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THE TRANSMISSION OF BABESIA CANIS (Piana and Galli-Valerio, 1895) TO THE BLACK-BACKED JACKAL [Thos mesomelas mesomelas (Schreber)], with a discussion on the classification of the piroplasms of the Canidae.

W. O. NEITZ and H. P. STEYN
Onderstepoort Johannesburg

INTRODUCTION

The morphological and biological studies on the Babesidae during the last five decades have shown that these parasites are specific for mammals belonging to closely allied genera. The available information regarding the susceptibility of various animals to the different species of the Babesidae is given in the subjoined Table 1. From these data it will be seen why some protozoologists in the past concluded that *Babesia canis* is very specific for the dog, whilst others hesitated to accept this view. This controversy was finally settled, when Schoop and Dediè (1938) demonstrated that the silver fox is susceptible to *B. canis*. This observation naturally suggested that further work should be undertaken, in order to ascertain whether the conclusions of Lounsbury (1903), Nuttall and Graham-Smith (1909) and Mettam (1933) regarding the insusceptibility of the two species of African jackals to *B. canis* were justified or not.

The wide distribution of the vectors of biliary fever *Rhipicephalus sanguineus* (Latreile, 1806) and *Haemaphysalis leachi* (Andouin, 1826) in Africa suggests that the jackals used for the transmission experiments by the above-mentioned authors, may have been harbouring a latent infection of *B. canis*. This fact is stressed, because it has been found that the demonstration of *Babesia bigemina* in cattle, which have been premune for periods of nine months and longer, has often only been possible when a large quantity of blood (half a litre or more) was transfused into susceptible animals. Nothing is known about the nature of the premunition in piroplasmosis in jackals, but it should be borne in mind that the basic principles, responsible for the maintenance of a latent infection, are probably the same in all mammals.

The consideration of these facts clearly indicated the importance of using fully susceptible jackals for experiments of this nature. The difficulties in procuring such animals in a tick-infested country like South Africa was fully realized. Nevertheless attempts were made

TABLE 1.

The available information regarding the susceptibility of various animals to the different Babesia Spp.

PARASITE		HOST						METHOD OF TRANSMISSION.	
THE OLD NOMENCLATURE.	THE REVISED NOMENCLATURE.	VERNACULAR NAME.	ZOOLOGICAL NAME.	FAMILY.	COUNTRY.	AUTHOR.	Year	Artificial	Natural
Piroplasma bigeminum (Smith and Kilborne, 1893)	*Babesia bigemina* (Smith and Kilborne, 1893)	Cattle	*Bos taurus*	Bovidae	Many countries	Smith & Kilborne	1893	+	+
		White-tailed deer	*Odocoileus chiriquensis*	„	Panama	Clark	1918	+	—
						Clark & Zetek	1925	+	+
Piroplasma ovis (Lestoquard, 1925)	*Babesia motasi* (Lestoquard) Wenyon, 1926	Sheep	*Ovis aries*	Bovidae	North and Central Africa and Southern Europe	Motas	1903	+	+
		Goat	*Capra hircus*	„	„	Lestoquard	1925	+	+
Babesia ovis (Starcovici, 1893)	*Babesia ovis* (Starcovici, 1893)	Sheep	*Ovis aries*	Bovidae	North and Central Africa and Southern Europe	Babes	1892	+	+
		Goat	*Capra hircus*	„	„	Dschunkowsky & Luhs.	1909	+	+
Nuttallia equi (Laveran, 1901)	*Babesia equi* (Laveran, 1901)	Horse	*Equus caballus*	Equidae	Many countries	Laveran	1901	+	+
		Mule		„	„	Theiler	1906	+	(+)
		Donkey	*Equus asinus*	„	„	Dale	1903	+	(+)
						Theiler	1906	+	(+)
		Zebra	*Hippotigris quagga*	„	„	Theiler	1909	+	(+)
Piroplasma canis (Piana and Galli-Valerio, 1895)	*Babesia canis* (Piana and Galli-Valerio, 1895)	Dog	*Canis familiaris*	Canidae	Many countries	Piana & Galli-Valerio	1895	+	+
		Black-backed jackal	*Canis mesomelas* = *Thos mesomelas*	„	South Africa	Lounsbury	1903	(—)	(—)
					England	Nuttall & Graham-Smith	1909	(—)	—
					South Africa	Neitz & Steyn	1942	+	+
		Side-striped jackal	*Canis adustus* = *Thos adustus*	„	Uganda	Mettam	1933	(—)	—

TABLE 1 — (Continued).

PARASITE		HOST						METHOD OF TRANSMISSION.	
THE OLD NOMENCLATURE.	THE REVISED NOMENCLATURE.	VERNACULAR NAME.	ZOOLOGICAL NAME.	FAMILY.	COUNTRY.	AUTHOR.	Year	Artificial	Natural
		Red fox	*Canis vulpes* = *Vulpes valgaris*	„	England	Nuttall & Graham-Smith	1909	(—)	—
					Germany	Schoop & Dedié	1938	Doutful	—
		Silver fox	*Vulpes vulpes*	„	Germany	Schoop & Dedié	1938	+	—
Babesia rossi Nuttall, 1910 = *Rossiella rossi* Nuttall, 1912	*Babesia canis* (Piana and Galli-Valerio, 1895)	Side-striped jackal	*Canis adustus* = *Thos adustus*	Canidae	East Africa	Nuttall	1910	—	(+)
Piroplasma sp. (Yakimoff and Schokhor, 1917)	*Babesia canis* (Piana and Galli-Valerio, 1895)	Wolf	*Canis lupus*	Canidae	Turkestan	Yakimoff & Schokhor	1917	—	(+)
Babesia gibsoni (Patton, 1910)	*Babesia gibsoni* (Patton, 1910)	Dog	*Canis familiaris*	Canidae	India	Patton	1919	+	+
		Jackal	*Canis aureus*	„	India	Patton	1919	+	+
Nuttallia bauryi (Leger and Bediér, 1922)	*Babesia gibsoni* (Patton, 1910)	Fox	*Fenneus dorsalis* = *Vulpes dorsalis*	Canidae	French Sudan	Leger & Bediér	1922	—	(+)
Babesia sp. (Plimmer, 1915)	*Babesia gibsoni* (Patton, 1910)	Indian wild dog	*Cyon dukhunensis*	Canidae	Zoological Gardens London	Plimmer	1915	—	(+)
Babesia sp. (Yakimoff and Schokhor, 1917)	*Babesia gibsoni* (Patton, 1910)	Wolf	*Canis lupus*	Canidae	Turkestan	Yakimoff & Schokhor	1917	—	(+)
Theileria sp. (Yakimoff and Schokhor, 1917)	*Babesia gibsoni* (Patton, 1910)	Fox	?	Canidae	Russia	Yakimoff & Schokhor	1917	—	(+)
Piroplasma pitheci (Ross, 1905)	*Babesia pitheci* (Ross, 1905	Monkey	*Cercopithecus sp.*	Cercopithecidae	Africa	Ross	1905	+	(+)
		Monkey	*Macacus rhesus*		Germany	Kikuth	1927	+	—

NOTE: The following signs signify:—

— No attempts were made to transmit the disease.

\+ Experimental transmission was successful.

(—) Experimental transmission was not successful.

(+) Disease transmitted by exposure to ticks in nature.

to procure very young black-backed jackals, since it was believed that the chances of a natural infection at that age would be less than in adult animals. A further precaution that was taken was to splenectomize the jackals, in order to ascertain whether they harboured a latent infection of piroplasms or not.

Observations at Onderstepoort

Before giving an account of the transmission experiments, we wish to record an observation made at the beginning of 1939. A very young black-backed jackal, approximately two months old, was presented to the Institute by a farmer, who had captured it in the vicinity of Komatipoort, Transvaal. The whelp was placed in a kennel infested with a relatively large number of dog ticks (Rh. sanguineus), which were known to be infected with *B. canis* and *Rickettsia canis,* Donatien and Lestoquard, 1935. About two months later the animal died. The post mortem examination showed the presence of lesions suggestive of biliary fever. On examining the blood and lung smears *R. canis* as well as parasites resembling *B. canis* were found. No doubt existed about the nature of the *Rickettsia,* since Neitz and Thomas (1938) had shown experimentally that the black-backed jackal is susceptible to this parasite. It was, however, not possible to establish the identity of the *Babesia,* as no susceptible dogs were available at the time for transmission experiments. In view of this it was concluded that the parasite in question was either *B. canis* or *B. rossi.*

This observation prompted us to continue our investigations, but it was only two-and-a-half years later when another opportunity presented itself. Towards the end of October, 1941, three young black-backed jackals, approximately six weeks old, were purchased from a Native, who had captured them on a farm in the vicinity of Soutpan, 30 miles north of Pretoria. They were placed in a kennel, which had been rendered free of ticks by thoroughly spraying it on several occasions with a pyagra * solution according to the method described by Neitz (1943). Their food consisted of raw meat and milk. They adapted themselves well to their new surroundings. Ten weeks after their admission two of them were splenectomised. The following procedure was adopted for the operation:—

The jackals weighed 8lbs. 12ozs. and 9lbs. 12ozs. respectively. Each received a hypodermic injection of 1·5 cc. of Bayer's eukodal as a preparation for anaesthesia. About an hour later complete anæsthesia was induced by the intravenous injection of 16 cc. and 20 cc. of pernocton respectively. Pernocton is a barbiturate which was procurable in this country before the war.

Laparotomy was performed by making a vertical incision midway between the last rib and the external angle of the ilium, on the left

* Pyrethrum preparation.

side. The spleen, which is loosely attached, was lifted out of the abdominal cavity, two catgut ligatures were applied to the splenic vessels and the spleen was detached by an incision between the ligatures. Thereafter the laparotomy wound was closed by the usual method and the line of skin sutures was sealed with iodoform in collodion. A narrow strip of sterile gauze was laid over the wound and an elastoplast bandage encircling the abdomen, applied over the gauze.

After the operation the jackals were placed in their kennel and were not handled for a period of seven days in order to allow the operation wounds to heal. On the eighth day the protective bandages and the skin stitches were removed. The wounds had healed by primary intention.

The method of anaesthesia employed deserves special mention. The method described was the routine procedure used in inducing anaesthesia in dogs at that time. Morphine may be used instead of eukodal. By this means the animal is sufficiently narcotized to eliminate excitement and struggling during the intravenous administration of any selected barbiturate. The use of morphine or eukodal considerably reduces the quantity of barbiturate required to induce anaesthesia and lengthens its duration. The elimination of excitement is a great advantage when handling wild and nervous animals, as in this experiment, because injury or bruising of the body is avoided and there is less risk of respiratory failure which might be caused by a too rapid injection of the barbiturate during the period of excitement.

From the day of the removal of the bandages daily blood smears were prepared. During the ensuing three weeks no blood parasites other than *Hepatozoon canis* (James, 1906) could be demonstrated in the blood smears. The details of the observations are mentioned, in Table 2. The presence of these parasites showed that the splenectomized jackals had been in contact with ticks *(Rh. sanguineus)*, but that they had not become infected with *B. canis*.

Once it was established that the splenectomized jackals did not harbour a latent infection of *B. canis* the transmission experiments were undertaken. Both splenectomized jackals (Nos. 3870 and 3871) were injected subcutaneously on 4.2.42 with blood from a dog suffering from biliary fever. After an incubation period of three days *B. canis* appeared in both jackals, and could be demonstrated daily for a period of 50 days. The observations are detailed in Table 2. The parasites multiplied rapidly, so much so that on the eighth day after the first appearance of the parasites sixty per cent. of the erythrocytes were parasitized. On several occasions as many as eight parasites were found in an erythrocyte. A very severe anaemia and icterus could be demonstrated clinically. The blood smears showed anisocytosis, polychromasia, normoblasts, Jolly bodies and a mono-

TABLE 2.

The transmission of Babesia canis *to the Black-backed Jackal.*

NUMBER OF ANIMAL	DATE OF SPLENECTOMY	RESULT OF SMEAR EXAMINATION AFTER SPLENECTOMY.	DATE OF ARTIFICIAL INFECTION	INJECTED FROM	DOSE OF BLOOD	INCUB. PERIOD IN DAYS.	RESULT OF SMEAR EXAMINATION AFTER THE ARTIFICIAL INFECTION.	BLOOD COUNT.				REMARKS.
								Date.	Erythrocytes.	Leucocytes.	Precipitate.	
Jackal 3870	7.1.42	Negative for *B. canis* until 6.2.42. *Hepatozoon canis* observed on 23.1.42. Anisocytosis and polychromasia constantly present.	4.2.42	A dog suffering from piroplasmosis.	10.0 cc. subcut.	3	*B. canis* demonstrated regularly in daily smears for a period of 50 days. Up to 60% infection. 1, 2, 3, 4, 5, 6, 7 and 8 parasites in the erythrocytes. *B. canis* found again on 27.4.42 and 2.5.45. Rectal temperature continuously high and varied from 104° to 107°F over a period of 12 weeks. Average 105°F.	4.2.42 11.2.42 16.2.42 25.2.42 6.3.42 14.3.42	6.41 x 10^6 5.15 x 10^6 2.42 x 10^6 2.55 x 10^6 3.32 x 10^6 3.54 x 10^6	18,200 10,400 14,400 36,200 41,900 43,600	38 29 17 19 23 26	Marked anæmia accompanied by the presence of anisocytosis, polychromasia, Jolly bodies, erythrophagocytosis, normoblasts and icterus. No inappetence was noticed. Blood injected into two dogs mentioned below on 2.5.45.
Jackal 3871	7.1.42	Negative for *B. canis* until 6.2.42. *Hepatozoon canis* observed on 23.1.42. Anisocytosis and polychromasia constantly present.	4.2.42	A dog suffering from piroplasmosis.	10.0 cc. subcut.	3	The same observations were made as in case of Jackal 3870.	4.2.42 11.2.42 16.2.42 25.2.42 6.3.42 14.3.42	6.17 x 10^6 4.66 x 10^6 2.47 x 10^6 2.41 x 10^6 1.19 x 10^6 4.84 x 10^6	11,600 12,900 40.800 24,900 60,900 27,400	35 31 16 20 14 21	The same observations were made as in case of Jackal 3870. Blood injected into two dogs mentioned below on 2.5.45.
Jackal 3872	–	Not splenectomized.	12.2.42	Jackal 3870	10.0 cc. intrav.	2	*B. canis* demonstrated daily for 26 days and then	16.2.42 25.2.42 6.3.42	7.12 x 10^6 4.94 x 10^6 5.35 x 10^6	11,000 55,600 17,400	36 30 31	A comparatively mild anæmia and icterus de-

TABLE 2 — (Continued).

NUMBER OF ANIMAL	DATE OF SPLENECTOMY	RESULT OF SMEAR EXAMINATION AFTER SPLENECTOMY.	DATE OF ARTIFICIAL INFECTION	INJECTED FROM	DOSE OF BLOOD	INCUB. PERIOD IN DAYS.	RESULT OF SMEAR EXAMINATION AFTER THE ARTIFICIAL INFECTION.	BLOOD COUNT.				REMARKS.
								Date.	Erythrocytes.	Leucocytes.	Precipitate.	
							occasionally during the following 14 days. Up to 10% infection. 1, 2, 3 and 4 parasites in the erythrocytes. Smears examined negative on 27.4.42 and 2.5.45. Rectal temperature continuously high and varied from 103° to 107°F. Average 105°F.	14.3.42	5.34 x 10^6	16,300	32	veloped. No inappetence was noticed. Blood injected into 2 dogs mentioned below on 2.5.45.
Dog 5507	—	Fully susceptible. Not splenectomized.	2.5.45	Pooled blood of jackals 3870, 3871 and 3872.	2.5 cc. intrav. 2.5 cc. subcut.	6	*B. canis* demonstrated daily for 13 days. Up to 20% infection. 1, 2, 3 and 4 parasites in the erythrocytes. Typical febrile reaction.	—	—	—	—	Typical clinical symptoms of biliary fever developed. Dog died on 20.5.45. The post-mortem examination showed typical lesions of biliary fever.
Dog 5508	— —	Fully susceptible. Not splenectomized.	2.5.45	Pooled blood of jackals 3870, 3871 and 3872.	2.5 cc. intrav. 2.5 cc. subcut.	6	*B. canis* demonstrated daily for 11 days. Up to 20% infection. 1, 2, 3 and 4 parasites in the erythrocytes. Typical febrile reaction.	—	—	—	—	The same observations were made as in the case of dog 5507. Dog died on 18.5.45.

cytosis. Phagocytosed erythrocytes and piroplasms were frequently observed in the monocytes. There was a marked drop in the erythrocytic count and the blood precipitate, and a marked temporary leucocytosis. Haemoglobinuria was not observed. Despite the parasitic infection and the severe anaemia both the jackals made an uninterrupted recovery.

On the sixth day after the first appearance of the parasites in jackal No. 3870, blood from this animal was injected into the non-splenectomized jackal, No. 3872. After a period of two days *B. canis* appeared, and was demonstrable in the blood smears for twenty-six days. A mild anaemia and icterus developed. A temporary leucocytosis was noticed. No other clinical symptoms developed and the jackal recovered.

During the period of observation, which lasted approximately three months, it was observed that the three jackals showed a continuous hyperthermia varying from 103·0 to 107·0°F., with an average of 105·0°F. Whether this hyperthermia is normal for the jackal is difficult to state. It should, however, be mentioned that Nörr (1933) observed that the temperature of normal foxes varied from 100·5 to 107·0°F., with an average of 100·0 to 104·0°F. He ascribed this hyperthermia to the struggling and psychic influence. Schoop and Dediè (1938) record similar high temperatures from their foxes. The jackals used for these experiments were very timid and struggled tremendously when handled. It is, therefore, not surprising that their temperatures were high.

Although these results proved that the black-backed jackal is susceptible to *B. canis*, we regarded it as advisable to confirm this by transmitting the parasites of the jackals to the dog. These experiments, however, could only be undertaken approximately three years later, when an opportunity presented itself to procure susceptible dogs. The jackals were maintained in the kennel, but it cannot be stated with certainty whether they were naturally reinfected with *B. canis* during this interval. Whatever the case may have been, it was found that on the 2.5.45, i.e. more than three years after the artificial infection, *B. canis* could still be demonstrated microscopically in the blood smears prepared from the splenectomized jackals, but not in those from the non-splenectomized one.

Pooled blood of the three jackals was injected intravenously into two susceptible dogs (Nos. 5507 and 5508). The details of the observations are mentioned in Table 2. Both dogs showed the presence of *B. canis* six days later. They developed typical biliary fever symptoms and died after 18 and 16 days respectively. The post-mortem examination showed the usual biliary fever lesions.

This experiment gave further proof that the black-backed jackal is susceptible to *B. canis*. The parasite had not changed its virulence for dogs nor its morphology by passage through these carnivores.

Discussion.

Wenyon (1926) concludes from his review on the Babesidae of the carnivora belonging to the family Canidae "that as regards the validity of the various species described, this can only be decided by further investigations." The importance of this statement must be obvious to veterinarians and protozoologists investigating these diseases. It is the inadequate information and in many cases the complete lack of knowledge about the biological characteristics of these protozoa, that has led to the present confusion in the nomenclature. In our opinion it seems essential that some general agreement amongst workers engaged in these studies should be concluded. The demonstration of the susceptibility of the silver fox and the black-backed jackal justifies us in concluding that the opinion expressed by several protozoologists in the past, that *B. canis* is specific for the dog can no longer be accepted. These transmission experiments have shown that this parasite possesses the same biological characteristics as the other species of the family *Babesidae,* mentioned in Table 1. Furthermore, there is every reason to believe that this characteristic is also shared by the other *Babesia* recorded from the various species of the Canidae.

The confusion which has arisen in the nomenclature makes it necessary to discuss briefly the classification of the Babesidae recorded from the Canidae. In this connection the available information on the morphology, the susceptibility of the different carnivores, the immunological differences and the reaction to chemical compounds will be taken into consideration.

(1) There is no doubt that *B. canis* and *B. gibsoni* are distinct species. Besides the morphological and immunological differences there is the difference in the reaction to chemotherapeutics. Trypan blue is a specific for *B. canis,* but has no influence on *B. gibsoni.* Acaprin, on the other hand, has a specific action on both parasites.

