V.S.'s and other overseas graduates to 210 B.V.S.c.'s which is roughly 1 to 3. The proportion of overseas graduates is still declining rapidly as most of them are middle-aged or old so that the deaths amongst veterinarians are mainly amongst them. A few are still coming into the country mainly to go into private practice. There have been eight in the last four years.

In order to review the present position satisfactorily it will be convenient to give certain figures relative to the members of the profession, the obtaining of which has been greatly facilitated by the creation of a Register of veterinarians subsequent to the passing of the Veterinary Act of 1933. Information about veterinarians before that date had to be obtained from various sources and some of it was difficult to get.

Before going on to give various tables referring to the profession, it may be of interest to give a short review of past conditions. In the early years of the veterinary profession in South Africa, which for practical purposes may be considered as the period from 1880 to 1900, there were only state veterinary services in the Cape Colony and Natal. After the Anglo Boer war of 1899-1902, services were organized in all four divisions of the country. These slowly developed until at the time of Union the figures were as previously mentioned in table 1. Laboratory services existed to a very limited extent in Cape Town, where a field officer did some diagnostic work as a part-time occupation, and there was a small laboratory at Grahamstown, at first controlled by a medical man and later by a veterinarian. At Allerton near Pietermaritzburg there was a small laboratory which did some good pioneer research work. In the Transvaal Theiler started his laboratory at Daspoort where he commenced the systematic study of South African stock diseases, later in 1908 to move to Onderstepoort. The staff in all these places was small and only Allerton with two research officers and Onderstepoort with four were more than one-man shows. Soon after Union Grahamstown closed down and it is only recently that in Cape Town a laboratory has been opened with one research officer. The field staff increased from the number at Union to 73 in all provinces but subsequently a number of resignations took place of men who took up private practice and the full staff has never existed since. For some years now the great majority of the students who have graduated have gone into private practice so that recruiting for both the field and laboratory services has been difficult.

At the present time the position in the government services is as follows: In the field service there are 59 posts of which 44 are filled and in the laboratory service 40 posts of which 27 are filled.

Mention may be made here of the Veterinary Faculty which since its inception in 1920 has been an integral part of the Onderstepoort laboratory. Of the 30 veterinarians on the Onderstepoort staff 20 are part-time members of the teaching staff. Originally there were 8 veterinarians on the staff of the Faculty in 1921 but there were a number of vacancies and in 1925 there were 15 veterinarians out of a staff of 20. New posts have been created from time to time. At present the separation of the Faculty from Onderstepoort is under consideration. That this separation must take place has been accepted but how the new staff arrangements will be made has not yet been decided.

It may be mentioned that the Onderstepoort staff has also suffered considerably from officers resigning to take up other appointments or to go into private practice. This is a healthy sign in a growing and developing profession, when replacements are available, but causes much dislocation when they are not. It leads to curtailing of essential services and to restriction of research work.

Municipal services in the Union have developed very considerably since the early days. At Union there were very few veterinarians in Municipal employ. At Cape Town there was a part-time one and at Johannesburg and Durban a full-time man at each place. Since then a gradual development has gone on until there are now 14 in the employ of different municipalities.

At this stage it will be of interest to mention the remarkable development of private practice in South Africa. After the Anglo-Boer war there were a few veterinarians in practice in the larger towns such as Cape Town and Johannesburg but not much progress was made. Recently graduated students did not even consider the possibilities of private practice and were nearly all absorbed into the government services. From about 1936 a renewed interest in the possibilities of private practice developed and it has progressed by leaps and bounds until at the present time nearly all the centres where a living can be made are catered for. As with the medical profession there is a tendency for veterinarians to concentrate in the larger towns or in the more densely populated areas. This is on account of small animal practice and the fact that in many country areas distances to be travelled limit the amount of work that can be done and the value of the stock may not be high.

At present there are roughly 120 veterinarians in private practice in the Union of whom 93 are B.V.Sc. graduates. It is difficult to give absolutely accurate figures as the position is constantly changing. In less than 20 years the position as regards the state services and private practice has completely changed and may continue to change for some time to come as the possibilities of extension of private practice are by no means exhausted. The position is now approaching that in most

European countries where the private practitioner is and has been for many years the backbone of the profession.