(2) The various species of the Babesidae described in the Canidae, with the exception of *Rangelia vitalii* (Pestana, 1910) = *Babesia vitalii* are mentioned in Table 1. Doubt is expressed by Wenyon (1926) and by Doflein and Reichenow (1929), whether this organism is a valid species. They suggest that further investigations will show that this parasite is *B. canis,* and that the "endothelial forms" are either *Toxoplasma* or phagocyted micro-organisms. In view of the limited information about the characteristics of this micro-organism it is impossible to arrive at a definite conclusion at present.

(3) As far as *B. rossi* is concerned, only the morphology is known. Nuttall (1910) states that they are large and rounded, that the reproduction appears to be effected by simple division, and that from one to four parasites occur in an erythrocyte. On comparing the morphology and the mode of reproduction of *B. rossi* with that of *B. canis* no distinct differences could be detected. On the con-

trary, we have encountered parasites in dogs suffering from biliary fever in South Africa, identical to those described in the side-striped jackal from East Africa. It would seem that Nuttall (1910) was influenced by the conclusions of Lounsbury (1903) and Nuttall and Graham-Smith (1909) that *B. canis* is very specific for the dog, and hence the parasite of the jackal was regarded by him as a distinct species. The above-mentioned observations on *B. canis* suggest that *B. rossi* possesses the same biological characteristics. In view of this one must conclude that *B. rossi* is not a valid species and that it is a synonym of *B. canis.*

(4) The large piroplasm described by Yakimoff and Schokhor (1917) in wolves in Turkestan is said to be very common and to correspond morphologically with *B. canis.* Since it is known that *B. canis* is not specific for the dog only, one is justified in concluding that this parasite is identical with *B. canis.*

(5) The parasite recorded by Plimmer (1915) from a wild dog of India was placed by him in the genus *Babesia* but no specific name was given. Wenyon (1926) is of opinion that this parasite may possibly be the same as *B. gibsoni.* This view is probably correct since *B. gibsoni* is a common parasite of dogs and jackals in India.

(6) Yakimoff and Schokhor (1917) described a parasite which is morphologically indistinguishable from *B. gibsoni* in wolves in Russia. We believe that biological studies will show that this micro-organism is *B. gibsoni.*

(7) A small piroplasm has been recorded from a fox in Russia by Yakimoff and Schokhor (1917). They placed it in the genus *Theileria,* without any evidence of the existence of a schizogonous cycle. No description of the morphology is given, but the fact that they proposed the name of *Theileria* for this parasite indicates that it is a small organism. It is well known that individual parasites of *B. gibsoni* may be very small and that it is possible to confuse them with the large forms of *Theileria.* In view of this, it is possible that both the morphological and biological studies in future will show that the *Theileria* sp. of the fox is *B. gibsoni.*

(8) As regards *B. bauryi* only the morphology has been described. Leger and Bediér (1922) state that this parasite is small, and when division takes place four daughter cells are produced, which arrange themselves in the form of a cross. They concluded from their morphological studies that this parasite is distinct from either *B. gibsoni* or *B. canis,* and for this reason they proposed the name *B. bauryi.* In the case of *B. gibsoni* the micro-organisms may also arrange themselves in the form of a cross, when two parasites in an erythrocyte undergo binary fision at the same time. In these cases it is extremely difficult to ascertain whether one is dealing with a true maltese cross or not. The consideration of these facts clearly indicates that before

species of Babesia can be described accurately their entire life cycle and biological characteristics should be known. The inadequate information about this parasite suggests that further studies should be undertaken. It is possible that these investigations will show that *B. bauryi* in reality is the same as *B. gibsoni.*

Conclusions.

1. The technique employed for splenectomizing jackals is described.

2. It was possible to transmit *B. canis* to splenectomized and non-splenectomized black-backed jackals.

3. A marked anaemia and icterus was produced by *B. canis* in the splenectomized jackals.

4. A mixed infection of *Babesia canis* and *Rickettsia canis* in a very young jackal terminated fatally.

5. *B. canis* did not change its morphology and its virulence for dogs after having been passaged through jackals.

6. The opinion expressed by several protozoologists that *B. canis* is very specific for the dog can no longer be accepted.

7. It is stressed that before species of *Babesia* are described their entire life cycles and biological characteristics should be known.

8. In view of the confusion which has arisen in the nomenclature, we suggest the following classification for the *Babesia* of the Canidae.

Family: Babesidae, Poche, 1913.

Babesia canis. (Piana and Galli-Valerio, 1893). Synonyms:

Piroplasma canis. (Piana and Galli-Valerio, 1893). *Piroplasma rossi* (Nuttall, 1910); *Rossiella rossi* (Nuttall, 1910), and *Babesia rossi* (Nuttall, 1910).

Babesia gibsoni. (Patton, 1910). Synonyms: *Piroplasma gibsoni,* Patton, 1910; *Theileria* sp. Yakimoff and Schokhor, 1917; *Nuttallia bauryi,* Leger and Bediér, 1922.

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RECOMMENDED NUTRITIVE ALLOWANCES FOR DOGS

J. W. GROENEWALD,
Onderstepoort.

The wide range in breeds of dogs, sizes and purposes for which they are kept, makes it almost impossible to give the nutritive requirements in accurate tabular form. Similarly, the relative difficulty of measuring work or performance in the dog, will be appreciated. However, the recommended nutritive allowances of dogs can readily be met by using properly selected foods of good quality and above all by using discretion in applying the available knowledge in regard to such requirements. Do not simply use the family dog as the second garbage can.

Although dogs vary considerably in regard to the amount and kind of food that will give the best results, the approximate daily amounts to feed the mature working animals would be:—

Live weight lbs.	Total feed on wt. basis lbs.	Food per lb. live wt. ounces.
1	$\frac{1}{8}$	2·0
10	$\frac{3}{4}$	1·2
25	$1\frac{1}{2}$	0·9
50	$2\frac{1}{2}$	0·8
75	$3\frac{3}{4}$	0·7
100	4	0·6
150	$5\frac{1}{4}$	0·5
225	7	0·5

It is not the intention to discuss the various foods which may be suitable in the diet of dogs. However, one proved example will be given in order to compare it with the actual requirements considered to be optimum in the daily ration.

At the Police Dog Training Depôt, Quaggaspoort, mature, hard-working dogs that weigh about 50 lbs., are fed a diet of 1 lb. of mealie meal porridge and 1 lb. of raw meat per day. Part of the meat, consisting chiefly of the bone is used for soup. When the soup is ready, grated vegetables consisting of carrots, beans, cabbage and rape are put into it. The vegetables are never allowed to simmer for longer than 15 minutes. Part of the vegetable soup is then poured over the fairly stiff porridge. In addition the dogs receive about an ounce of kaffir corn beer waste. This wet brewers' grain is steamed separately for a few minutes and a little put over the food. If vege-

tables are not available, green lucerne tops are used. The soup and porridge mixture is naturally flavoured with salt.

The bones are put into the kennels where the dogs are allowed to crunch them. All dogs are fed three times a day.

It may be assumed that 2½ lbs. of the ration is fed to each dog daily, which would result in a nutritive intake of approximately:—

Protein gms.	Fibre gms.	CaO gm.	P_2O_5 gm.	Vit. A. I.U.
105·5	4·85	8·36	6·6	2000

Thiamin microgm.	Riboflavin microgm.	Nicotine Acid microgm.	Pantothenic acid microgm.
1100	3500	21000	6800

Although the ration appears to be adequate and has actually proved very satisfactory, greater variation could be effected by the occasional inclusion of raw liver, paunch and entrails. It has ,for instance, been found that about a quarter of a pound of cooked beans, especially soya beans, would not only be beneficial, but prove of assistance in the saving of meat, as less meat may then be used in the ration.

The figures indicating the daily amount of the most important nutrients consumed, compare very favourably with those recommended for dogs, which may be listed as:

PROTEIN. On a moist basis, the diet should contain 10%, or dry basis 20%, of protein. If possible, approximately 50% of the proteins (moist basis) should be derived from meat or meat products, eggs, fish or milk. However, it is not absolutely essential that all the proteins be derived from animal sources, as long as the essential amino acids are present. Several amino acids appear to be of great importance to the health of dogs. The dog is distinctly limited in its capacity for producing glycine for detoxication purposes.

It is not advisable to feed rations which contain more than 25% protein during warm weather, because proteins have a specific effect in the increase of body heat. Too low a protein diet may, on the other hand, be associated with the development of peptic and duodenal ulcers.

FIBRE. The ration should contain about 0·5% fibre, on the moist basis. A certain amount of bulk in the nature of vegetables is essential for a healthy laxative diet.

CARBOHYDRATES. On a moist basis the proportion of carbohydrate to protein plus fat should approximate a ratio of 2:1. Although too high a percentage of starch may be overheating and

constipating, there appears to be no evidence that it is in itself the cause of hysteria.

FATS. The moist diet should contain approximately 3 to 5% fat in order to provide energy and essential fatty acids. Moderately fat meat may suffice, or if dry meat meals are used some additional fat will be necessary. A low fat diet is apt to cause a flaky dermatitis. If the fat intake is raised in order to get a good glossy coat, it would be advisable to also raise the protein, especially methionine and choline, in order to prevent fatty cirrhosis of the liver.

MINERALS. (Dog weighing 50 Lbs.). The most important minerals for the dog appear to be calcium, phosphorus, sodium, chlorine, iron and copper. The actual amount appears to be of less importance than the ratio of $CaO : P_2O_5$ which should approximate 1·2 : 1.

The following approximate values may be used as a guide:

CaO	4·2 gms.	Fe	0·007 gms.
P_2O_5	4·0 „	Cu	0·002 „
NaCl	5·0 „	Mn	0·005 „
K_2O	3·8 „	Zn	0·002 „
MgO	0·5 „	I	0·005 „

Numerous investigations have been directed towards the haemoglobin regeneration in dogs after haemorrhage. These, together with the response to nutritional anaemia, indicate that maximum regeneration is not obtained by administering iron and copper only. Better results appear to be obtained if the presence of the B-Complex is assured.

VITAMINS. (Dog weighing 50 Lbs.).

Vitamin A — "Carotinol"	Vit G 1000 to 2000 microgm.
Vitamin B1 — Thiamine — Aneurin ...	1750 I.U.
Vitamin B2 — Riboflavin — Lactoflavin	625 to 1250 microgm.
Vitamin P.P. — Nicotinic Acid — Niacin — Niacin Amide	5000 to 10000 microgm.
Pantothenic Acid — Filtrate Factor ...	2500 microgms.

The vitamin requirements for dogs may easily be met if fish liver oils, yeast, 2 to 5% yellow vegetables or lucerne leaf, 1 to 5% liver, hearts and kidneys are fed at such times as any of these products may become available.

FOOT AND MOUTH DISEASE IN GAME

L. W. ROSSITER AND A. A. L. ALBERTYN,
Barberton.

In November, 1944, foot and mouth disease was diagnosed in cattle on farms adjoining the Crocodile River in the Barberton district for the third time within a decade. It was subsequently encountered in the Toulon Block, west of Skukuza, in December, 1944, where its rapid spread westwards in the Bushbuckridge Ward, in the Pilgrimsrest district, could be accounted for by cattle movements, as also its spread into the Letaba district, just north of the Olifants River.

A quiescent period of several months followed, and then all of a sudden the disease broke out on several farms just south of the Olifants River and to the east of the Selati Railway Line. This was very puzzling as spread by cattle movements could definitely be excluded.

The source of the infection caused a great deal of speculation by veterinarian and layman alike, and although no positive proof existed it was generally felt that game in the Kruger National Park was responsible for the initial outbreaks and for the subsequent spread of infection in the absence of cattle movements. In order to establish this point, it was decided to shoot and examine game on farms that had just become infected, it was thought, through game. The method used was a rather haphazard one, namely to shoot any animal offering a fairly easy target. The tongue, lips, gums and feet were then carefully examined. The following table records the number of each species so shot and examined and the lesions found:—

Species	No. examined	Tongue Lesions	Foot Lesions
Impala *(Aepyceros melampus)*	35	2	2
Kudu *(Strepsiceros strepsiceros)*	9	1	1
Waterbuck *(Cobus ellipsiprumus)*	5	2	—
Sable antelope *(Ozanna grandicornis)*	4	1	—
Blue Wildebeest *(Connochaetes taurinus)*	10	—	—
Tsessbe *(Damaliscus lunatus)*	2	—	—
Steenbuck *(Rhapicerus campestris)*	2	—	—
Warthog *(Phacochoerus aethiopicus)*	2	—	—
Reedbuck *(Cervicapra arundinum)*	1	—	—
	70	6	3

No tongue and foot lesions were encountered in the same animal with the exception of one impala which showed definite foot lesions approximately six weeks old and an indefinite scar on the tongue. In other words, eight or about 9% of game shot at random in this area was found to show lesions. This corresponds very closely with the results obtained in California, when out of 22,214 deer shot or destroyed, some 2,279 were infected or had been infected. Keane (1927) and Walker (1934) saw foot lesions corresponding to those seen in cattle, in wildebeest, in Bechuanaland Protectorate, but there were no tongue lesions. Du Toit (1932) mentions an infected kudu and the infected feet of a bush pig in Southern Rhodesia.

Of the animals shot, only three cases were considered fresh enough to justify sub-inoculation into guinea pigs. One was a young waterbuck heifer with a fresh healing lesion on the tongue, and the other a young kudu bull with a fairly fresh foot lesion. The results were negative. The third case was a young impala ram shot on the farm Rome 181, on the Olifants River, on 6.7.45. The animal appeared quite healthy, as did the rest of the troop (± 15); on examination five small lesions varying in size between 0·25 and 0·5 cm. were seen on the anterior dorsal surface of the tongue but no lesions were noticed on the gums or feet. The tongue was excised and wrapped in a portion of the animal's skin and taken to camp where a concentrated suspension was made of deep scrapings of the bottom and sides of the lesions in 0·5 ccs. of normal saline. A few drops were inoculated into the pads of the right hind feet of three guinea-pigs, B, C, and D, whilst a fourth, A, was kept as a control. B and C showed definite vesicles at the site of inoculation sixty-six hours later, whilst D (and A) showed no lesions then or later. One hundred and fifty hours after inoculation B and C showed in addition vesicles on the pads of the left hind feet but no lesions elsewhere. On 9.7.45, i.e. twelve hours after the first formation of vesicles in B and C, some of the vesicle fluid was aspirated from the lesions in both guinea-pigs, pooled and inoculated into the pad of the right hind foot of guinea-pig E. Twenty-four hours later this guinea-pig showed a reddening, and the initial stage of a vesicle along the needle track, whilst at forty hours after inoculation a large vesicle had formed; no other lesions were noticed. Concurrently inoculations into guinea-pigs were done with material from infected cattle and the lesions so obtained in guinea-pigs were identical with those seen in guinea-pigs B, C and E, i.e. those reacting to the impala virus. An attempt was made to pass the impala virus back into a bovine, but owing to a series of unfortunate accidents the virus was lost.

The Director of Veterinary Services, Southern Rhodesia, reports in 1937 that fresh foot and tongue lesions were observed in a kudu and that three susceptible cattle that were injected reacted typically,

furnishing evidence that the kudu virus was that of foot and mouth disease. He further discusses the very important part played by game in the recrudescences of the disease, many of which coincided with movements of cattle to fresh grazing grounds or watering places, or with the seasonal movement of game. In Northern Rhodesia outbreaks are recorded in which infection by domestic stock played no part (De Kock, 1946).

Roualeyn Gordon Cumming, one of the earliest big game hunters in Southern Africa, describes how in 1848 his oxen were attacked with either "tongue or hoof sickness," with lameness and loss of condition. According to his diary these oxen had not been in contact with any other cattle for weeks previously, but had freely mixed with the vast herds of blesbuck which he encountered near the junction of the Vet and Vaal Rivers (Cumming, 1904).

The question arises as to whether or not foot and mouth disease has not now become endemic in game in Southern Africa, and from the evidence at our disposal it would appear that the answer is in the affirmative.

It appears therefore abundantly clear that game can and do get foot and mouth disease, and that game can and do transmit the disease to cattle. This means that game from the Kruger National Park were responsible for the outbreak of foot and mouth disease in the Barberton and Pilgrimsrest districts during 1944-45. The disease passed slowly through the scattered herds of game, as it was six months after lame game had been seen in large numbers on the Crocodile River in the Park, and foot and mouth disease was diagnosed from the few specimens recovered (De Kock, 1946) that it was established in game on the Olifants River, a distance of some 110 miles, even assuming that the disease had travelled due north, which is unlikely.

Owing to over-grazing and the lack of suitable and sufficient watering facilities in the Kruger National Park, there is a big westward migration into Portuguese territory (Stevenson-Hamilton, 1937). Under these circumstances, therefore, where contact between game and cattle is so very likely, foot and mouth disease can always be expected in those areas adjacent to the Kruger National Park until such time as an effective and efficient barrier is erected to separate game from cattle completely.

Summary.

The results of subinoculation into guinea-pigs with foot and mouth virus obtained from an impala are given.

The game factor in the incidence and spread of the disease is discussed.

ACKNOWLEDGMENT.

Thanks are due to Mr. Paul Ahlers, of Pilgrimsrest, for his public-spirited action in allowing this shooting on his farms Rome 181, Brussels 169 and York 168, without which these observations would not have been possible.

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CYSTICERCOSIS OF THE IMPALA OR ROOIBOK (Aepyceros Melampus) WITH REFERENCE TO MEAT HYGIENE

G. MARTINAGLIA,
Assistant Director, Abattoir and Livestock Market Dept., Johannesburg,

and

F. A. BRANDT,
Department of Pathology, South African Institute for Medical Research.

The occurrence of cysticerci (measles) in the flesh of game has been noted by Le Roux, Ortlepp and others on various occasions, but little is known of the natural history of these parasites. Recently, a minor problem arose, when measles were found in blue wildebees (*Connochaetes taurinus*) and impala (*Aepyceros melampus*) during meat inspection, by the Public Health Department, at the Johannesburg Market.

After restricted shooting during the war period, a large consignment of game, particularly impala, had been sent to the market. Careful

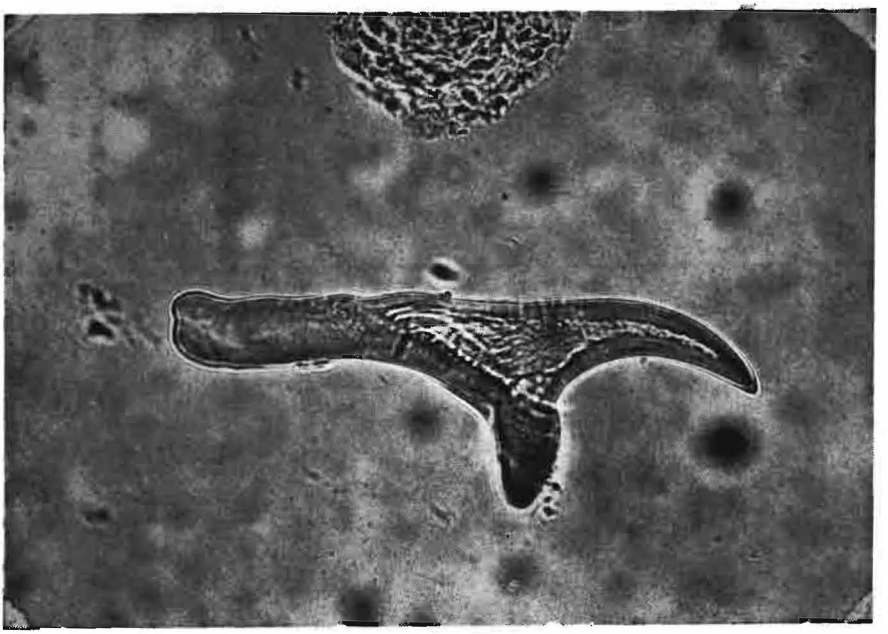

Fig. I. — *Photomicrograph of a large hooklet of the cysticercus of the impala. Not stained.* (× 500).

and systematic examination of the antelope revealed infested carcases which were condemned as unfit for human consumption. None was detained, as there was no information available as to how these cysticerci would remain viable under cold storage and freezing conditions. There was uncertainty, too, as to whether this might be a new species or one of the known species from domestic animals.

Cystercus bovis was eliminated as it is unarmed, while the cystercerci of the impala possess a prominent double row of hooks.

The elbow cut proved a valuable site for the detection of game

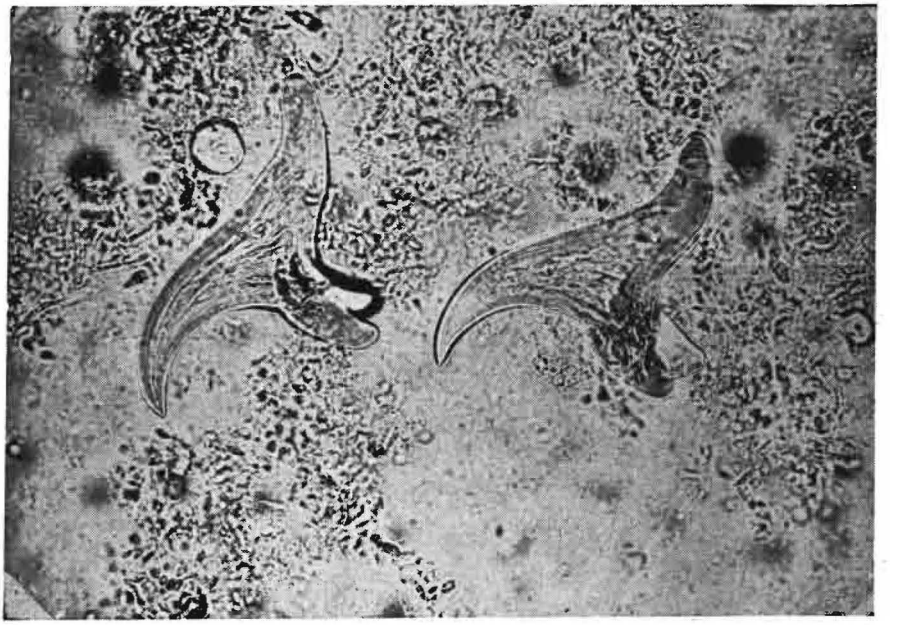

Fig. II. — *Photomicrograph of two small bifurcated hooklets of the cysticercus of the impala. Not stained.* (× 500).

measles, even in cases where the muscle infestation was very low. In the impala the masseter muscles are not so well developed as in bovines and are not such a good predilection site as the elbow. In eight measly impala examined, the elbow cut was primarily positive and cysticerci were found in the tongue once, psoas muscle once, and in the intercostal muscles twice. When condemned carcases were cut up, measles were found in the shoulder and gluteal muscles in all cases. In only one case out of eight were more than five measles detected in th secondary shoulder cuts. This warranted condemnation under the Union Public Health Regulations.

During the shooting season, the impala is the commonest buck sent to the market. It is as familiar in the lowveld as the blesbok and springbok are in the highveld and plains of the Orange Free State.

The chances of the impala becoming infested with cysticerci are favourable as, in certain regions, they come in contact with a great variety of wild carnivora. The impala under consideration were shot at Stegi in Swaziland, and the farmer informed us that recently a cheetah had been destroyed on the farm.

A dog about two years of age was kept under laboratory conditions and fed with impala meat in which cysticerci were present. It was then given the usual diet and kept under observation for over ninety days, when it was given arecoline, per os. Ascarids and hookworms were expelled, but no tapeworm segments were observed. Fourteen days later the dog was humanely destroyed. Autopsy revealed the prsence of the nematodes already mentioned, but not of tapeworms.

It is possible that the dog is not susceptible, as it is not likely that the cysticerci in the flesh of game would die, under winter conditions, within three to four days.

The little doubt we had as to its relation to *Cysticercus* and *Cysticercus cellulosae* of the sheep and pig respectively, was soon dispelled

Fig. III. — *Photomicrograph of the cysticercus of the impala in section. Stained Haematoxylin-Eosin.* (× 180).

when the biology of these parasites was taken into account and their hooks compared with those of the cysticerci in question. The possibility exists that these cysticerci may infest cattle, as an unusual measle was encountered at the Johannesburg Abattoir in 1932 (Martinaglia, 1937). The cysticerci were armed and unlike the bovine bladder worm. On

further identification, Dr. Mönnig, of Onderstepoort, considered the hooks of this cysticercus closely resembled those of *Taenia hyaenae*, a known tapeworm of hyenas.

Up till now, much more attention has been paid to the cestodes of carnivores than to cysticerci of antelopes.

Baer described *T. regis* (1923) from a lion and *T. hyaenae* (1927) from a hyena. Ortlepp (1936) in a comprehensive article described *T. bubesei* and *T. gonyamai* from lions, *T. ingwei* from leopard, *T. hlosei* and *T. acinomyxi* from cheetahs and *T. jakhalsi* and *T. pungutchi* from jackals. The hooklets of all the above mentioned *Taenias* were carefully compared with the hooklets of the impala cysticercus, but the hooklets of the former all differ from the hooklets of the latter in several essential features, *T. hyaenae* showing the closest resemblance. We have thus come to the conclusion that the adult form of the impala cysticercus has not yet been recorded. We suggest the name *Cysticercus impalae* for this immature form of the unknown tapeworm. Its distinguishing characteristics are given in the attached micro and macroscopic findings, table and diagrams.

Further study of this game measle by parasitologists and veterinarians in the field should help to identify and place it in its proper

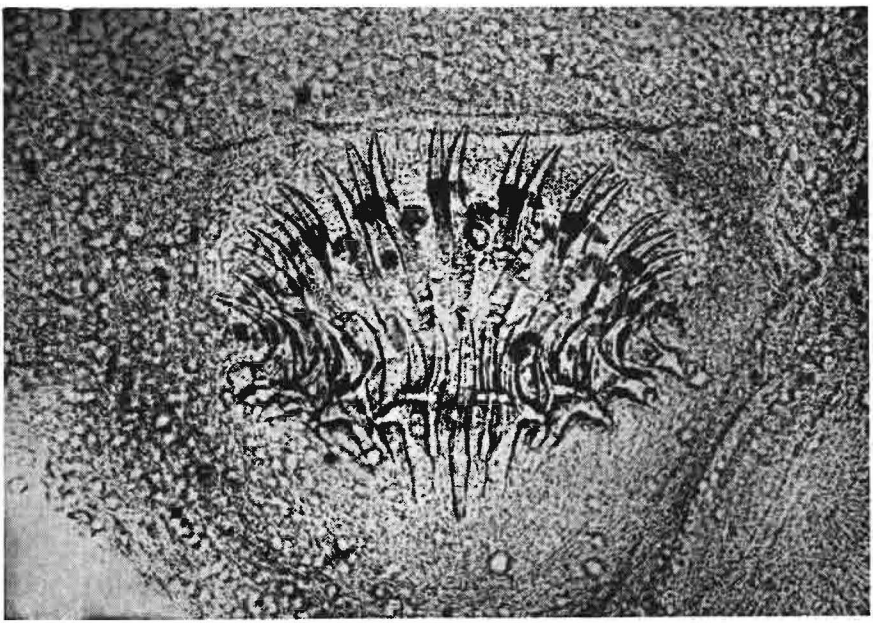

Fig. IV. — *Photomicrograph of a complete head of the cysticercus of the impala, crushed, but not stained, showing the hooklets.* (× 180).

zoological relationship to the natural host. Intensive investigation of the Taenias infesting the lion and scavengers of the wilds such as the hyenas, seems to be indicated.

The cysts found were intramuscular, resembling very closely those of *C. cellulosae*. The vesicles were covered by a thin, semi-transparent wall, slightly pointed at both ends and filled with a clear fluid. The average size of the complete cyst was 8 m.m. × 4·5 m.m. One or two cysts were slightly larger, especially one found on the external surface of the muscle, which measured 9·5 m.m × 4·5 m.m. The cysts are macroscopically indistinguishable from *C. cellulosae*. Microscopic examination of the scolex showed four prominent suckers and a double row of hooklets. The hooklets were of two sizes and differed essentially from those of *C. cellulosae*.

The larger hooklets had a relatively long handle, which was straight and strong. The guard was prominent, pointed and showed a slight convexity on the blade side. The blade was moderately curved and of very robust construction (Fig. 1).

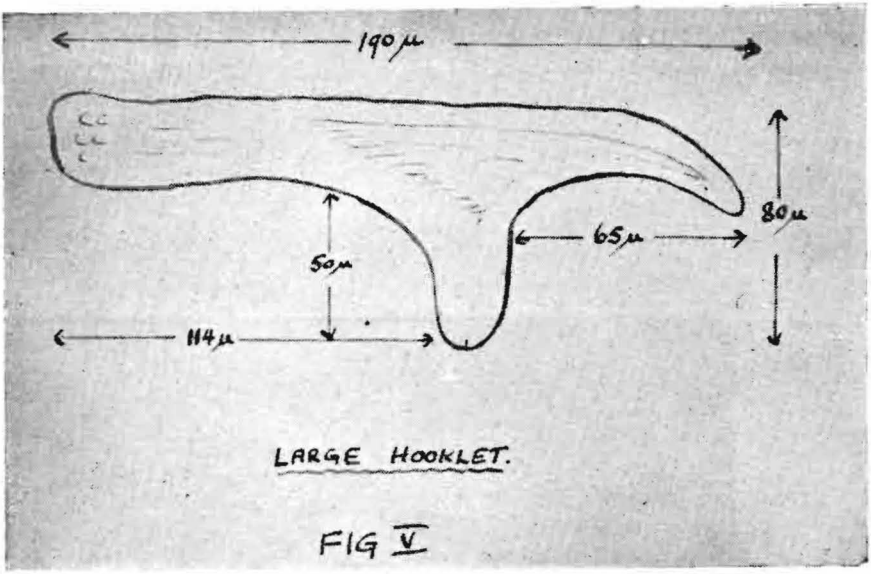

Fig. V. — *Diagram showing measurements of the large hooklet.*

The guard of the smaller hook was in most cases deeply cleft. The handle was short, pointed and curved backwards. The blade was curved to about the same extent as that of the larger hooklets, but not so strongly constructed (Fig. II).

Serial sections of the cysticercus *in situ* in the muscle showed a typical inverted scolex (Fig. III).

The measurements of the hooklets illustrated in Fig. I and Fig. II are given in Fig. V and Fig. VI.

Fig. IV illustrates the crushed, unstained head of the cysticercus

of the impala, partially cleared in glycerine, with the complete set of hooklets.

The average number of hooklets found in a large number of *C. cellulosae* cysts examined was 26, whereas in the cysticercus of the impala the average was 32. The large hooklets of *C. cellulosae* measured 170 m.microns as compared to 190 m.microns of the cysti-

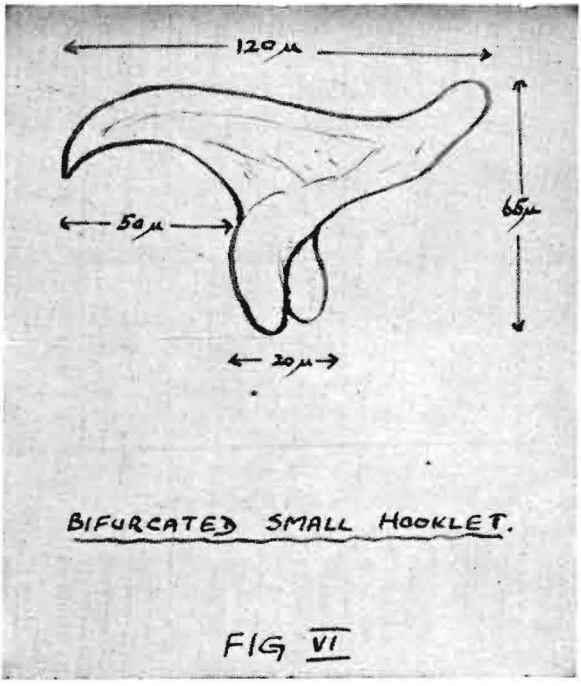

Fig. VI. — *Diagram showing measurements of the small hooklet.*

cercus of the impala. The small hooklets of *C. cellulosae,* on the other hand, were 18 to 20 m.microns larger than those of the cysticercus of the impala. True bifurcation of the guard of the small hooklets of the cysticercus of the impala was characteristic, while the nearest approach to bifurcation in *C. cellulosae* hooklets was a slight groove in the guard.

A comparative table, showing the salient features of common bladderworms, is included. Unarmed scolices (e.g. *C. bovis*) are not included.

Comparative table of Armed Bladderworms.

NAME.	COMMON SITE.	PRIMARY HOST.	SECONDARY HOST.	AVERAGE NUMBER OF HOOKLETS.	AVERAGE SIZE OF LARGE HOOKLETS.	AVERAGE SIZE OF SMALL HOOKLETS.	SIZE OF COMPLETE CYST.	NUMBER OF HEADS IN CYST.	OCCURRENCE IN SOUTH AFRICA.
C. cellulosae	Intra-muscular	Man	Pig, etc.	26	170μ	128μ	Small	One	Common
Cysticercus of impala	Intra-muscular	?	Impala	32	190μ	110μ bifurcated	Small	One	Fairly common
C. tenuicollis	Peritoneal and thoracic cavities	Dog cat ? jackal	Pig, sheep duiker springbok impala, etc.	30	195μ	135μ	Very large	One	Common
C. ovis	Intra-muscular cardiac	Dog	Sheep goat	30	170μ	110μ	Small	One	Very rare
C. pisiformis	Mes-entreric liver	Dog, cat, tiger fox, etc.	Rabbits, hares, etc.	40	260μ	150μ bifurcated	Small	One	Common
C. fasciolaris	Liver	Cat fox lynx, etc.	Rats mice squirrel	34	400μ	260μ	Small	One evaginated scolex	Common
C. tarandi	Intra-muscular	Dog	Reindeer	30	160μ	100μ			
M. multiceps	Neural	Dog fox jackal	Sheep, occasionally in man	28	160μ	110μ	Large	Numerous	Common in sheep, rare in man
M. serialis	Sub-cutaneous intra-muscular	Dog	Rabbits hares	30	155μ	100μ	Large	Numerous	Common

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DIABETES MELLITUS IN A DACHSHUND BITCH

W. D. MALHERBE,
Onderstepoort.

The dog has for many years been the subject of choice for research into diabetes mellitus, and the literature of this disease contains numerous references to cases produced by injections of alloxan, anterior pituitary extract, and other substances acting more or less directly on the pancreatic islets. Reports on the subject of naturally occurring diabetes mellitus in dogs have, however, only occasionally appeared in the veterinary press. The impression gained is that it is an extremely rare condition in this animal.

Milks and Stephenson (1937), Parkin and Graf (1938), and more recently Vine (1946) and Russo (1946) have expressed the opinion that the disease probably occurs more frequently than is shown by the reports, for, in the absence of urinary examination it is quite possible that its presence may remain undetected. Against this, however, it may be stated that in the small animal clinic at Onderstepoort, diabetes has been diagnosed in only five cases, including the one to be described, in a total of the order of 2,500 dogs examined over a period of 10 years. In the majority of these dogs urinary examinations have been carried out as a routine, even when there was no particular indication for this procedure, the diagnosis being obvious or established.

Reduction of the copper sulphate in Sheftel's or Benedict's Reagents has been seen on numerous occasions in a variety of conditions, and in most of these glucose could not be demonstrated by the fermentation test. A positive reaction to these reagents can therefore only be regarded as an indication for further examination. Even when glycosuria is confirmed, a definite diagnosis of diabetes mellitus is still not justified. Confirmation must be sought in blood sugar determination. The reason for this is that transient glycosurias sometimes occur in association with renal and possibly hepatic conditions. This fact is significant from the point of view of prognosis.

A recent case in point was a Dobermann dog, 9 months old, reported on by the veterinarian in attendance. Urine examination showed a high specific gravity (1045 – 1055) and glycosuria. Associated with this, there was advanced posterior paresis. Insulin treatment caused the sugar to disappear, but there was no improvement in the paresis or the general condition. The dog was admitted to

Onderstepoort for treatment about six weeks later. Repeated examinations after admission did not reveal the presence of sugar or other abnormalities in the urine.

Case Report

On 12.6.'46 a purebred Dachshund bitch, five years old, was presented, with the following history: She had produced a healthy litter of five pups three months previously. About a month after whelping, she was noticed to have developed a voracious appetite and a tendency to scavenge. At the same time she started suffering from incontinence of urine. She lost her former keenness for exercise and became increasingly lethargic. A day or two before presentation portions of her mammary glands had been noticed to be tense and sensitive to the touch and these proved to be developing abscesses.

She had been a good specimen of her breed and had even been a prize-winner. On examination her back gave the impression of weakness by sagging behind the shoulders. The abdomen was flaccid and pendulous. The skin, previously sleek and healthy, was unthrifty and dry to the touch. There were small patches of alopecia not associated with parasites or fungi. All the skeletal muscles lacked tone. Dehydration was well advanced.

The abscesses, which were obviously causing extreme discomfort, were lanced immediately. Urine examination showed the presence of albumen. Sheftel's test gave a strongly positive reaction, as did Rothera's for ketone bodies. Glycosuria was confirmed by very rapid evolution of gas with yeast fermentation. The centrifuged deposit was large in amount and consisted mostly of granular kidney casts. The specific gravity for some unexplained reason was within the normal range.

Examination of the blood revealed plasma markedly milky in appearance (lipaemic). The non-protein nitrogen figure was 40 mg per 100 cc. and blood glucose 240 mg per 100 cc. of blood. Uraemia could thus be eliminated and a diagnosis was made of diabetes mellitus.

The prognosis was considered to be hopeless, but, nevertheless, treatment with insulin was undertaken for the information to be gained and for sentimental reasons. The abscesses, however, soon involved the entire mammary tissue, and penicillin had to be used in addition. The patient refused to eat or drink anything, and by midday on 15.6.'46 toxaemia and dehydration were so advanced as to make further treatment useless.

Autopsy

The post-mortem examination showed marked lipaemia (the blood having the appearance of gravy), chronic catarrhal enteritis, advanced fatty changes and passive congestion of the liver, pulmonary oedema and degenerative changes of the kidneys. The abscesses showed indications of granulation. The pancreas appeared to be normal.

Histopathology

The LIVER showed severe venous stasis. In the central area of the lobules the hepatic cells were infiltrated with fat to such a degree that the cytoplasm had entirely lost its basophilic staining reaction. The cells of the periphery of the lobules were considerably infiltrated but to a lesser extent than those of the central area.

The SPLEEN showed decreased lymphopoietic activity.

The KIDNEYS showed degenerative changes in all the tubular epithelial cells with fatty changes in the more distal elements. Small interstitial accumulations of cells of the plasma cell type indicated early nephritic changes.

Of the PANCREAS the acinar structure was normal, but the islets of Langerhans were markedly atrophic and the few cells remaining consisted of little more than small nuclei with slack cell membranes loosely surrounding them. Occasionally some nuclei appeared to be naked.

Discussion

The normal microscopic appearance of the pancreas, and the histological demonstration of normal acinar structure, when considered with the evidence of gross liver changes, gives rise to speculation on the rôle played by the liver in the pathogenesis of diabetes mellitus. Mallory (1923) makes the rather categorical statement that cell changes of the pancreatic islets, such as described in the present case, are "unquestionably to be regarded as the result of diabetes, not the cause of it." More recently Soskin and co-workers (1934, 1935, 1938) in a series of studies have shown that the presence of a normal liver is essential to the metabolic reactions which determine the normal dextrose tolerance curve. The pancreas was formerly regarded as providing the body's sole response to increased sugar intake, by secretion of more insulin. They state that "in the presence of a sufficiency of insulin, but not necessarily an extra secretion from the pancreas, the normal liver as one of its responses to administered dextrose, decreases the output of blood sugar, which it has been supplying from its own resources." In their experimental work, diphtheria toxin was used to produce the liver damage, but the literature now contains abundant evidence that with long continued vitamin B complex deficiencies there can be a significant impairment of hepatic response to endogenous insulin and the consequent development of diabetes. Biskind and Schreier (1945) have carefully weighed a considerable amount of evidence and have been able to show in the light of the response of 94 unselected diabetics to intensive Vitamin B complex therapy, that this complex should play a most important rôle in the therapy of diabetics. It has been shown conclusively to be capable of the important function of protecting the liver from structural and functional impairment.

It has consequently been claimed that a rational line of therapy in cases of diabetes would be to combine large doses of B complex with insulin injections in the hope of producing cures. According to Biskind and Schreier, this has actually been achieved in a number of their patients who have survived after reduction of insulin dosage and even cessation of insulin therapy.