There are a number of veterinarians in other avenues of employment. Six are employed by firms selling stock foods or by ranching organizations. Eight are farming in different parts of the country.

Having given a brief resume of the position which the profession finds itself in at the present time a few figures of general interest will be given.

The following table gives a summary of the position of the M.R.C.V.S.'s in South Africa.

TABLE 2.

M.R.C.V.S.'s	in private practice	28
,,	in municipal employ	1
,,	in state field services	3
,,	in state research institutions	3
,,	retired	11
,,	retired and temporarily employed	9
,,	retired and farming or doing a limited amount of private practice	8
,,	at Agricultural Faculties	2
		65

There are seven veterinarians in South Africa with degrees from other countries than South Africa or Great Britain. Two are in private practice in the Union, three are in the South-West African service and two have retired from the Union government service.

The following table gives the position of the B.V.Sc. graduates in South Africa.

TABLE 3.

B.V.Sc.'s	in private practice	93
,,	in state field service	41
,,	in South-West Africa	5
,,	at Onderstepoort and substations	28
,,	in municipal services	13
,,	with firms or in ranching organizations	6
,,	farming more or less whole time	8
,,	at Agricultural Faculties	1

In addition there are 14 in other services such as the British Colonial, High Commissioned Territories and Southern Rhodesia.

In table 4 some figures are given relative to the number of students who have graduated annually since 1924, the year of the first graduates. It will be seen that the number of graduates in the early years was not high and it was not until about 1945 that an upward tendency started.

TABLE 4.

	Number of graduates	*Number of students at Onderstepoort (2nd to 5th years)*	*(Pretoria University) 1st year students*
1924	8	Figures not available	Figures not available
1925	10	,,	,,
1926	7	,,	,,
1927	6	,,	,,
1928	5	,,	,,
1929	7	,,	,,
1930	0	21	8
1931	4	22	18
1932	9	36	11
1933	2	35	9
1934	4	37	7
1935	7	33	8
1936	13	28	11
1937	7	18	24
1938	4	30	22
1939	4	45	29
1940	2	52	11
1941	8	52	17
1942	13	50	16
1943	13	44	9
1944	6	45	38
1945	10	51	52
1946	10	58	63
1947	5	63	40
1948	19	69	24
1949	16	68	21
1950	13	60	26
1951	10	64	34
1952	—	66	25

From these figures it will be seen that the average number of students graduating per year has been approximately eight. This figure is somewhat lower than it might have been had the number of students allowed to go on to the second year not been artificially restricted since 1940.

In the early years of the course students at Pretoria University were interviewed to give them an idea as to the prospects in the veterinary profession. No restrictions on the number in the second year were then applied and it will be seen that there were never many students taking up the course until the end of the recent war. The figures for the first year students show a sudden jump about 1944 but have since declined somewhat. The first year figures given are only for Pretoria University but

are a good indication of the trend. It is difficult to draw any conclusions about the effect of the depression period after 1929 on the number of entrants for the course. The number of first year students dropped sharply between 1939 and 1943 after which it rose higher than it had ever been previously.

The figures for the number of students over the last four years of the course at Onderstepoort have shown a slow continuous upward trend which may continue if and when the present limiting of entrants to the second year is discontinued.

Before there was any limitation there was always a certain wastage due to failures and to students changing to other courses.

The wastage in the profession due to deaths has averaged 3.3 per annum since 1933. As was to be expected the majority of the deaths were amongst the old men and the death rate cannot be considered as abnormal. It is of interest to note that, contrary to what might have been expected, the death rate amongst B.V.Sc. graduates has been higher than usual. Since the first students graduated in 1924 there have been 13 deaths at an average age of 36, the youngest being 25 and the oldest 50. The number of graduates has been 222 which gives a mortality figure of 6% approximately. Four of these deaths were due to coronary thrombosis which must be considered as somewhat unusual.

Having given some information about the present position of the veterinary profession in South Africa one may be permitted to speculate to some extent about future developments. It is not likely that there will be a big influx of veterinarians from overseas so that the future of the profession will depend on the South African graduate. The separation of the Faculty from Onderstepoort as an organization, how it will be staffed and on what lines it will develop in the future is now receiving a great deal of consideration. Whatever is the outcome, the standard of teaching must not be allowed to decline. On the contrary every effort should be made to maintain and improve on the present standard, and to provide the best possible facilities for student instruction.