In many instances, however, there is complete destruction and even disappearance of the entire pancreas. In these, this Vitamin B method of treatment would be foredoomed to failure. Milks and Stephenson (1937) and Parkin and Graf (1938) give descriptions of such cases.

In the case described above, any attempt at cure was prejudiced from the start by the intercurrent state of toxaemia as a result of the secondary abscesses.

Summary

1. In the Onderstepoort small animal clinic diabetes has been found to be a rare condition in dogs.

2. The criteria for diagnosis are discussed.

3. Clinical, post-mortem, and histopathological details are given of a case of diabetes in a Dachshund bitch.

4. The pathogenesis of diabetes in dogs is discussed in the light of newer knowledge on the rôle played by the liver in carbohydrate metabolism.

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SPIROCHAETOSIS OF PIGS

A. S. CANHAM,
Allerton Laboratory, Pietermaritzburg.

In the Sixteenth Report of the Director of Veterinary Services, published in August, 1930, there appeared an article entitled: "A short note on the Spirochætal wound infection in Pigs," by Neitz and Canham. Since that time many outbreaks of this disease have been seen. Apparently the lesions described, viz., those of the limbs, testicles and the large ulcers of the skin, are the ones most commonly found among pigs in the Union.

Occasionally an outbreak of this disease is seen, where the site of the lesions is unusual. A number of young pigs, varying in age from two to four months, were brought in from the Greytown area, showing oval superficial ulcers round the eyes, and extending on to the face. At this early stage each ulcer was well demarcated. The pigs were in fair condition, ate readily, and, apart from the skin lesions, were in apparently good health. After the ulcers had been cleaned, scrapings were made, and microscopical examination of them revealed many spirochætes and the usual accompanying fusiform organisms. Inquiries as to the presence of the usual lesions in the remaining pigs on the farm elicited the information that all the other pigs were healthy. These affected pigs soon recovered when the ulcers were treated daily for a few days with a 1·4% solution of Cooper's Double Dipping Powder. The affected pigs were of the Large White variety.

It is interesting to note that Dodd (1906) described another cutaneous form of spirochætosis in pigs in Pretoria. The lesions took the form of small, circumscribed, superficial ulcers about three-quarters of an inch in diameter, which were found over the whole body. The ulcers showed no tendency to spread at the edges. All the animals affected were white-skinned animals. Spirochætes were found in scrapings from fresh lesions. No mention was made of any fusiform organisms being found. All lesions eventually healed up, but the pigs gradually lost condition. They were mere skeletons at the time of death.

The next outbreak to be reported also originated from the New Hanover area in a group of Large White pigs, which were about six months of age. There was a heavy infestation of lice, but the outstanding lesions were hæmatomata of the ears in some, while other pigs showed shrunken ear-flaps. The owner had, in these cases, opened the hæmatoma with resultant shrinking of the flap. Smears from the discharge from such wounds revealed spirochætes, fusiform organisms and cocci. In an attempt to make sure that spirochætes

were the cause of these hæmatomata, the ear-flaps were first cleaned and the swellings punctured with a sterile needle. Smears were made from the liquid obtained and stained with Giemsa, but no spirochætes or other organisms could be seen. The swellings were then opened up and the contents evacuated. Within twenty-four hours a thick discharge escaped from the wounds and in this discharge were found spirochætes, fusiform organisms and cocci. These cases cleared up eventually with ordinary wound treatment, but the ear-flaps became shrunken and deformed. Photographs are given showing hæmatomata and the shrunken ear-flaps.

It is doubtful whether the spirochætes caused the original condition; the more likely supposition is that they were secondary invaders, lice, through irritation, being the predisposing cause.

The last two outbreaks to be described are probably true cases of Spirochætosis of the pig.

CASE 1.

History: Two weaners, Large Black pigs, were brought to the laboratory showing peculiar skin lesions, which were found on the face, the neck, and in the perineal region. The lesions were round in shape, while others were eliptical. They had the appearance of a calf ringworm lesion, the scabs being dry and somewhat asbestos-like in

Fig. 1. — *Head of pig showing shrunken right ear-flap as a result of opening hæmatomata of ear.*

appearance. It is probable that these were old lesions. Ticks, resembling the Brown Tick, *Rh. appendiculatus,* were present in addition to some fleas and lice. The pigs themselves, apart from the

lesions, appeared healthy in that they ate well and took an interest in their surroundings. Treatment of the lesions with sulphur ointment cleared them up.

Microscopical examination: Scrapings were made after the scabs had been removed. Examination of these smears showed a fair number of eosinophile leucocytes, together with cocci, but nothing resembling fungi or spirochætes could be seen. Blood smears were also made. These showed small bodies in some of the cells resembling Jolly bodies. This was not unusual, as smears from many pigs show these bodies. In addition, some cells showed faintly staining, small, ring-like bodies. They may have been Cabot's-ring bodies or some stage in the life cycle of a parasite.

Fig. 2.—*Pig showing shrunken ear-flap.*

Biological examination: Blood was taken directly from the heart of one of the infected pigs, and into each of two young weaners, obtained from the local Mental Hospital, 100 cc.'s of this blood was injected subcutaneously at the back of the ear. They were temperatured daily, and blood smears were made at the same time.

(a) *Pig* (*i*): The temperature fluctuated for the first few days

and then fell to normal. From the ninth day temperatures began to rise gradually up to the fourteenth and fifteenth days. It then dropped gradually to the seventeenth day. This rise and fall was repeated until the close of the experiment. Spirochætes were first observed on the ninth day. They were fairly short and thick and had from two to three spirals. They measured from 3μ to 10μ and were much thicker than *Sp. suilla,* which is commonly found in the typical skin lesions described earlier in this article.

Fig. 3. — *Pig showing hæmatomas of both ears.*

Neitz (1940), of Onderstepoort, compared this spirochæte with *Sp. theileri, Sp. obermeyeri, Sp. morsus muris,* and *Sp. icterohæmorrhagiæ,* but stated that it did not resemble any of these. On the twentieth day, just after a rise in temperature to 104° on the eighteenth, spirochætes, although rare, were again found, the temperature on this day being 103·4°. On the thirteenth day a small abscess was found below the the right eye. It had ruptured, and smears made from the pus revealed typical *Sp. suilla.* The small ring-like bodies that were observed in the blood of the original pig that showed the skin lesions, were seen in the blood of this experimental pig on the fifth, eleventh, fourteenth, fifteenth and sixteenth days. No skin lesions

resembling those seen on the original case were observed throughout this experiment, and the general health of the pig was good.

(b) *Pig (ii)*: The chart of this pig showed gradual rises and falls of temperature throughout the experiment. Spirochætes, similar in appearance to those seen in smears from Pig (i), were seen on the sixth, the eighth, and the twentieth days after inoculation. The small ring-like bodies in the red blood cells were present on the tenth and twelfth days. No skin lesions appeared on the body of this pig and its general health throughout the experiment was good.

An examination of the temperature charts of these two artificially-infected pigs shows that there was some resemblance to the charts of relapsing fever in man. This is further strengthened by the finding of a presumably new spirochæte in the blood smears during the rises of temperature.

Case 2.

About a year later a report was received from the Government Veterinary Officer, Greytown, to the effect that a number of young pigs on the farm of a well-known pig-breeder were showing a peculiar skin condition. He described its development among young Tamworth pigs. Lesions began as deep vesicles, from which he was able to obtain a little serous fluid. Other lesions showed the recent formation of a scab. The bristles were intact, but the skin was much thickened. These lesions were oval in shape and were found mainly in the perineal region, but odd lesions were present on the back. The sow that was

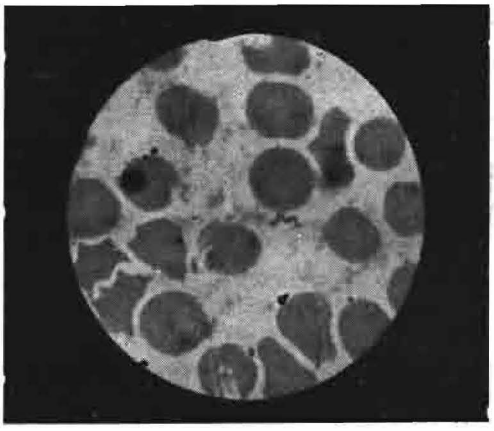

Fig. 4. — *Spirochæte in blood smear.*

suckling them showed no lesions anywhere. Scabs were removed and smears made from the small amount of pus that was present. The bristles still remained intact after removal of the scabs.

History: Two young affected pigs were received showing similar lesions to those described in the first case. There were a few lice

present and the pigs did not appear thrifty, although their appetites were fair.

Microscopical examination: Examination of the smears made by the Government Veterinary Officer, Greytown, from the lesions he described, showed many eosinophile leucocytes and cocci. The same results were observed in smears taken from the pigs that were received at the laboratory. Blood smears showed again small ring-like bodies in the red blood cells.

Biological examination: Sub-inoculation subcutaneously, with blood from an infected pig, was made into two healthy pigs, the amount being 30 cc.

Pig I: The temperature rose on the third day and remained fairly high for fifteen days. On the twenty-fifth day a small abscess was

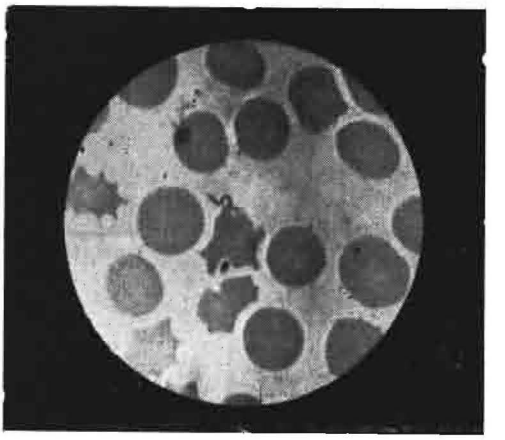

Fig. 5.—*Spirochæte in blood smear.*

observed on the ear. On the forty-second day, and on the forty-sixth day rare spirochætes were seen in the blood.

Pig II: The temperature chart of this pig closely resembled that of Pig I. Spirochætes were observed in the blood taken on the twenty-seventh and thirty-seventh days.

Both pigs were kept under observation for almost three months, but no skin lesions resembling those in the original pigs were observed.

Summary.

(1) Cases of spirochætal wound infection, involving unusual sites of the body of pigs, have been described.

(2) Two outbreaks of what appear to be definite Spirochætosis of pigs, with a description of the lesions, are recorded.

(3) Photographs of the lesions and of the blood-spirochæte are attached.

Conclusions.

It appears as if pigs are extremely susceptible to spirochætal infection of wounds, more so than any other species of domestic animal.

It is possible that the organism found in the blood of the pigs and described in this article, may be a new spirochæte.

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Addendum.

Since this article was written the author had a visit from Professor Trautmann, after whom the Piroplasm of the pig, *P. trautmanni,* was named. He stated that, while in East Africa, he also investigated a number of cases of human relapsing fever, and found that many pigs that were visibly ill in the same vicinity as these human cases occurred showed spirochætes in the blood. Many of the pig-styes, which were primitive, harboured numerous ticks of the Ornithodorus type.

ARTIFICIAL BREEDING OF POULTRY

G. C. VAN DRIMMELEN,
Bloemfontein.

In several countries artificial insemination of fowls and other birds has been adopted in the practice of poultry husbandry, although only on an experimental scale. The method has advantages and limitations. The technique is, however, so simple, when compared with this type of work in other animals, that it will, no doubt, be applied on an increasing scale in the establishment of breeding programmes, including such systems as progeny testing, because it allows for the

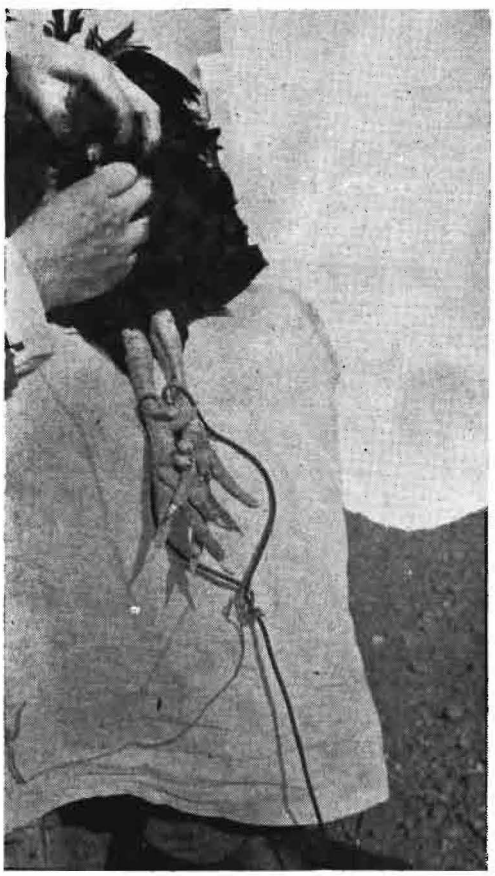


Fig. A(1). — *Semen collection in the fowl (note position of the bird and wire loop for control of the legs).*

testing of a male with a very much larger number of females simultaneously (*Warren and Gish,* 1943).

The average number of female progeny from one cock in one breeding season of 100 days is 200 to 300, with ordinary pen mating.

Fig. A(2).—*Semen collection in the fowl. (Note the position of vent, fingers and test-tube used as a receptacle.)*

With artificial insemination this can easily be increased tenfold, which, considering the decrease of semen production in the second and third season of cocks, can be very useful in establishing their value early. Another aspect is the saving of cocks, which is considerable in the case of the very best, and thirdly, the change of males during the season can be effected more rapidly and with less losos in progeny of the hen, by the aid of artificial insemination. This will be described in greater detail below.

Semen Collection.

Requirements: The method of semen collection used is based on the experience of *Burrows and Quinn* at Beltsville, U.S.A., where they noticed an ejaculation in a particular fowl cock during preparation of the abdomen for intraperitoneal injections of disease germs. They developed a technique requiring two persons, the operator and an assistant. This was modified by the author by controlling the bird on the seated operator's knees with the aid of a wire loop for the legs as shown in figure A(1).

In this way it was found easy to deal with two dozen cocks when held in cages, in the space of one half-hour. For a semen receptacle a funnel with closed stem, an egg-cup or a short, wide test-tube can be used.

Ejaculation: The method of procuring ejaculation as developed by *Burrows and Quinn* in the U.S.A. consists of four actions in very rapid succession, which with a trainer cock and operator should on the average occupy only a few seconds:—

1. Placing the bird in a comfortable position. No force or tension should be applied.

2. Holding the tail forward with the left hand and picking up the dry, clean receptacle with the right forefinger.

3. Massaging the abdomen with the thumb and remaining fingers of the right hand.

4. Grasping the vent with the left thumb and forefinger on protusion of the copulatory organ, and milking out the semen ejaculated.

Insemination.

Requirements: The simple structure of the genital opening of the hen makes elaborate equipment unnecessary. All that is required is a blunt glass pipette (see figures B and C) graduated to measure $^1/_{10}$th of a c.c. Preferably it should be fitted to a strong rubber teat, but if long enough, it can be discharged by blowing.

Introduction of the Semen: The vagina of the hen is exposed by lifting the hen on the left hand, placing her, head downwards, with her tail and back against the operator's chest and applying gentle but firm pressure against the abdomen. If the bird is in active production,

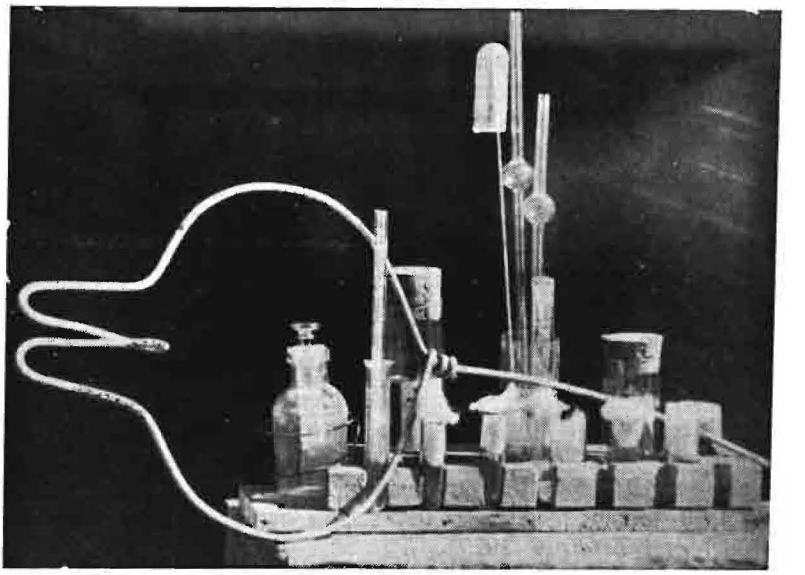
the rectal and vaginal openings can easily be protruded from the vent, the vagina is, of course, normally on the left. The loaded pipette is then introduced into the vagina with the right hand (2 - 5 c.m. deep is sufficient) and the contents are expelled by air pressure after the organs have been allowed to slip back into position. The operation is best done in the afternoon, as there is less chance of a hard-shelled egg being present in the uterus at this time. (Figure B.)

Insemination of the hen. (Note everted vaginal opening protruding from vent prior to introduction of the pipette.)

Handling of Semen.

Fowl semen is very sensitive to external influences and rapidly loses its effectiveness when exposed to chemicals or to air. All instruments should be absolutely clean and dry. They should be cleaned and carefully rinsed in glass-distilled water to avoid traces of chemicals, particularly metals, which are present in tap water. At present no satisfactory diluents for fowl semen have been generally adopted. Egg-yolk, egg-albumen (both fresh) and physiological saline may be used, but the results are variable.

Fowl semen cannot be stored satisfactorily for longer than a few hours. A semen sample may be stored pure, if covered with sterile liquid paraffin and cooled slowly after collection to room temperature (about 15°C.). In this way extension of its period of usefulness to about 24 hours is possible, but decided loss of effectiveness will be noticed from about 8 hours after collection (Figure C).



Instruments which may be used for artificial insemination of poultry by the technique of Burrows and Quinn (1939). *(Note the wire loop for holding the cock's legs at collection, the cottonwool-stoppered semen receptacles, the bottles with distilled water,* 65% *alcohol and physiological saline for rinsing and cleaning glassware and the pipette for measuring and depositing of the semen in the vagina.)*

Uses of Artificial Insemination.

Fertility in specific cases has been raised very spectacularly in several instances by workers with this method of breeding in turkeys (*Burrows and Marsden,* 1938) and in fowls (*Black and Scorgie,* 1940). It can thus come in useful when a valuable male happens to lose fertility for instance as the result of injury to his legs, provided a thorough veterinary examination of the male is made to exclude the possibility of hereditary origin. Where an unforeseen shortage of males occurs, the method will allow of the raising of the season's full complement of young stock.

As mentioned before, the work of *Warren and Gish* (1943) has proved that artificial insemination of hens is very suitable to expedite the change-over from one male to another in a breeding pen. If for any reason a mating is not found satisfactory during the season, the hens have to be left normally at least a fortnight before the eggs

produced can, with a measure of certainty, all be taken to be fertilized by the new male. However, if all the hens are artificially inseminated in the afternoon when the new cock is introduced, all the eggs laid more than 48 hours after insemination are almost certain to be fertilized by the new male.

If a valuable cock dies and the high-quality hens in the breeding pen are to be kept in the breeding flock for the production of fertile eggs, they may be fertilized with semen from males used in adjoining pens, provided the operator and the birds are trained. In an emergency a trained operator could even attempt such a step with untrained males. A single careful trial will not harm the fertility in the pen, to which the other male belongs, in the least.

Where a special effort is justified to obtain in a single season the maximum number of progeny from a particular proved sire, the hens should be inseminated in the afternoon every 7 - 10 days. Such hens must be trap-nested and only active producers should be considered. As semen collection must be done daily to obtain the largest quantity from the male, he should be kept separated in a comfortable cage and the semen taken at, say, 2 p.m. The semen must be inseminated immediately in doses of 0·1 cc. and depending on the capacity of the cock, the fertility of 50 to 100 hens can easily be maintained if they are inseminated in rotation. Thus 200 to 400 fertile eggs can be obtained weekly from the one male. When a better technique for dilution of semen becomes available this figure could be increased (*Bonnier and Trullson,* 1939).

With poultry other than fowls and turkeys, artificial insemination is being developed for purpose of overcoming sterility (not due to inherited factors) and the method has possibilities in the production of fancy crosses where natural mating is difficult to bring about.

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CASE REPORT

BIRTH-PLUG STOPPAGE IN THOROUGHBRED FOALS.

C. W. A. BELONJE,
Middelburg (Cape).

Anamnesis: A thoroughbred colt, by Makena out of Miss Mercia, was born during the night of 16/9/46. By next morning the foal became uncomfortable through meconium being retained. A dose of 4 tablespoonfuls of liq. paraffin was given, as well as an enema of liq. paraffin. A certain amount of meconium was removed with digital manipulation. The discomfort increased, the foal being in great pain and rolling. Enemas, etc., had no effect.

Examination: At about 3 p.m. I examined the foal. It was very exhausted, lying down, breathing rapid and shallow, and it was taking no interest in its surroundings. The anus was swollen and bled easily. The plug could only just be felt with the tip of the index finger and it was noticed that the pelvic bones were so close that it was realised that the plug could never pass *in toto*. Enemas were given with warm water and oil to try and soften it. It was, however, noticed that every time the plug was pushed away from the pelvic inlet considerable relief was given. I decided to concentrate on keeping the foal alive rather than to worry unduly about the plug.

The foal was picked up and held to the mare and allowed to suckle. After a good feed the colicky pains commenced again and another enema was given and the foal allowed to lie down. The stable was darkened and the foal allowed to sleep as long as it would, i.e. from 1 - 2 hours as a rule. It usually awoke with colic, was given an enema, held up to drink, given an enema and allowed to sleep again. This treatment was continued right through the night.

On 18/9/46 I examined the foal again. It was bigger, had filled out, was strong and took an interest in its surroundings. The procedure of feed, sleep, enema, feed, etc., was followed. At 10 a.m. it became necessary to exclude the possibility of congenital occlusion or bowel twist. 3 oz. castor oil in mare's milk and port wine were given, but the feeding, sleeping routine was continued. Between 12 noon and 2 p.m. the foal went into violent colic, throwing itself around, groaning and lying on its back. The attack was alleviated a little by giving mare's milk, chlorodyne and port wine. After 2 p.m. it was noticed that small drops of castor oil and soft yellow fæces were adhering to the tube after an anema. Evacuation of the colon was then undertaken by passing a foal stomach tube with a lateral opening

past the plug and a considerable amount of fæces was removed at various intervals, allowing the foal to feed and sleep as well. At 4 p.m. the author had to leave through other appointments, but instructions were left to continue as before, but to use 2% bicarbonate of soda in warm water as the enema agent. This was continued, and at 11 p.m. the foal passed the plug. On 19/9/46 the mare and foal were put into a small paddock in the morning. The foal was healthy and strong as well as playful. The mild diarrhœa cleared up without medication.

Comment: Meconium retention in thoroughbred foals has been associated with high mortality within 36 hours of birth. The purpose of this article is to throw some doubt on this supposition. It may be that such mortality is the result of rectal injury from the insertion of instruments, teaspoons, fingernails, and from the desire to interfere too energetically. The permeability of the bowel at this age lends itself very easily to bacterial invasion with consequent peritonitis and death. This is naturally hastened by the continuous interference with the foal, its starvation and hence rapid exhaustion.

OBITUARY.

MICHAEL MOZES NESER,
1896 — 1946.

The untimely death of Michael Neser on 29th April, 1946, in his fiftieth year, robbed the Veterinary Profession in South Africa of one of its most valuable members.

Throughout his career he gave his best, unstintingly and lastingly, though his retiring disposition forbade any claim to applause in exchange.

His steadfastness of character, his great strength of will and his high principles commanded the respect of all those with whom he came in contact, either privately or officially. Logical and unemotional in whatever he said or did, and essentially practical minded, he could never share the enthusiasm of the visionary. Only reason and facts appealed to him.

Born in Hanover (Cape) on 8th September, 1896, he was educated first at the local school and later at the Boys High School, Paarl, where he matriculated at the end of 1912.

As a member of the Hanover Commando he took part in the suppression of the 1914 Rebellion, being actually taken prisoner of war for a short while.

After assisting his father on the farm for a time he joined the Public Service during October, 1916, serving as a clerk at Onderstepoort until 1919.

His contact with Onderstepoort and such members of the Professional staff as Sir Arnold Theiler and Prof. D. Kehoe, both of whom he greatly admired, no doubt influenced his choice of Veterinary Science as a career.

During 1919 he obtained leave and proceeded overseas to take up the necessary studies.

After a brilliant study career, during which he gained much distinction, he qualified in July, 1923, at the Royal Veterinary College, Ballsbridge, Dublin, where the M.R.C.V.S. was conferred on him.

Returning to the Union during the same year he resumed duty in the service of the State, this time as a Government Veterinary Officer at Umtata where, single handed, he carried a heavy load in smear examination for four years. Later he served as G.V.O. in charge successively at Louis Trichardt, Piet Retief and Dundee.

In 1934, he was transferred on promotion to Senior Veterinary Officer, South West Africa, with Headquarters at Windhoek, a position which he held with distinction until health considerations compelled him during 1938 to ask for a transfer back to the Union.

Unfortunately this could at the time be arranged only at the sacrifice by him of his S.V.O. status and he served as G.V.O., Worcester, until the opportunity arose later for his promotion to S.V.O. for a second time, with Headquarters at Pretoria.

His highly developed sense of duty and his preparedness to serve his Profession and his Country led him to overtax his strength and contributed in no small way to his early demise. The malady which first attacked him in South West Africa took a firm grip on his overworked constitution and led to the close of a career of real service.

To the bereaved family we offer our most sincere condolences in their sad loss.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

Council Meeting held at the Tilsim Hotel, Pretoria, February, 13th, 1947, at 2.15 p.m.

Present: J. H. Mason (President), A. M. Diesel, A. D. Thomas, P. S. Snyman, J. G. Boswell, A. C. Kirkpatrick, R. Alexander, E. N. Robinson, P. J. du Toit, D. G. Steyn and S. W. J. van Rensburg (Hon. Sec.-Treas.).

Apology for Absence: M. C. Lambrechts.

(1) *Minutes* of Meeting held on 21st November, 1946, were confirmed.

(2) *Arising from these minutes:*

(a) *Tuberculin Testing*: In view of a letter from Dr. de Kock stating that tuberculin testing will be discussed at the forthcoming conference of Senior Veterinary Officers, the discussion of the report by the Committee was postponed till the next meeting of Council.

(b) *Veterinary Auxiliaries*: Drs. Boswell and Alexander reported on the investigations made by them regarding the training of farriers and veterinary technical assistants respectively.

(c) *Sale of Laboratory Products*: Dr. du Toit advised that the Division will in future supply firms consisting of more than one veterinarian with laboratory products at reduced rates according to the number of veterinary surgeons in the relative firm.

(d) *Amendments to Stock Diseases Act*: It was decided that the letter from the Director of Veterinary Services be circularised and that members be asked to submit their views. A Committee consisting of Drs. Diesel, Snyman and Parkin was appointed to consider the replies and to report to the next meeting of Council.

(e) *Milnerton Turf Club*: Correspondence with this club and with Dr. C. H. Wadlow was read. It was decided that the matter be referred to the South African Turf Club. If the representations were not successful, members were to be circularised and asked not to accept posts at Turf Clubs at less than £10 10s. 0d. per meeting.

(f) *Reciprocity with R.C.V.S.*: The Secretary was instructed to write to the R.C.V.S. asking for provision for reciprocity to be made in the proposed new Act.

(g) *Importation of Veterinarians*: Correspondence between the Honorary Secretary and the Secretary for Interior re importation of Veterinary Surgeons from European Countries was read and approved.

(h) *Protectorate Posts*: Correspondence between the President and the N.V.M.A. was read and approved.

(3) *Amendment to Veterinary Act*: A minute from the Chairman of the Veterinary Board was read and it was agreed that copies of this be also sent out to members for their comments. The replies to be considered by the Committee appointed to deal with the Amendments to the Stock Diseases Act.

(4) *New Members*: The following were approved for submission to the next General Meeting: (Miss) M. Bales, P. Casserly, J. A. de Kock, W. P. S. Edwards, A. S. Erasmus, E. de V. Erasmust, L. L. Hansmeyer,

(Mrs.) A. V. May, J. D. Neethling, B. A. Pappin, W. E. Pearson, R. K. Reyneke, J. Schuss and A. L. Wessels.

(5) *Items under "General"*: The President pointed out that items were frequently received too late for inclusion in the agenda for Council Meetings and these have to be discussed under "General". It was decided to draw attention of members to the fact that notice of matters to be brought before Council must reach the Secretary at least three weeks before the meeting. It was further agreed that in future Council Meetings be held regularly on the second Thursday of February, May, August and November.

(6) *Correspondence from Dr. C. F. B. Hofmeyr re*:

(a) *Representation at funerals*: noted.

(b) *Specialisation*: The views of the Association had already been referred to the Veterinary Board and the matter further be considered in the proposed Amendment to the Veterinary Act.

(c) *Publicity*: Letter to be referred to the General Purposes Committee. Council, however, wishes to point out the dangers of undue publicity.

(d) *Formation of a Pretoria branch*: Council is in favour of the formation of a branch in Pretoria and would give it the same support as the other branches.

(7) *Complaint re Housing*: The Secretary was asked to communicate with the Controller of Housing re the complaint by a member.

(8) *General*:

(a) *Health Foundation*: It was agreed that a representative for Northern Natal be selected by the Natal branch.

(b) *General Meeting*: It was decided that this be held during the third week of September, and that Council consider hiring a loud-speaker for the meeting.

(c) *Benevolent Fund*: Council agreed to a suggestion that those Government Veterinary Officers who desire it be supplied with a collection box for receiving donations from owners of animals, who are not permitted to make payments to the officers concerned. It was also decided to publish a list of donations received for the fund in the Journal, from time to time.

The meeting adjourned at 5.10 p.m.

S. W. J. van Rensburg,
HON. SEC.-TREAS. S.A.V.M.A.

A REVIEW OF THE BLUETONGUE PROBLEM

R. A. ALEXANDER, W. O. NEITZ, T. F. ADELAAR, AND D. A. HAIG,

Onderstepoort.

A search through the literature shows that the published work on bluetongue is somewhat pathetically scanty. Theiler in 1905 showed that the disease is caused by an ultravisible and filtrable virus in accordance with the criteria of filterability in vogue at that time. He and other contemporary investigators, notably Hutcheon and Spreull, briefly recorded some other properties of the virus and described the salient features of the symptomatology and pathology of the disease. Then in 1906-07 Theiler described a method for the production of a prophylactic vaccine based upon the attenuation of the virulent virus by serial passage through sheep. In 1907 this virus vaccine was introduced into practice with what appeared to be most encouraging results. While the mortality in non-vaccinated flocks of sheep that year amounted to 11%, the mortality as a direct result of immunization was estimated to be 0·4%, and deaths among vaccinated sheep as a result of subsequent natural infection were computed to be 0·1%. The total mortality in treated flocks was 0·5% as compared with 11% in the controls, but it should be noted that no data are available on the incidence of, and recovery from, infection in either group.

At the time it appears to have been taken for granted that bluetongue could be brought under control merely by universal application of the method of immunization. Where mortality did occur amongst immunized sheep in the late summer months the cause was usually ascribed to some other condition — chiefly panverminosis. This diagnosis was based upon extreme debility, anaemia, and the presence of intestinal parasites, but chiefly upon failure to isolate virulent virus from the sick animals by subinoculation of blood into susceptible sheep in the laboratory. It will be shown that, in the light of our present knowledge of the disease, the validity of many of these diagnoses must be open to question. This doubt has been strengthened by continued annual mortality in the face of the introduction of progressively more efficient measures for the control of worm infestation.

That some misgivings were entertained as to the true value of the vaccine after it had been in general use for some 20 years, is shown by the publication of " further studies on the virus of bluetongue," by Du Toit in 1929. Du Toit mentions that there might exist a danger of the strain of virus used for vaccine production losing some of its antigenicity as a result of progressive attenuation by continued serial passage through sheep (it had then reached the 54th generation).

Using a strain of virus isolated from a lamb which had died of bluetongue, he repeated and confirmed Theiler's original work on attenuation by passage and in addition directed attention to a comparatively short duration of immunity. From this attenuated virus strain, vaccine was produced which differed from that previously issued only in the proportion of infective blood to anticoagulant-preservative diluent. The results in the field appeared to be similar to those obtained with the original Theiler vaccine. Complaints about the severity of the reactions particularly during the hot summer months, together with failure to produce a solid immunity continued to be received. The serious nature of these complaints was magnified by economic factors associated with the decrease in the price of wool, with resultant smaller margin of profit from Merino sheep farming, and the increasing attention being paid to the breeding of the hyper-susceptible English breeds of sheep for fat lamb and mutton production. The result was that in 1938 it was decided to investigate afresh the whole problem of bluetongue. A great deal of work has been carried out and it is believed that considerable progress has been made. Reports on various aspects of the investigation have been in press in some instances for more than three years. It is hoped that these will appear in the near future, but in the meantime it is considered advisable to give a short resumé of the salient features for the information of practising veterinarians.

The symptoms of bluetongue as described in the literature are substantially correct, but sufficient stress has not been laid upon their sequence as distinct from their nature or severity. Although it is not possible to lay down any dogmatic rule, a wide experience with a large number of strains isolated from points as far apart as East London and the Island of Cyprus has shown that the following is probably the typical picture. After an incubation period of from 3 to about 8 days, the first symptom is a rise in temperature to about 106°F. though frequently to as high as 108°. Usually marked buccal lesions do not appear until some 48 hours after the commencement of the febrile reaction and it is not unusual to find sheep with severe hyperaemia of the mouth feeding almost normally, and, under field conditions, showing no signs of listlessness. From this stage the temperature starts to return to normal by lysis. Foot lesions appear as shown by the gradual development of coronitis and concurrently the non-woolled portions of the skin take on a bright pink or purplish appearance. It is now, after the temperature has returned to normal, that the animals are noticed to be sick for the first time. Loss of condition is rapid, the sheep are dull and listless, and later the cachectic debility, which may persist for weeks, with or without lameness, effectively prevents grazing. It is rare indeed for a sheep to die during the acute phase of the febrile reaction. Death usually occurs about a week after the temperature has returned to normal, at or about the time when torticollis is first noticed. The virulence of different strains of virus and the percentage mortality even in the same locality vary within the widest possible limits.

In investigating an outbreak of bluetongue an appreciation of the sequence of symptoms is of extreme importance. Usually virus is present in the peripheral circulation in detectable amounts only during the febrile phase. When an animal is noticed to be really sick, it is the usual experience to find that subinoculation of blood by the subcutaneous route into susceptible sheep produces merely a very mild febrile reaction (up to 105°F.) of about 48 hours duration, with none of the pathognomonic symptoms of bluetongue. If, however, a further subinoculation is made at this stage, the usual severe clinical syndrome will be produced. It is quite clear that failure to appreciate this rapid disappearance of virus from the blood before the onset of easily detectable clinical symptoms has been the reason for failure to arrive at a correct diagnosis of the cause of mortality on many occasions in the past. Why the virus titre of the blood should decrease so rapidly before the onset of symptoms is not known: possibly it is associated with the rapid formation of antibodies. Recognition of the phenomenon has led to the adoption of a routine diagnostic procedure in the laboratory in keeping with the modern conception of a very real difference between an absolute and an apparent neutral mixture of a virus with its antibody. In cases of suspected bluetongue a request is always made that blood be collected from an animal as soon as it is noticed to be off colour. This blood is injected into a susceptible sheep (5-10 cc.) by the intravenous route to bring into operation the well known dilution phenomenon. Whether or not a febrile reaction is produced, a subinoculation is made between the 7th and 9th day, and a negative diagnosis is given only when the third passage, after the same interval, also proves to be negative. A typical example is the experience with the isolation of an exceedingly virulent strain of virus from an outbreak reported by an experienced and most intelligent farmer in the Eastern Transvaal. Citrated blood from two sick sheep was forwarded to Onderstepoort. The samples were pooled and 10 cc. injected into a susceptible sheep (74651). On the 10th day the temperature was slightly elevated (104°F.) and remained at that level for 24 hours; in spite of careful daily examination no other symptoms whatever were detected. Blood was drawn on the 10th day and subinoculated into a second sheep (75593). On the 7th day the temperature rose abruptly to 106°F. and remained above normal for 3 days. Blood, collected on the 7th day, was subinoculated into a third sheep (75612). A marked febrile reaction commenced on the 6th day and on the 11th day the animal died of typical bluetongue. The strain has been maintained without difficulty from that time onwards.

Little or nothing has been added to our knowledge of the pathology of the disease, but there became apparent one point of extreme practical importance that appears to have been missed previously, although it was briefly referred to by Neitz and Riemerschmid (1944). Although attention has been directed to the extreme emaciation which is so prominent a feature (Bekker, de Kock, and Quinlan, 1934; de Kock, du Toit, and Neitz, 1937), the pathogenesis of this had not been adequately explained. Microscopically, the muscles show multiple

small haemorrhages and in addition individual muscle fibres, groups of fibres or even whole muscles, have an opaque greyish straited appearance apart entirely from perimuscular or intramuscular gelatinous infiltration. Microscopically (Thomas and Neitz, in press), the sarcoplasm of the affected muscle fibres is found to have disappeared partly or completely, there is an absence of cross striation, and what was previously a fibre is now an empty sarcolemma sheath beaded with nuclei. It is not claimed that this condition is pathognomonic for bluetongue (personal communication, A. D. Thomas); but it adequately explains the severe emaciation, the prolonged weakness and debility, the frequent incidence of wry-neck (torticollis), and the protracted convalescence. Recovery cannot be complete until the sarcoplasm has been regenerated and this may take some time.

What is known of the pathology of the disease therefore supports the contention that although bluetongue may be a disease characterised by heavy mortality — a virulent strain has been isolated recently which has caused practically 100% mortality under stable conditions — the usual picture is comparatively low mortality, but severe economic loss. Lambs which recover do so slowly, never thrive, are hyper-susceptible to worm infestation and remain runts. The recovery of adult sheep is slow. Usually the fleece is much reduced in value, owing to a break in the staple, or is actually cast, and a breeding season is lost. Many farmers believe it is preferable to cut their loss and dispose of the remnants of an infected flock at any price, rather than to persevere with nursing over a long period of time, and this applies equally whether infection is initiated by the injection of virulent vaccine or by natural agencies. In these days of highly competitive wool, lamb, and mutton production, the economic significance is obvious.

The very nature of the disease, the fact that no chemotherapeutic treatment has any specific value, and the comparatively low average value of the large number of individuals exposed to infection, indicate that control must depend upon the development of a safe and highly efficient method of immunization. One important feature in the report of a prolonged series of investigations by Neitz (in press) is the contention that Theiler's original virus strain was characterized, from the time of its isolation, by comparative avirulence and that no attenuation occurred as a result of passage through sheep. This conclusion is supported by other workers, none of whom, with the exception of du Toit (1929), has succeeded in attenuating a strain by this technique. Further work has also shown that not only does virulence vary within wide limits, but also that there exists a wide difference in the antigenic structure of different strains (Neitz, in press). The establishment of these two cardinal principles permitted no other conclusion than that the method of immunization being practised is unsatisfactory for two reasons. It is unsafe because it involves the use of an unattenuated virus, and it is inefficient because the range of monovalent immunity produced was insufficiently wide to protect against the plurality of strains in the field.

The first step taken was to eliminate one source of complaint, the severe reaction produced. Carefully controlled experiments in open camps under conditions which would approximate those in the field, showed that the original Theiler strain of virus was appreciably less virulent than the Veglia strain. In 1943, issues of vaccine prepared from the Veglia strain were discontinued, and were replaced by a product prepared from the Theiler strain isolated from a 25-year-old bottle of vaccine. The desired result was achieved and reports from the field showed that the severity of reactions had been reduced appreciably.

Meanwhile considerable progress had been made with a method of propagating bluetongue virus in the developing chick embryo, and with attenuating antigenically different virus strains by that method (Alexander; Alexander, Haig and Adelaar in press; Haig to be published). The salient features of this work are:—

1. Embryos of fertile hens eggs, after 8 days preliminary incubation, may be infected with bluetongue virus by injection of virulent material into the yolk sac.