In view of the development of private practice it is likely that the state veterinarian in the field service will do less and less clinical work and will confine his activities almost entirely to the control of infectious diseases. In certain areas where a private practitioner cannot make a living the state veterinarian will still have to do what clinical work he can, but there is a possibility of the development of veterinary services for such areas by Farmers Co-operatives or something on the lines of the New Zealand veterinary club system may develop. The personnel of the field service may eventually develop into a small highly trained staff for dealing with outbreaks of infectious diseases, to be switched to danger points at a moment's notice and to do the

preliminary investigations of outbreaks of other types of stock disease.

Research work must continue to develop and given the staff and facilities will do so. It must be remembered however that it is only a comparatively small number of veterinarians who have that bent for research work without which a career as a laboratory worker will not give that personal satisfaction which is so essential to happiness.

Diagnostic services must develop as well and it has been shown that they must not be too difficult to reach if they are to be of any real value. It has been shown that diagnostic services are mainly of use to the immediate neighbourhood and the number of specimens sent in declines with the distance from the laboratory. To give an example, the specimens sent in to the poultry diagnostic laboratory at Onderstepoort are predominantly from the Pretoria area and the Witwatersrand. Diagnostic facilities are provided at Onderstepoort, Allerton, Cape Town and East London. So far no veterinarian has attempted to establish a diagnostic laboratory on a private basis but the time may come when this will be possible.

Although there are now veterinarians in private practice in most areas where a living can be made, the possibilities for practice are still far from exhausted. Some form of subsidization would enable veterinarians to practice in places where at present it would be difficult to make a living. The subsidy could vary according to the district, being highest in the poorer areas.

Municipal employment should absorb more and more men as time goes on, but it is difficult at present for the smaller municipalities to find the means to employ a veterinarian except on a part-time basis.

An avenue of employment which has opened up in recent years is the service of private firms such as some of those which produce stock feeds, insecticides, stock remedies, etc. A few veterinarians will no doubt continue to take up farming either at once after graduation or after some years of experience in one of the usual avenues of work open to them.

The veterinary services of neighbouring territories will continue to provide openings for employment and the South African graduate by virtue of his training is well suited to employment in such services.

At present the number of new entrants to the veterinary course in South Africa is limited to 15 per annum. With the facilities which are now being created it will be possible to double the number. The question is frequently asked, whether this will lead within a short period of time to saturation. We do not know the answer but past fears in this direction have not been realized. Supply and demand have a habit of adjusting

themselves and the number of students will probably soon fall off if there is any danger of a saturation point being reached.

In this short paper a review of the progress made by the veterinary profession in South Africa has been given and there is every reason to hope and expect that this progress will be maintained in the years to come.

BOOK REVIEW

"PHOTOSENSITIZATION IN DISEASES OF DOMESTIC ANIMALS" by N. T. Clare. Review Series No. 3 of the Commonwealth Bureau of Animal Health. Published in 1952 by the Commonwealth Bureaux, Farnham Royal. Bucks, England. pp. 58. Price 7/6.

This excellent review summarizes the present state of our knowledge on photosensitization, and the conditions under which it occurs. A suggested classification, based on the origin of the photodynamic agent or the means by which it may reach the peripheral circulation, is extremely logical. Under this scheme, Clare lists three main types of diseases in which photosensitivity occurs, as follows:—

Type 1. *Primary Photosensitivity*: "The photosensitizing agent is a substance not normally encountered in the diet, which is absorbed directly by the digestive tract and not completely excreted by the liver." Examples of this type are Hypericism (St. John's Wort Poisoning) and Fagopyrism (Buckwheat poisoning). Photosensitization due to drugs such as Phenothiazine (Keratitis in calves) and Phenanthridinium 1553 also fall into this class.

Type 2. Photosensitivity due to Aberrant Pigment Synthesis: The only photosensitivity of this type in animals is the Congenital Porphyrinaemia of Cattle (Pink Tooth), described in South Africa by Fourie 1936 and Fourie and Rimington 1938. The photosensitizing agents in this condition are uvo and coproporphoryrin formed in the aberrant synthesis of haemoglobin.