2. Multiplication of virus does not take place on subsequent incubation at temperatures above 38°C. but does occur at lower temperatures.

3. By serial passage through eggs a virus may be adapted to multiplication in its new environment.

4. For every 1·5°C. drop in the temperature of incubation below 36·5°C. there is approximately a tenfold increase in the virus titre of the embryos harvested at death.

5. Optimum conditions for virus multiplication are provided by injecting 1,000 infecting doses of virus into the yolk sac of 8-day embryos, incubating for 24 hours at 35°C., transferring the eggs to an incubator adjusted to 32°C. and harvesting all the embryos, dead or alive, after a further 48 hours.

6. By careful standardization of this technique about 10 cc. of chick embryo emulsion can be produced from 3 eggs, with a virus titre of approximately 1/1,000,000 and never less than 1/100,000.

7. Estimation of the virus content of an egg-adapted virus emulsion by titration in 8-day-old embryos incubated at 33.5°C. corresponds almost exactly with the results of similar titrations in susceptible Merino sheep.

8. Virulent strains of virus may be attenuated by serial passage through fertile eggs to a point where practically no detectable reaction is produced in sheep.

9. Attenuated virus strains retain their full antigenicity.

When these results had been confirmed by the attenuation of a number of different strains of virus, the immediate problem was reduced to one of producing a polyvalent vaccine from eggs in sufficient quantity to meet the annual demand of some two to three

million doses, and to turn out that vaccine in such a form that when it reaches the user the virus will still be viable. There remained to be elucidated a number of difficulties connected with mass production, as well as the selection of the most suitable vehicle and diluent for the embryo emulsions. As a preliminary it was decided to investigate the possibility of using the avirulent egg culture virus strains to produce the necessary vaccine from sheep by what may be termed Theiler's classical technique. First, it was shown that once a strain of virus had been attenuated, virulence was not restored or enhanced by passage through sheep for eleven generations. Bearing in mind the fact that sheep infected with avirulent cultures invariably show no febrile reaction to indicate the day on which the virus titre of the blood has attained a maximum (and therefore the day on which they should be bled), attempts were made to plot the rise and fall of the virus content by daily titrations in eggs. Unfortunately it was found that an egg-adapted virus, after only one passage through sheep, reverted to what may be termed a " sheep-adapted " strain, and the virus titre of blood could not be determined by titration in eggs. Even though the virus content of the blood was high, it was necessary to readapt the strain to eggs, although admittedly this second adaptation was brought about rapidly. The requisite information was therefore obtained from a restricted series of quantitative experiments in sheep. It was found that virus had made its appearance in the blood of sheep, which had received approximately 500 infecting doses of virus intravenously, by the fifth day. The titre rose rapidly to a peak on the 7th day, after which it decreased rapidly, being present in scarcely demonstrable amounts on the 11th day. Therefore a procedure was decided upon whereby, in batches of 16, sheep were given by the intravenous route not less than 500 infecting doses of an attenuated virus strain. On the 7th day, whether or not any febrile reaction had been produced, 700 cc. of blood was tapped into 1,400 cc. of exalate-carbol-glycerine anticoagulant and preservative vehicle. The pooled blood from each batch of sheep was kept separate and mixed later with other pools prepared from different strains of virus. At first three strains of virus were incorporated in the vaccine, later a fourth was added and the final product contained not less than 250 infecting doses of virus of each strain.

After preliminary field experiments on some 40,000 sheep, vaccine prepared in this way was released for general use for the season 1946-47. As far as can be ascertained the results have been good in spite of the fact that, since the incidence of natural bluetongue was low, a uniformly exacting immunity test was not applied. At least the reactions produced were so mild as to be scarcely detectable. Immunity tests applied in the laboratory by the injection of the four homologous virus strains, either separately or pooled, showed that a solid immunity had been produced. Further, careful observations on selected flocks, in at least one of which were included an adequate number of susceptible controls that reacted seriously to natural bluetongue, showed that highly satisfactory results had been

obtained. A similar vaccine will be issue for the 1947-48 season and simultaneously an attempt will be made to eliminate the sheep entirely as a culture medium for the large amount of virus required, and to substitute the fertile hen's egg alone. In using this vaccine, several points should be borne in mind.

1. Remember that the essential portion of the vaccine is a living virus and that no immunity will be produced if the virus is dead by the time it is injected. Therefore only order vaccine when it is required, inject as soon as possible after receipt, and in the interim store in a cool place, preferably in a refrigerator at about 5°C.

2. The previous monovalent vaccine contained, at the time of issue, at least 1,000 infecting doses of virus per 1 cc. dose. The present quadrivalent vaccine contains only about 250 infecting doses of each strain. Therefore it is all the more important to handle the vaccine as if it really did contain a living antigen, pending the results of detailed work in progress on the keeping qualities under a wide variety of conditions.

3. The reaction produced is practically undetectable, but occasional hypersusceptible individuals may show some buccal hyperæmia, sometimes slight coronitis, and dullness for a few days from about the 9th day after injection.

4. Since there is practically no reaction, sheep may be injected at any time before or after shearing, but remember that even this slight reaction may be sufficient to produce anœstrus in ewes, so do not inject within three weeks of mating.

5. Since it is desirable to develop the widest possible polyvalent immunity, it is advisable to inject sheep every year at least one month before the onset of the natural disease may be expected and at a time which fits in with other operations like shearing and mating.

6. Newly born lambs out of immune ewes possess a high degree of passive immunity which decreases fairly rapidly. The duration of this transient immunity is not known with any accuracy, but it probably lasts about three months. During a portion of this period the immunity is insufficient to protect against natural infection, but is sufficient to neutralize the attenuated virus in the vaccine. Therefore it is not possible to immunize lambs from immune ewes dropped in the spring or early summer, before the onset of natural bluetongue. In other words, the effective control of bluetongue in young animals is an animal husbandry problem as well as an immunological problem, and in the bad bluetongue areas breeders must realize that early summer lambing (September to December) is simply uneconomical.

7. The dose for all classes of sheep is the same — 1 cc. given subcutaneously.

Finally it is necessary to answer one question that is continually being asked. Has the vaccine any curative value? The answer is "No." However, low grade immunity starts to develop very rapidly,

usually within 10 days of injection; so when an outbreak does occur, inject the flock as soon as possible and from the 10th day deaths and severe clinical cases will start to decrease rapidly. When injecting the sheep care must be taken to ensure that virulent virus is not passed from sick to healthy sheep by means of the syringe needles used.

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GAME IN RELATION TO ANIMAL DISEASES*

P. J. DU TOIT,
Onderstepoort.

"Game" has been defined as "the various animals which are considered worthy of pursuit by sportsmen" (Webster).

In this definition I dislike the word "game," and I object strongly to the use of the word "sportsmen" for a class of person whose idea of "sport" is the killing of defenceless animals. In this "game" the dice seem to me to be unduly heavily loaded.

But in spite of this objection I shall, because of its general acceptance and its brevity, continue to use the word "game" for the indigenous wild fauna, particularly the large mammals, of the various countries.

Africa is exceptionally rich in game. They represent an asset of great value, both for sentimental and for economic reasons; but they also represent a danger, as we shall see.

Other countries may well envy us our natural fauna. It is interesting to note that the United States, more than a dozen years ago, spent some 13 million dollars annually on her national parks and monuments. In these parks, covering about 19,500 square miles, they have, apart from bears, eight species of wild ruminants. We in South Africa, in our dozen parks covering 11,500 square miles, have lions, elephants, baboons, monkeys, giraffes, rhinoceroses, hippopotami, crocodiles, ostriches, leopards, cheetahs, hyenas, warthogs, bushpigs, zebras, and some 30 species of ruminants, including the buffalo, eland, koodoo, wildebeest, hartebeest, gemsbuck, sable, roan antelope, waterbuck, nyala, blesbuck, springbuck, impala, bontebuck, bushbuck, and many more.

The great value of such a wonderful fauna to a country need not be stressed, and it is our duty to the world at large to preserve it for posterity. But our desire to preserve this asset dare not blind us to the dangers inherent in the preservation of the game.

In this discussion I shall confine myself to the danger of game becoming infected with or being the carriers of diseases transmissible to domestic animals.

The classical example of a disease fatal both to domestic animals and game is *rinderpest*. In its march through Africa in the 1890's this disease killed off large numbers of game, almost exterminating some species. The species which suffered most were buffalo, koodoo, waterbuck, reedbuck, warthog, and bushpig. But also eland, sable, wildebeest, giraffe and many other species were found to be susceptible and suffered losses.

* Paper presented to the Royal Society Empire Scientific Conference, London, Jun, 1946.

The most serious aspect of the problem is not so much the immediate mortality in game and cattle, disastrous though this may be, but rather the fact that the disease may persist in game and thus become endemic.

It was perhaps fortunate for us in South Africa that the disease was so virulent that it nearly wiped out some of the susceptible species of game with the result that when the disease had passed through the country and the cattle population had either died or been immunized, there was no focus of infection left. But Central Africa was not so fortunate. There the disease lingered on in cattle or in game and became endemic.

A strenuous campaign has been waged against rinderpest in both East and West Africa since the end of last century. Millions of cattle have been immunized by various methods and, on the whole, with very satisfactory results. Frequently the disease was suppressed completely in a certain area when, after a time, it broke out again. There is good reason to believe that in many of these recurrences game were responsible. Actually many outbreaks of rinderpest in game have been recorded, and frequently these were held responsible for outbreaks in cattle.

In the recent joint campaign undertaken by the Southern African states with the object of preventing the spread of rinderpest from Tanganyika towards the south, special attention had to be devoted to the game. The great danger was that infected game might migrate across the border from Tanganyika into Northern Rhodesia or Nyasaland and so start a conflagration in those countries. Accordingly, elaborate precautions were taken on the border to prevent the crossing of game. A fence nearly 300 miles in length was erected and game were shot and driven away both north and south of the fence. In addition all cattle in the adjoining areas were immunized. A danger-point that caused great concern was the border near the coast, between Tanganyika and Portuguese East Africa. In this wild country nothing could be done to control the game, but fortunately the disease did not spread there.

The measures adopted proved effective, and rinderpest was kept out of the southern states. Had these steps not been taken a national catastrophe similar to that of 1896-97 might have resulted.

In the case of *Nagana* the rôle of game is perhaps even more serious. Ever since the classical investigations of David Bruce in Zululand in 1894 it has been known that wild animals may harbour in their blood the trypanosomes which cause fatal diseases in domestic animals and man. Generally these trypanosomes produce no clinical symptoms in the wild animals, but the *tsetse flies* which feed on these animals may pick up the infection and be able afterwards to transmit it to susceptible animals (or human beings).

These facts are not disputed. The only question that requires further discussion is in how far game must be held responsible for the outbreaks of nagana in cattle (or sleeping sickness in human beings).

The life of a tsetse fly is short, so that all infected flies would soon disappear unless new flies constantly picked up the infection from infected hosts. If infected cattle are present in a flybelt there is plenty of opportunity for the flies to become infected, but if cattle are completely absent the only possible source of infection is the game on which the flies feed. It follows therefore that if the game could be removed all infection must disappear.

But the ultimate object in any campaign against nagana is the complete eradication of the fly. One way of achieving this object would be to remove the food supply of the fly. Now it is known that tsetse flies live on blood only, so that it would only be necessary for this source of food to be removed for the flies to die.

This dual rôle of game, firstly as the carriers of the infection (trypanosomes) and secondly as the source of food for the transmitters (tsetse flies) of nagana, has prompted the idea that the game should be destroyed in or near flybelts where cattle are exposed to nagana infection. Such a suggestion immediately raises a storm of protest from game-protectionists and all animal lovers. But an involved matter like this can never be solved by relying entirely on sentiment or prejudice, just as little as it can be solved by ignoring completely the strong claims that can be put forward in favour of game preservation. Only by analysing calmly and dispassionately the facts that are available to us can we hope to arrive at a solution.

This matter was discussed fully at the Pan-African Conference held in Pretoria in 1929, when the following resolutions were adopted unanimously:—

" (1) The preservation of all existing species of African mammals, with the exception of those directly dangerous to man, is both desirable and necessary.

(2) The presence of game in settled areas, however, is a constant menace to stock, crops, and general agricultural development. In this connection special emphasis must be laid on the relation of game to such epizootic diseases as rinderpest, and their capacity for acting as hosts to many endo- and ecto-parasites of domestic animals.

It is therefore uneconomical and unjustifiable to endeavour to enforce game preservation in such areas.

(3) Adequate and efficiently controlled reserves should therefore be established away from settled areas.

(4) Existing scientific evidence is now sufficient to justify the following conclusions:—

(a) Game constitute the most important reservoir of the trypanosomes pathogenic to domestic animals.

(b) Game constitute the most important source of food to the open forest tsetse-flies, such as *Glossina morsitans* and *G. pallidipes.*

(c) The disappearance of these species may be expected to follow radical reduction of all game animals in any area.

(5) To ensure the perpetuity of game reserves and to prevent their constituting a menace to the surrounding districts, they should be free from Glossinae, with a reasonable prospect of so remaining."

It may be deduced from these resolutions that it was the considered opinion of this very representative Conference that game reduction was unavoidable if tsetse flies were to be eradicated. Experience in many parts of Africa has shown that no campaign against tsetse flies will be successful without adequate game reduction. Other methods, such as bush-clearing, veld-burning, trapping, etc., may be very useful, but they will not achieve eradication of the fly if the game is left undisturbed. There is just a ray of hope that the new insecticides (DDT, etc.) will enable us in future to destroy the tsetse fly without destroying the game.

Another disease in which game play a part is *foot-and-mouth disease*. It has been known for many years that some species of wild animals are susceptible to this disease. The most spectacular proof of this was furnished in 1924, when the disease broke out amongst the deer in the Stanislaus National Park in California, and more than 22,000 animals had to be destroyed before the disease was eradicated.

In Southern Africa too, in the outbreaks which occurred since 1931, the infection was found in game (buffalo, koodoo, sable, impala, etc.) on several occasions. In Southern Rhodesia it was proved that infected material taken from a koodoo, when transferred to cattle, produced the disease.

The important question is whether foot-and-mouth disease can linger on in game, in which it would produce only very mild, perhaps almost imperceptible symptoms, and then be responsible for a serious outbreak in cattle when they come in contact with the infected game. It is difficult to get positive proof of such an occurrence, but there is a very strong presumption that several recent outbreaks in cattle originated in game. Thus in 1940 the disease broke out in an isolated herd of cattle at Wankie in Southern Rhodesia. These animals were far removed from the next nearest herd of cattle, the country around the Wankie mine being infested by tsetse; there are no cattle but plenty of game. The probability is that the herd at Wankie became infected from the game; suspicious lesions were actually found in a koodoo and a buffalo in the neighbourhood. A similar outbreak occurred at Mamwala in Northern Rhodesia in 1944.

The outbreaks that occurred on the borders of the Kruger National Park towards the end of 1944 also gave rise to very strong suspicion that the infection came from the game in the Park. At those points where there was closest contact between cattle and game the disease first broke out.

A further disease which is transmitted from game to cattle is *malignant catarrh* (or "*snotsiekte*," as it is sometimes called in South Africa). Here again wild animals, the blue and the black wildebeest (*Gorgon taurinus* and *Connochaetes gnu*) are latent carriers of the infection and show no symptoms at all. But when domestic cattle come in close contact with infected wildebeest,the virus is transmitted and a fatal disease, which may spread through the herd, is set up in the cattle. It may be interesting to record one actual instance where a blue wildebeest cow died leaving a young calf behind. The calf was fed on a domestic cow foster-mother which contracted malignant catarrh and died. This was the start of a serious outbreak of the disease in a valuable herd.

In Europe it is believed by many that sheep form the reservoir of malignant catarrh of cattle. Preliminary experiments in South Africa have shown that sheep may also act as reservoirs here, but the chief culprit seems to be the wildebeest.

A very similar sequence of events is found in *swine fever* in South Africa. The natural carriers of the infection are wild pigs, both the warthog (*Phacochoerus aethiopicus*) and the bushpig (*Potamochoerus koiropotamus*). These animals show no symptoms of disease, but when they come in contact with domestic pigs they transmit the infection and cause a most fatal disease. This strain of swine fever virus is actually much more deadly than the European or American strain. The two strains are immunologically distinct.

This latent infection with swine fever seems to be widespread among the wild pigs in the Northern Transvaal and probably in other parts of Africa. The eradication of these animals is no easy matter, but fortunately it seems that very close contact between the wild and domestic pigs is necessary before the disease can be transmitted and by taking precautions this contact can, to a large extent, be prevented.

Rabies should be mentioned here because in South Africa it is derived almost exclusively from wild animals. Several species of mongoose, belonging to the family *Viverridae*, two species of wild cat, and a ground squirrel have been found infected in nature. In the case of rabies the wild carriers suffer just as much as the domestic animals and die from the disease. They infect each other, as well as domestic animals or human beings if these should be bitten by an infected specimen.

Attempts are made in badly infected areas to eradicate these small carnivores by gassing their burrows and by trapping; but it is a very big undertaking. In localized areas complete eradication has been achieved.

A last example in this group of disease may be mentioned. In the Kruger National Park it was observed by the late warden, Col. Stevenson-Hamilton, that wild dogs (*Lycaon pictus*), which at one time were plentiful, had practically disappeared. At the same time it was found that domestic dogs could not be kept in the Park, but invariably died after a time from some mysterious disease. The

matter was investigated and it was found that the cause of the disease was a *Rickettsia* (*R. canis*) which was transmitted from dog to dog by a tick. The presumption is that the disease was originally brought to the Park by the wild dogs which infected the ticks and so caused the disease to appear in domestic dogs. Unfortunately, as was feared, the disease now seems to have spread to other parts of the country.

But not only protozoal and virus diseases, also ordinary *bacterial diseases* may appear in wild animals and may again be transmitted from them to domestic animals. Two examples may suffice.

In the Albany district, in the Eastern Cape Province of South Africa it was found that koodoos were dying in considerable numbers under suspicious conditions. Investigation revealed that they were dying from *tuberculosis*. The surprising aspect of this outbreak was that these animals, which were always thought to be highly resistant to such diseases, and were living in an open, sun-drenched country, should contract and die from tuberculosis.

The other example is *anthrax*. Most wild animals are just as susceptible to and die just as readily from anthrax as domestic animals when they are exposed to infection. However, it is possible that the disease may be present primarily in the wild animals and then be carried to domestic animals, as the following incident shows. In the Kimberley district of the Cape Province a herd of hartebeest (*Bubalis caama*) has been preserved for many years on certain farms. During the last few years anthrax appeared in the herd and a number of these animals died. Recently the disease broke out among a valuable troop of horses on an adjoining farm and nearly 200 died. There is strong reason to believe that the hartebeest were responsible for the infection in the horses.

It is unnecessary, in this discussion, to refer to the many *ecto-* and *endo-parasites* which are propagated on or in wild animals and may then be responsible for heavy losses among domestic stock. Enough has been said to prove that our wild fauna may be a serious menace to our domestic stock.

The question before us is how to reconcile the conflicting interests in this difficult problem. On the one hand we have the over-enthusiastic game-protectionists who claim that it is our sacred duty to preserve this wonderful heritage for posterity whatever the cost may be. At the other extreme we have many farmers and others who see in the game nothing but an obstacle to successful stockfarming and would like to see them completely wiped out. It is our duty as men of science to study the problem from all angles and point the way to the best solution.

The claim for game preservation must immediately be conceded. Every right-thinking and right-feeling person will admit that no effort should be spared to preserve, in perpetuity if possible, all those species of animals and plants which have survived the vicissitudes of evolution up to our own time. Few chapters in human history make sadder reading than those dealing with the disappearance of so many species

of animals which became extinct within historic times. It is indeed gratifying to note that determined efforts are now being made in various countries to preserve those species which are still in danger of extinction.

But it is doubtful whether all so-called game-preservationists are actuated solely by these lofty motives. Many " sportsmen " want the game preserved so that they may shoot them at their leisure and so add to their collection of trophies. The greater the " bag," the better " the day's sport." It is against these hunters (not sportsmen) that the enthusiastic protagonists of game preservation should direct their energies, rather than against those who try to assist a sorely harassed farming community, by reducing the game in areas where game is a real danger. It would surprise many people to learn that the number of shooting licences issued in one shooting season in only a few districts of the Transvaal covers a much larger number of big game than the total number shot during the nagana campaign in Zululand during the last three years and against which campaign there has at times been such an outcry.