Type 3. *Hepatogenous Photosensitivity*: To this type belong Geeldikkop, Dikoor and Facial Eczema of New Zealand. The basic cause is the failure of the liver to excrete phylloerythrin formed in the rumen by the microbial breakdown of chlorophyll. This substance is normally formed and absorbed but is rapidly excreted by the liver. Any liver damage which hinders this function causes an accumulation of photodynamic phylloerythrin in the blood and hence results in photosensitivity, usually accompanied by hepatogenous icterus.

Poisoning with Lantana and Lippia species also fall in this type as does the photosensitization reported in Rift Valley Fever.

The review gives some 150 references to relevant literature and a list of plants known to produce or suspected of producing photosensitivity.

It will be of interest to readers to hear that this review is dedicated to the memory of J. I. Quin, "pre-eminent worker in the subject."

R.C.

"KING SOLOMON'S RING" by Konrad Z. Lorentz (Methuen & Co., London).

This fascinating book should be read by all who are interested in animals. It is a study of animal behaviour written by one who has spent a lifetime living with, and making personal friends of all types of animals from tropical fish to dogs and wolves. The writer is not only a keen observer but also obviously a trained biologist, although he never admits it. What makes the book so eminently readable is the fact that he is also a student of literature and a philosopher with a keen sense of humour, with sentiment, but no sentimentality. Mr. Lorentz's analogies between the behaviour of communal animals and humans are food for original thought.

R.C.

ANTIBIOTICS : A Survey of their Properties and Uses. Published by the Pharmaceutical Press, 17 Bloomsbury Square, London, W.C.1, 1952. Pp. ix + 290. Price 25/-.

Contents : *Preface to Second Edition. Preface to First Edition.* 1. *Historical Summary.* 2. *Commercial Manufacture.* 3. *Chemistry.* 4. *Stability.* 5. *Standards and Methods of Assay.* 6. *Experimental Background.* 7. *Clinical Use.* 8. *Veterinary Practice.* 9. *Pharmacy and Pharmaceutical Preparations.* 10. *Legal Aspects of Antibiotics.* 11. *Commercial Preparations. Appendices. Index.*

The first edition of this book was published under the title "Penicillin : Its Properties, Uses and Preparations" in 1946. Since it was designed specifically to meet the needs of medical practitioners and pharmacists it was warmly welcomed, and the demand continued until the discovery of other antibiotics had rendered the book out of date. It was then decided to rewrite it entirely and enlarge its scope to include the newer antibiotics.

At the time of going to press (May, 1952) the only ones available in more than experimental quantities in the United Kingdom were penicillin, streptomycin, chloramphenicol and aureomycin, so that this book is mainly concerned with these. For completeness, however, information is also given on other known antibiotics, including those of bacterial origin.

Published by direction of the Council of the Pharmaceutical Society of Great Britain, the book is authoritative and represents in handy form the collated results of a very large amount of research, as is shown by the inclusion of some 800-900 references to original papers, patent specifications and other sources.

The chapter on Veterinary Practice includes sections on the toxicity of antibiotics, sensitivity of bacteria pathogenic to animals, blood concentrations of antibiotics, the retention of antibiotics in the bovine udder, clinical use in veterinary medicine : bovine mastitis, bovine pyelonephritis, actinomycosis, reproductive disease in cattle, infection due to mycobacteria, swine erysipelas, canine leptospirosis.

In some parts of South Africa veterinarians may note the absence of reference to the use of antibiotics in the rickettsial diseases of

cattle and dogs, but since there has (as far as your reviewer is aware) been no publication of such results, this could hardly be expected. In the therapeutic field, thus, there will undoubtedly be developments in the future, but these will in no way diminish the general usefulness of this standard work for years to come.

W.D.M.

THE STRUCTURE OF THE MEAT ANIMALS. A Guide to their Anatomy and physiology. Roderick MacGregor, F.R.C.V.S., M.R.S.I., M.I. of M., with a foreword by F.R.I. Gerrard, M.R.S.I., M.I. of M. Illustrated by A. P. Burton. 238 pages, 62 figures and 15 plates. London : The Technical Press Ltd., 1952. Price 20/-.