It is not contended that there should be no shooting of game in areas where they are not responsible for major diseases amongst stock. Game must be controlled and reduced, if necessary, just as domestic stock; over-grazing and over-stocking are no lesser evils when applied to game. But my contention is that too much unwarranted slaughter of game goes on under the guise of sport.

The disappearance of the game in many countries has been the almost inevitable result of advancing civilization. We must remember that so-called civilization is a brutal process. Examples readily come to mind of countries where the indigenous flora and fauna and, in some cases, even the original races of man disappeared soon after the advent of civilization. If we could protect our fauna against civilization their future would probably be assured.

If we ask the world at large to concede the claims for game preservation we must also ask the game-preservationists to concede the right and necessity for game reduction and, if need be, the total eradication of some species where they constitute a menace to the human community and its livelihood. The examples quoted in the foregoing pages prove conclusively that game may be responsible for enormous losses and may even constitute a threat to the supply of human food. In such circumstances it is the duty of governments and particularly of the veterinary services of the countries concerned to take appropriate steps to avert the danger even though it may mean the destruction of game.

Much has been made of the cruelty of shooting game to protect the farmer and his stock. But, almost invariably, in cases where game destruction has to be carried out it is done by experienced marksmen under controlled conditions. The cruelty inflicted in such cases is infinitesimal compared with the cruelty of the veld, where lions and

other carnivores kill numbers of terrified animals nightly; or the cruelty of the abattoir; or the cruel nature of those very diseases we are trying to control; or the cruelty inflicted on those people whose only means of livelihood is taken from them by those diseases.

In conclusion I would urge closer co-operation between those entrusted with the care and the preservation of game and those whose duty it is to look after the welfare of domestic animals (in regard to some problems the co-operation of the medical profession is also essential). At present we find instances of Boards of Management of Game Reserves which do not include a single scientific member. There seems to be a fear that such a member might bring to light some danger hidden in the Reserve. But that is the policy of the ostrich. It would be far better to throw the full glare of scientific knowledge on the problem, to study carefully any danger there may be, and to try to devise means to counteract such dangers and so to ensure the safety and the future preservation of our wonderful fauna.

SOME VETERINARY PROBLEMS OF SWEDEN

DR. S. HOFLUND,
Royal Veterinary College, Stockholm.

The climatic conditions in Sweden make the problems of animal husbandry and veterinary science very different from those in South Africa.

Even in the south the land is covered with snow for six to eight weeks in the year, during the period December to March, while the summer only lasts three months. In the north the snow may lie for seven months and the summer last only six weeks. Temperatures during winuter are well below freezing point, so that the snow is dry and suitable for winter sports. Sweden is over 700 miles long and in the north is an area within the arctic circle where at mid-winter the sun never rises.

In order to meet these conditions, special varieties of quick growing crops have been evolved which can mature during the short growing season. A large portion of the country is mountainous and much is covered by natural forest so that intensive farming has to be practised on the available arable land in order to support the population of about seven millions.

During the summer the stock are on artificial pastures, mostly clover and lucerne. In the south they may be out for five or six months, but in the north for only ten weeks. For the rest of the year all stock, including sheep, are stabled. The feed during the winter consists of clover and lucerne hay, silage, root crops and concentrates. Under these conditions it is uneconomical to keep beef cattle and only small herds of high producing milk cows are maintained. By improved breeding and feeding the average milk yield per cow has been doubled during the last fifty years. Most owners aim at having their cows pregnant within eight to ten weeks after calving. Artificial insemination is largely practised and the veterinarians are called on for numerous examinations for pregnancy and the treatment of sterility. Owing to the rich feeds used, the digestive disturbances encountered among stock are mainly due to overfeeding.

There are few protozoal or virus diseases in Sweden. Only one tick (*Ixodes ricinus*) occurs and carries redwater (*Babesia*). Infectious anaemia of horses is present and is thought to be carried by gnats which are often a plague during the summer. Foot-and-mouth disease breaks out every few years in the south of Sweden, mainly by infection through Denmark. The Danes are now vaccinating on a large scale and it is hoped that this will protect the Scandinavian countries in future.

Tuberculosis was introduced into Sweden in the middle of the 18th century with cattle from Friesland and spread rapidly. An

intensive campaign against this disease has been carried out for the last twenty years, among both the human population and among cattle. School children and students are tuberculin-tested annually and all reactors X-rayed. Free hospital treatment is given to all cases requiring it. Mass X-ray examination of the general public, with special regard to school teachers, is undertaken. Mobile plants are used for this purpose in rural areas.

With regard to cattle, the country is divided into free, protected and infected areas. Only about one-quarter of Sweden is now designated as infected. The intradermal tuberculin test is used. In tuberculosis-free areas, all reactors are slaughtered immediately and compensation paid at the rate of £7 per cow, with provision for higher compensation in the case of stud animals. In protected and infected areas, reactors are clearly marked and must be isolated on the farm. Animals giving milk infected with tuberculosis organisms must be slaughtered regardless of which type of area they come from. Persons who have consumed infected milk are traced and X-rayed. In the towns all milk must be pasteurised unless produced by a dairy certified free from tuberculosis and conforming to the accepted standards of general hygiene. Owing to the high price of animal products and the short distances involved, very few animals are allowed to die on the farms. They are almost all slaughtered in State-controlled slaughter houses. This means that practically every animal is eventually inspected post mortem by a veterinarian and this is a great help in tracing tuberculosis infections.

Contagious abortion is also controlled by the State. The country is again divided into free, protected and infected areas and, as with tuberculosis, movements between these categories are controlled. Bulk milk samples are subjected to the Abortus Bang Ring test which will give a positive reaction if only one out of fifty of the cows is infected. The individual cows of a herd giving a positive test are subjected to blood tests. The slaughtering of a reactor is voluntary, but where the percentage of infected animals is small the owner can usually be persuaded to permit it. If not slaughtered, reactors must be isolated when they calve, and the afterbirth is examined bacteriologically. If this examination is negative the animal may be returned to the herd. All calves from herds containing infected animals are vaccinated. In this way a herd is gradually cleaned until final eradication by slaughtering is practicable. Cattle can be sold as free from tuberculosis and contagious abortion only on a certificate from a Government Veterinary Officer.

Other bacterial diseases such as anthrax and black quarter, are rare. By rigid control of importation, Sweden has been kept free from glanders and rabies for the last 60 years. Malignant oedema and pulpy kidney disease occur.

Sweden carries about 400,000 sheep which are mainly kept for the production of mutton. There is a Swedish breed, but Cheviots, Shropshires and Oxford Downs are also kept. Worm infection is

severe owing to the concentrated grazing on artificial pastures. The grazing would appear to be too high in protein and too low in fibre to be suitable for sheep. During the spring and summer, digestive upsets among the sheep are common. The older sheep can be cured by feeding straw, but lambs of two to three months old will not take the straw and losses among them are often severe.

Many areas in Sweden are deficient in phosphate, others in copper. The whole country has been surveyed for these minerals. There is a suspicion that parts of the country may be deficient in cobalt. The phosphorus deficiency leads to arthritis in high-producing animals not receiving phosphate. Botulism does not occur.

Before the war Sweden imported large amounts of concentrates for cattle feeding. One of the largest exports was paper and paper-pulp. When war broke out, all trade with the outside world ceased and it was feared that 30% of the cattle would have to be slaughtered for lack of feed. To make matters worse, a severe drought occurred during the first two war years. Experiments were started on the use of paper pulp as a feed for cattle and horses. It was found that this material could be readily digested if supplemented with 9% molasses (beet), some protein (soyabean) and a mineral mixture consisting of sodium chloride, calcium carbonate, dicalcium phosphate, and sodium phosphate. The reason for the two types of phosphate being given is that it was found that although the insoluble dicalcium phosphate was capable of supplying the animal with its requirements, it was not available to the ruminal organisms. Small amounts of soluble phosphate had to be given to promote normal cellulose digestion. Properly supplemented paper pulp was found to have the same feeding value as oatmeal. The animals take to the paper pulp readily, but small amount have to be fed at first. One pound a day is given for the first week and this is increased gradually to seven pounds a day by the end of the fourth week. Over two million cattle and 800,000 horses were fed largely on paper pulp for a period of three years with great success. This probably constitutes the biggest feeding experiment ever carried out in the world.

This work led Dr. Hedstrom and myself to a study of the micro-organisms of the rumen. Experimental sheep and cattle were fed paper and wheat straw supplemented with molasses, casein, cod-liver oil, and minerals. It was found that removal of the molasses or water-soluble phosphate caused the disappearance of the ruminal yeasts after about two months. About two weeks later the cellulose splitting cocci also died out. The animal could then not be saved by merely changing the food but if, at the same time, ruminal ingesta from a normally fed animal was dosed, complete and rapid recovery followed. The transplantation of ruminal ingesta acts as an inoculation of normal ruminal flora. If treatment was started when only the yeasts had died out, the animal could be saved by changing the food and dosing a pure culture of ruminal yeasts. Removal of the protein caused the disappearance of the cocci but the yeasts survived longer. On a protein-deficient diet the animals began to eat straw that was

contaminated with urine. The yeasts can synthesise protein from carbamide and so can survive longer in a protein deficient medium. The flora of the rumen appears to live in close symbiosis, one type cannot survive in the absence of the other types. The relative predominance of the different kinds of organisms depends on the diet. High sugar and protein favours the infusoria and yeasts.

I have fed sheep on paper pulp, straw, molasses, casein and minerals only for over four years continuously, with complete success. It was found essential, however, to dose yeast cultures periodically. Three generations of sheep have been raised on this diet. At weaning time the lambs had to be dosed ruminal ingesta from their mothers, as the normal flora was not obtained from the food.

In certain areas of Sweden a disease, "*skavelsjuka,*" is endemic. This disease occurs only in the winter and is characterised by loss of appetite and emaciation. The hay in these areas is very low in sugar and phosphate. Examination of the ruminal flora of sick animals shows that the yeasts have died out. In early cases, when there are still some surviving yeasts present, supplementation with molasses and soluble phosphate brings about recovery. This treatment is not successful if the yeasts have entirely died out. In such cases ruminal ingesta containing the yeasts must be dosed. As little as one pound per day of hay from another area will also bring about the reintroduction of the yeasts. For over a hundred years the farmers in the affected areas have used the cud of a cow from another area as a remedy. It would appear that the ruminal yeasts cannot maintain themselves when hay from these areas is fed and that the contamination on the hay is insufficient to cause successful reintroduction. The disappearance of the yeasts is followed by the suppression of the cellulose-splitting bacteria and the disease itself is a digestive disturbance followed by starvation.

Another disturbance of ruminal function is seen in weaning calves where large amounts of milk are fed only twice daily. Under these conditions the calves take in a large quantity of milk at a time and much of it passes into the rumen. Where the hygiene is bad, this mass of milk in the rumen becomes infected with coliform organisms which create an alkaline medium. When the calf starts eating herbage, the normal ruminal flora cannot establish itself, as it requires a slightly acid medium. The calves, therefore, cease to thrive when their milk is removed. This condition can be cured by dosing sour milk. The acid-forming organisms in the sour milk kill off the coliform types and create a medium suitable for the normal ruminal organisms.

During my study on ruminal digestion I have followed the work done at Onderstepoort in this field. When I was granted six months' overseas study leave, I elected to come to Onderstepoort. I would like to express my thanks to the Director of Veterinary Services and the staff of Onderstepoort, who have so willingly assisted me. I am sure that I shall take home with me lifelong memories of the interesting and pleasant time I have had in South Africa.

CASE REPORT.

A SUBACUTE OR "ATYPICAL" CASE OF ANTHRAX IN A BULL.

G. C. VAN DRIMMELEN,
Bloemfontein.

Palaske (1937) mentioned in an excellent review on anthrax, that the different clinical forms of the disease may all be observed in man and other mammalian species. Depending on (a) the mode of infection, (b) the virulence of the infection, and (c) the resistance of the patient, the sub-clinical, chronic, subacute, acute, or peracute forms may present themselves.

In South Africa the danger of spreading anthrax from bovine carcasses after sudden death in the veld is widely known and it is no small tribute to the efficiency of the vaccine that stockowners generally exclude anthrax as a possible cause if the animal is known to have been inoculated within the previous twelve months. Apparently the

Fig 1. — *Photograph of affected parts of a pure-bred Friesland bull suffering from subacute anthrax of the throat and neck, with severe asphyxiating oedema of all the soft tissues around the pharynx. Taken twelve hours before death on the seventh day of illness.*

incidence of subacute and sub-clinical cases of anthrax in man and animals is greater than is generally realized. In bovines in particular these cases are only exceptionally diagnosed.

According to Clark (1938) much evidence points to the relative rarity of epidemic anthrax outbreaks in the Eastern Orange Free State, though cases in cattle are fairly common. The animals in

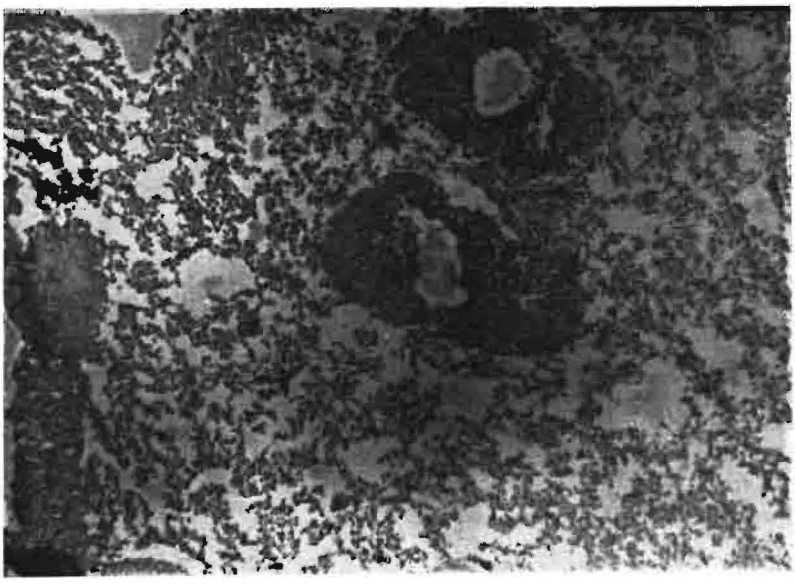

Fig. 2(a). — *Microphotograph of section of the left parotid lymph gland of the bull ten hours after death, showing some of the inflammatory foci with necrotic centres distributed throughout the lymphoid tissue* (× 90 diameters.)

contact with the case and exposed to the original source of infection for periods of weeks and months usually remain in perfect health as far as can be determined by field observation. In Zululand and in the Transkei, where a very accurate examination of spleen smears from all bovine deaths is made for purposes of East Coast Fever control, the author has on one occasion encountered a single anthrax bacillus in a smear from Zululand, and less than half a dozen anthrax bacilli in two cases from the Transkei. In all three instances no other evidence of anthrax being present was found in the dipping tank areas, although immunization of the cattle was not completed until at least 30 days after the death of the infected animals. In all three instances the carcass was eaten by human beings without any ill effects being recorded.

At a mission station in Tsolo district an outbreak occurred amongst cattle inoculated seven months previously, in which several bovines suffered a slow, painful, suffocating death. My colleagues Dr. J. G. Williams and Dr. Grist reported similar experiences (unpublished) in the Ladybrand and Bloemfontein districts and in a previous publication (van Drimmelen, 1938) mention has been made of a further outbreak of this kind in the Ermelo district. In all these cases cattle showed the clinical picture which is typical of anthrax in pigs.

In Egypt, Morcos (1940) reported the beneficial results obtained from treating with anti-anthrax serum four cases of an undiagnosed fever condition in horses suspected of being anthrax. The veterinary

records at Bloemfontein contain the report of an equine case in which the oedematous swellings resulted in a break in the skin and pigs were seen to feed on the exudate. Some of the pigs died of anthrax, but the horse recovered.

Protocol.

The case which is reported here was diagnosed per telephone on 16.10.46 from a description given by the mayor of a small township in the central Orange Free State. The subject was the municipal bull which had been purchased at considerable expense to the community, eight months previously, from a notable breeder of Friesian pedigree stock. A severe outbreak of anthrax had occurred on the Municipal lands and three adjoining properties between 20.12.45 and 4.1.46, and it was therefore a condition of the purchase, that the bull had to be inoculated fourteen days before purchase. This was done, although no record of the batch of vaccine used or the date of inoculation was kept.

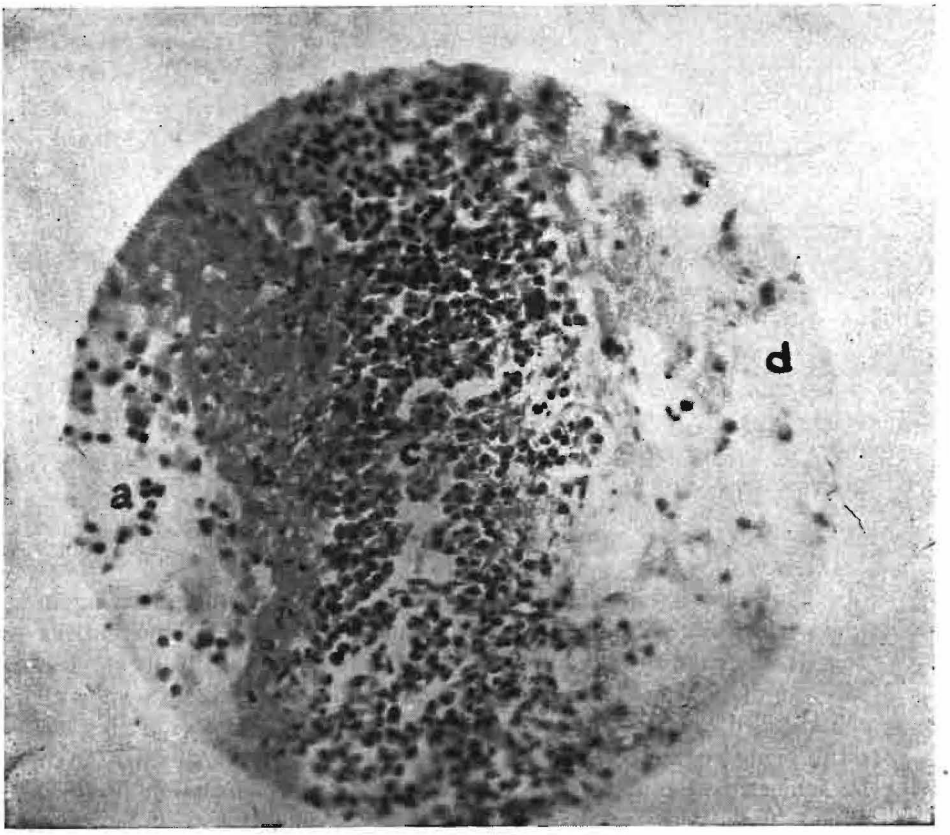

Fig. 2(b). — *Microphotograph of section of the lymph gland at the edge of an anthrax focus showing* (a) *healthy tissue,* (b) *fibrin layer,* (c) *infiltrated layer containing B. anthracis, and* (d) *necrotic tissue with cell debris and extravasated red cells* (× 450 diameters.)

On 9.10.46 the bull developed a swelling of the throat, stopped feeding, and remained near the water but could not drink. Suspecting snake-bite the town ranger treated the swelling with small incisions and permanganate of potash crystals, but the animal continued to lose condition rapidly.