Ostensibly this book is meant for the education and enlightenment of butchers and potential meat inspectors. As such, one can find little fault with the field covered, and with the way the material has been arranged. The approach throughout is from the angle of those directly concerned with the meat trade. It would therefore appear that the author has attempted this work in all earnest.

There are some needless repetitions, and occasionally rather irrelevant matters, such as artificial insemination, are dealt with in greater detail than is warranted in a book of this type. At times the author overdoes chatty deviation from the point to hold the reader's interest.

These criticisms are relatively insignificant when one comes to consider the factual detail as described in the two hundred odd pages. One could still condone certain dogmatically stated inaccuracies as the inevitable result of dealing with the problem — of bigger moment than is commonly realised — of stating biological facts in a concise, simple and generalised way for lay consumption. But it is difficult indeed to find justification for the large number of erroneous statements. Some of them are rather fantastic, to the bewilderment and embarrassment of the reviewer. A few examples are quoted at length :—

Page 13: "In a healthy young animal this synovia is sufficiently copious to keep the ends of the bones an inch or so apart and so there is no detectable friction when they move. In a starved or very aged animal the synovia is less and the ends of the bones may actually be in contact. In such a case the animal actually becomes visibly smaller . . ."

In dealing with the physiology of muscular contraction the author states (page 51): "The (muscle) cell contains a protein, called 'collagen,' a very small amount of fat and a fairly large amount of a starch-like substance called 'glycogen.' All of these contain carbon, and the lymph surrounding the cell contains free oxygen which the cell breathes in. On contracting, the carbon combines with the oxygen to form carbon dioxide and in doing so generates heat which causes the cell contents to expand, and the cell itself to contract. The heat and the carbon dioxide are then dissipated into the surrounding lymph, thus allowing the cell to relax again."

Or on page 206: "In a laying hen, the whole Graafian follicle breaks away from the ovary without bursting, travels down the oviduct with the ovum inside it, and becomes an egg. It takes about 10 days to reach the cloaca, and acquires, en route, a quantity of yolk and a thick layer of albumen, which swell it out, after which the shell, or hard chalky covering, is added a few hours before laying. In a bird in lay, fresh follicles are formed every other day or even every day, and the oviduct therefore contains eggs in all stages of development from the size of a millet seed to the fully formed egg."

It is a tragedy indeed that a work that could have filled such an urgent need should have miscarried. It is a cause for anxiety that it should be let loose on a public not fully competent to discriminate for itself.

A.d.B.

SHEEP DISEASES. By I. E. Newson DVS., DSc. Dean of Veterinary Medicine, President Emeritus of Colorado A and M College. Bailliere, Tindall and Cox, London. 1952.

In this volume, which runs to 352 pages, the author has attempted to survey the whole field of sheep diseases and has done so with a considerable degree of success. It is only natural with such a wide field to cover that some diseases are dealt with somewhat superficially and some have been omitted. For instance the condition produced in sheep in Australia by feeding on subterranean clover has not been mentioned. The section on bacterial diseases is particularly good but in the one on virus diseases mention could have been made for instance of the attenuated chicken embryo vaccine now in use for immunization against bluetongue. In other respects the section on virus diseases is rather superficial.

Under rickettsial diseases no mention is made of the method now in use for the immunization of young calves against heartwater. It is not clear why Rift Valley Fever has been included amongst the rickettsial diseases.

The list of external parasites is fairly complete and the description of the morbid conditions produced by them together with the treatment, although brief, is adequate for the purposes of the volume. A good list of references is given.

In the section on internal parasites the information is up to date, clearly presented and sufficient for practical purposes. From a South African point of view it loses in value in that several very injurious worms are not even mentioned, such as conical flukes, bilharzia worms and gaigeria hook worms.

No attempt has been made to show the relationships of certain parasites. The uninitiated would not know that the large and small lungworms are related and belong to the same family of round worms, the Metastrongylidae, but are not closely related to the stomach worms (Trichostrongylidae). Careful editing would not have placed Orloff's

work in South Africa (p 191) or maintained the generic name Distoma in fig. 60.

On the whole the book must be considered as a very useful contribution to our knowledge of pathological conditions in the sheep and can be recommended to veterinarians and others interested in sheep.

E.M.R.

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