This case was officially reported to my office, 45 miles distant, on 16.10.46, and when I mentioned my suspicion of anthrax (which was accepted under strong protest) a professional examination was demanded. I considered the bull to be in a dying condition and intending to do a post-mortem examination I visited the property about 2.00 p.m. The animal was still strong and fairly dangerous to handle, but the marked swellings and laboured breathing accompanied by a temperature of 104°F., did not hold out much hope of recovery. On pressure from the owners (rate-payers), who wished that everything possible be done, an intravenous injection of 2·25 Gm. N.A.B. was given at 4.00 p.m. The temperature was now 105·2°F. and smears taken from the ear, throat, nasal discharge (haemorrhagic) and neck (oedema), were later found to be completely free from any anthrax bacilli. At 6 p.m. the temperature was 103·6°F., but the breathing as difficult as ever. As can be seen from the photograph, tracheotomy was impossible on account of the enormous oedema. At 8 p.m. the temperature was 103·2°F. (taken by town-ranger) but when I examined the bull alive for the last time at 9.30 p.m. the reading was 105·2°F. At 3 a.m. the next morning the temperature was still 105°F. and the bull died before 6 a.m. The carcass was not opened but smears were taken from the ear, foot, oedematous swelling of the throat and the left parotid lymph gland, which was excised and preserved half in 10% Formalin and half in 50% Glycerin. Microscopically *B. anthracis* was demonstrated in the smears from the gland and the throat, and large numbers were seen in the sections of inflamed parts of the gland. Biological tests on guineapigs and cultural attempts to find out more about the strain involved, failed because the material in glycerin was kept too long before examination.

Discussion.

This case is one of the many that are suspected of occurring in areas where anthrax inoculation is regularly practised. Apparently a small percentage of the animals are subjected occasionally to massive infection (chewing bones, etc.) and the immunity breaks down with the so-called " atypical " symptoms. As a rule such carcasses are buried, death being attributed to snake-bite or injury. Such animals may even be subjected to emergency slaughter for human consumption in rural areas. Only when very valuable animals are involved do these cases attract sufficient attention to lead to a correct diagnosis.

The treatment of anthrax with arsenical or other preparations such as penicillin or sulphonamides is possible in veterinary practice,

but all the cases encountered by the author have been too far advanced to be treated successfully. The animals die of asphyxia rather than from septicaemia and unless the oedema can be arrested in time, as in the treatment of human cases, the expense is not justified. The N.A.B. given in the present case had to be introduced via the saphenous vein with a coarse veterinary hypodermic needle. Only a little more than half of the amount available (3·75 Gm.) was successfully introduced and this was considerably below the desirable dose. The rapid progress in penicillin production may soon alter the treatment

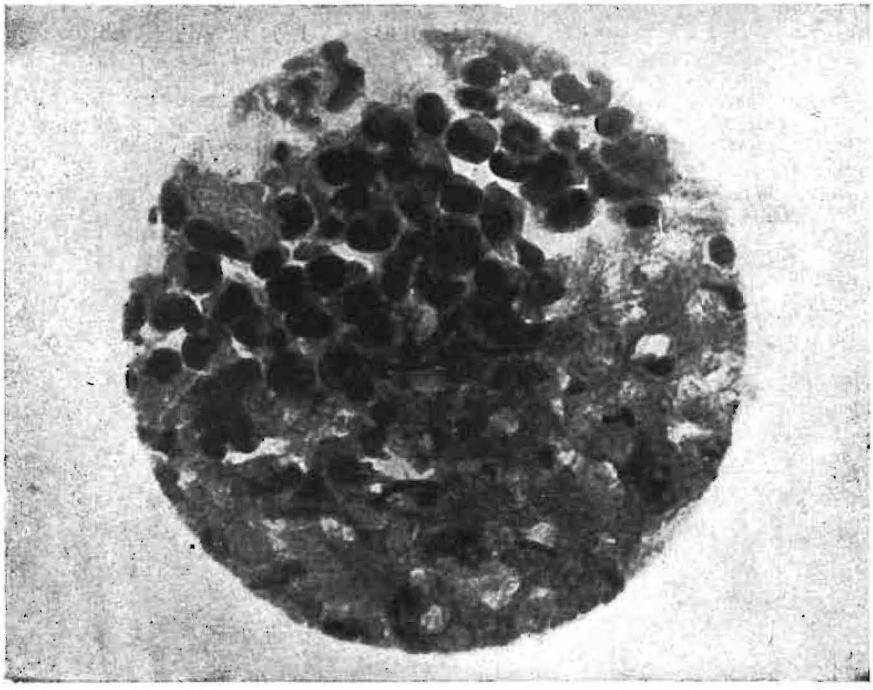

Fig. 2(c). — *Microphotograph of section shown in fig.* 2(b) *showing B. anthracis surrounded by fibrin, monocytes and polymorphonuclear cells.* (× 1100 diameters.)

position and such cases may become more commonly seen in veterinary practice if a suitable method of treatment is available. Significance might be attached to the fact that swelling of the throat in cattle has never been encountered by the author in the districts of Bethulie, Trompsburg, Fauresmith, etc., where anthrax infection is exceptional, while they were often met with in Ermelo, Bloemfontein, Brandfort, Thabanchu, etc., where the disease is prevalent.

The author is indebted to Dr. G. D. Sutton of Onderstepoort, for bacteriological examination and to Dr. A. D. Thomas for the patho-

logical examination of the specimens. Miss Y. Malherbe was responsible for the microscopical preparations.

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CASE REPORT.

TORSION OF SPLENIC VESSELS.

L. W. VAN DER HEEVER,
Pretoria.

The dog presented for examination was a Great Dane Cross, weighing about 50 lb., in excellent condition, and about four years old. The animal was in a semi-comatose condition, mucous membranes slightly pale, pulse hard and rapid, temperature 102°F. The abdomen was enormously distended, hard, and slightly painful.

The history given by the owner was that there had been a swelling about 3-4 inches in diameter, on the left side of the abdomen the previous evening. A year previously the dog had shown signs of haematuria, which had passed over without treatment.

With the history available, some obstruction to the outflow of the urine was considered.

Nembutal (5 cc.) was given intravenously, and a sterile puncture with a large bore needle was made in the region of the bladder. Only a small amount of dark red fluid could be obtained on aspiration. A more complete examination was made, and it was found that the "tumour" in the abdomen could be moved from side to side, and its edge could be felt on the right side just next to the vertebrae, but that no edge could be felt on the left side.

Diagnosis: Extreme tumour splenis. A blood smear was negative for P. canis and B. anthracis.

The animal died an hour or so later, and a post mortem was held.

The spleen was tremendously enlarged, and measured 18 inches by 6½ inches, and was almost 3 inches thick. The colour was dark purplish red. The other organs were aparently normal. Closer investigation showed a torsion of the splenic ligaments and vessels (see Fig. 1). To restore the organ to its normal position, three full turns had to be executed.

No theory can be advanced as to the cause of the condition. The owner was not aware of there having been any violent exertion.

Treatment — splenectomy, or a laparotomy with correction — could have been considered.

AVIRULENT ANTHRAX VACCINE.

G. D. SUTTON,
Onderstepoort.

Since the report on avirulent vaccine (Sterne, 1946) modifications have been made to overcome difficulties encountered in the production of the vaccine.

Immunogenic Capacity of the Vaccine Strain: Strain 34 F_2, which is used to produce the vaccine, loses its immunogenic capacity when stored on media either at room temperature or in a refrigerator. Covering the growth with liquid paraffin does not prevent this. The loss of immunogenic capacity is gradual, but practically complete after thirty days. The strain has to be dried down *in vacuo* from the frozen state and stored in sealed ampoules. The culture to be dried down should be suspended in brewer's yeast extract (125 Gm. per litre of distilled water) or nutrient broth. If physiological saline is used for this purpose the strain is affected adversely.

Medium: It has been found that all brands of casein do not produce a satisfactory medium for the production of this vaccine when used to make Gladstone and Fildes' casein hydrolysate medium (Gladstone and Fildes, 1940). The original brand used proved satisfactory, but four others used subsequently were unsatisfactory. The organism failed to sporulate well on media made from the latter four brands. The factor responsible for this appears to be mainly in the acid hydrolysate portion of the medium. When this is replaced entirely by tryptic digest of casein, a better vaccine is produced, which, however, is not yet up to the desired standard. The addition of the salt mixture used by Brewer and his co-workers (Brewer *et al*, 1946), with slight modifications, gives a medium which produces an effective vaccine.

The medium now used is:—

Tryptic digest of casein	10 parts
Brewer's yeast extract (125 Gm. yeast per litre distilled water)	40 parts
Distilled water	150 parts
K_2HPO_4	0·5%
KH_2PO_4	0·1%
Na_2SO_4	0·03%
$CaCl_2$	0·01%
$MgSO_4$	0·005%
$MnSO_4$	0·003%
$FeSO_4$	0·001%
Agar	2%

This medium is buffered by the phosphates used at pH 7·2. The potassium phosphates are essential. If they are replaced by sodium phosphates the medium is unsatisfactory.

The casein used to produce the tryptic digest of casein for this medium does not appear to matter. Even one very bad sample of casein with a distinct rancid odour and badly infested with weevils did not affect the medium adversely.

This medium is now used for all operations connected with the vaccine strain such as subculturing and vaccine production.

Production of the Vaccine: Woodhead flasks which give a surface area of medium of approximately 300 square centimetres are used as vaccine production flasks. Subcultures are made on successive days, from the vaccine strain in a freshly opened ampoule in which it has been stored. The growth from the second subculture is suspended preferably in brewer's yeast extract or else nutrient broth and this suspension used to inoculate the production flasks. If physiological saline is used for this purpose, growth and sporulation are partially inhibited. Sporulation is practically complete after 2-3 days incubation at 37°C. The growth is harvested from the production flasks by washing off with physiological saline, using glass beads. Approximately 30 cc. of physiological saline is added to each production flask. The washed off growth from 150 production flasks is added to 10 kilograms by weight of glycerine and adjusted by the addition of physiological saline to give a total weight of concentrated vaccine of 15 kilograms.

Testing the Immunogenic Capacity and Safety of the Concentrated Vaccine: The concentrated vaccine obtained above is first tested for its immunogenic capacity. Guineapigs are injected under the skin of the abdomen. Six(6) are given 0·02 cc., six (6) 0·01 cc. and six (6) 0·001 cc. Three weeks later the immunity is challenged by giving approximately 100 average killing doses for guineapigs of a Pasteur II strain. This infection is given under the skin of the thigh. Six (6) control guineapigs are included in the test. They are not given any vaccine, but receive the challenging dose. Any concentrated vaccine not giving full protection to all six guineapigs receiving 0·02 cc. is considered unsatisfactory and discarded. If 0·02 cc. gives full protection but 0·01 cc. does not, 500 cc. is added to 15 litres of a 50% mixture of glycerine and physiological saline plus ⅛% saponin. If 0·01 cc. gives full protection then only 250 cc. is added. The 0·001 cc. group is only included as an additional indication of the strength of the vaccine. This diluted product is the vaccine issued for use.

If the immunity produced by the concentrated vaccine is satisfactory, its safety is tested by infecting two goats each with 10 cc. subcutaneously. The goats usually show a temperature rise within 24 hours, which disappears after 12 hours. There should be practically no swelling at the infection site.

In addition 300-400 cattle under field conditions are tested as a

further safety measure. They are given 1 cc. of a $^1/_{25}$ dilution of the concentrated vaccine in 50% glycerine physiological saline. No ill effects should occur.

Testing the Vaccine for Issue: A final test is made on the diluted vaccine for issue described above. Six (6) guineapigs are given $\frac{1}{2}$ cc. under the skin of the abdomen. An abscess is caused, but the guineapigs survive. Three weeks later the same challenging dose as used previously is injected. All the six guineapigs should be completely protected against this by the dose of vaccine. If this test is passed, the vaccine is issued for use. The dose is 1 cc. subcutaneously for all animals.

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DESTRUCTION OF RABIES CARRIERS AT GROOTFONTEIN COLLEGE OF AGRICULTURE.

G. D. SUTTON,
Onderstepoort.

S. J. S. MARAIS,
Grootfontein, Middelburg (Cape).

The destruction of rabies carriers had to be undertaken at the Grootfontein College of Agriculture to control an outbreak of rabies. The authors of this article had no previous experience of this type of work and their object is to outline the difficulties which were encountered and the method used.

The system used in the Free State (Snyman, 1940) is gassing with Cyanogas A, followed by trapping with gin traps. The work is done in parallel strips approximately a mile long with a breadth governed by the number in the gassing gang, the members walking parallel and 25 paces apart. This method had to be modified to suit the local conditions and overcome a shortage of gin traps. Owing to war conditions sufficient traps could not be obtained.

At Grootfontein College of Agriculture the area which had to be cleared of rabies carriers is divided up into numerous small camps, lands, and plots. Rows of trees, aloe hedges, plantations of saltbush and spineless cactus, with staff and student residential quarters and office buildings, break the continuity of the ground. These obstacles and a large number of fences tend to throw the gassing gang out of their line and cause them to miss colonies. For this reason the area was done camp by camp in short strips. A great advantage of this method is that fences are not damaged by repeatedly being climbed over. In addition, the spaces separating the members of the gassing gang could be reduced or increased according to the requirements of the particular camp. For instance in spineless cactus or saltbush plantations the individuals of the gassing gang should not be more than five to ten paces apart, whereas in open spaces and lands the gang could be placed at 25 pace intervals. The distance between the members of the gang must be regulated according to circumstances.

It was noticed that ground squirrels were by far the most numerous of the rabies carriers being trapped. The ratio was approximately two ground squirrels to one of all the other carriers combined. The ground squirrels are rodents and will take grain bait. The others, being carnivores, will not. The trapping was supplemented by using strychnine bait. It was successful, the number of ground squirrels caught in the traps dropping to practically nil, and the number of traps was sufficient to catch the carnivores which escaped the gassing. The altered system was applied by sending the trappers out early

every morning to place bait at all the opened holes in a gassed area. The same afternoon these holes were revisited. If bait had been taken, the hole was closed. If it had not been taken, it was removed and a gin trap set in the hole.

The campaign would not have succeeded without the use of bait. No cases of poisoning occurred, but this danger was guarded against by warning all people and natives about what was being done. If any dogs or cats had been poisoned it would not have mattered, as such animals visiting meercat colonies in an infected area would have been a potential danger to their owners. Baiting and trapping together were found to be quicker, easier, and hence more economical than trapping alone. The bait was made up of: Strychnine 2 grains, Sugar 2 ounces, Mealie meal 1 pound.

The mealie meal was first cooked into a thick porridge. Then it was rolled out flat on a slab of glass with a bottle. The strychnine was powdered, mixed with the sugar and spread evenly over the mealie meal. It was then rolled in with the bottle. After that the mixture was well kneaded. A few small balls of this were placed at the opened holes. Mealies poisoned with strychnine were also tried, but were not successful. They would also have been more dangerous, as sheep in this area are used to eating mealies placed in the veld for them during droughts.

No trained gang was available for the work and all members, consisting of one European foreman, six natives on gassing and two on trapping operations, had to be trained. Under such circumstances, it was found essential to proceed slowly for the first week so that they could become used to the work. An explanation of the objects and importance of the work, stressing that overlooking holes or colonies meant extra unnecessary work, was beneficial. Odd holes missed by the gassing gang gave endless trouble to the trappers. All workers were ordered to report immediately if they were bitten so that preventive inoculation could be done. At Grootfontein, the labourers work nine hours a day. Their working time was split up into two periods, morning 6 a.m. to 11 a.m. and afternoon 3 p.m. to 7 p.m. with a break in the middle of the day. The gassing gang did not work on Sundays, on a few wet days, and only did a half day on Saturdays. These breaks in the work had no adverse affect on the campaign. The trappers, on the contrary, had to work continuously including Sundays to prevent rabies carriers returning to the gassed area and to keep pace with the gassing gang. This gang took six weeks to clear an extremely difficult and thickly populated piece of ground about 1,000 morgen in extent. The labour cost was £40.

The rabies carriers encountered were:—

1. *Cynictis penicillata* (Yellow mongoose).
2. *Suricata suricatta* (Suricate).
3. *Geosciurus capensis* (Ground squirrel).

4. *Ictonyx sp.* (Skunk)..
5. *Genetta felina* (Genet cat).
6. *Felis sp.* (Wild cat).
7. *Cynalopex chama* (Jackal).

Of these the first four were by far the most numerous.

The only effect on other fauna noticed up to the present has been an increase in the number of snakes.

Summary.

A campaign to destroy rabies carriers involving the use of baiting in addition to the usual gassing and trapping is outlined.

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A SHORT NOTE ON THE MILK SUPPLY FOR THE ROYAL PARTY DURING ITS STAY IN DURBAN.

C. C. WESSELS,
Durban.

As it was the responsibility of the Durban City Health Department to ensure that the Royal Party, during its stay in Durban, was adequately safeguarded from the dangers of infectious and preventable diseases, a comprehensive schedule was worked out. Every endeavour was made to ensure that the Party was not exposed to the dangers of contamination of milk, food, and water supplies.

Durban's water supply is maintained under continuous control by chlorination and can be regarded as 100% protected.

In respect of food supplies, all animals slaughtered at the Durban Municipal Abattoir are inspected ante-mortem, whereafter the carcases and offals are inspected before distribution.

All food shops within the City are registered and licensed annually and regularly inspected by the District Health Inspector. A Food Inspector attached to the City Health Department attends daily at the City Market in order to detect, and if need be, seize any unsound foodstuff exposed for sale.

By arrangement with the Catering Manager, S.A.R., a depot was selected as supplier of pasteurised milk, cream, and ice-cream to the dining cars and private saloons attached to the Royal and Pilot trains en route to Durban and to King's House, Durban, whilst the Royal Party was in residence at this centre.

Milk was delivered in new five-gallon cans and cream in quart bottles.

Every precaution was taken to ensure that:

(i) All employees concerned with the handling of such milk, milk products, machinery, and utensils had been Vi-tested and inoculated against typhoid fever prior to the arrival of the Royal Party.

(ii) No new employees were engaged from the time of arrival to that of the departure of the Party.

(iii) The milk, cream, and ice-cream intended for the Royal Party was available for the necessary tests before and after pasteurisation. Supervision of sterilisation of plant, equipment, etc., was carried out by members of the Health Department.

(iv) All dairy products ordered were delivered by the most expeditious means in new cans and bottles thoroughly cleansed, sterilised and conveyed in shippers with dry ice at the required low temperature.

(v) A Health Inspector was posted on the depot premises daily prior to despatch of the milk to the Royal trains and King's House.

(vi) A Bantu Health Lecturer addressed the Bantu employees in the depot on milk handling hygiene.

A week prior to the arrival of the Royal Party, a series of inspections of herds and premises were undertaken. Three herds were chosen. Physical examinations of all the dairy cows in the three herds were carried out. Several cows suspected of being infected with tuberculosis and others with clinical symptoms of streptococcic mastitis were excluded from the herds. In herd " A " all the cows were clinically healthy. In herds " B " and " C " there were several tuberculosis suspects and clinical cases of mastitis. Milk samples from the remaining individual cows were then examined microscopically for mastitis after incubation. Several more cows were found to be positive and these were also excluded from the herds.

Every morning the milk from the three herds, after cooling, was conveyed to Durban in separate new ten-gallon cans, each marked distinctly as to the herd of origin. A special delivery truck was used for transport. On arrival, at the depot, a pooled sample was taken from each of the three herds.

Bacterial counts by means of Breed smears, also plate and B. coli counts, were then carried out on each sample. As a check on mastitis, these samples were also incubated and examined microscopically.

After examination by the Breed smear method, the milk, if found to be satisfactory, was pooled and pasteurised in a special pasteurising plant of the " Holder " type and used solely for the milk intended for the Royal Tour. The temperatures were carefully checked on each occasion by means of the charts with which the plant was equipped.

From the outlet of the pasteuriser the milk entered the vacuum tank for homogenisation. The milk was processed in such a way that the fat globules would become evenly distributed throughout the milk. From the homogeniser, the milk was rapidly cooled by means of a blasting apparatus and kept at a low temperature in a cold room in new sterilised five-gallon cans, available for delivery as required.

After pasteurisation, samples were again taken and subjected to the phosphatase test, Breed smear clump count as well as plate and B. coli counts. The milk was then delivered to the Royal trains and King's House in special shippers packed with dry ice.

The remainder of the milk, after pasteurisation, was then utilised for cream separation and ice-cream manufacture intended for the Royal Party.

From the annexure it will be seen that from the 39 consignments of raw supplies only about 25% showed bacterial counts by the Breed smear method with an average of 70,000 organisms per cc., while 75% of the consignments showed the absolute minimum counts, i.e. total absence of organism in 0·01 cc. of milk.

The pasteurised milk derived from the 39 raw consignments showed twelve times out of the thirteen minimum counts and only in one instance the small count of 30,000 organisms per cc. This latter count was obviously due to the fact that the milk was run over the cooler where slight contamination took place, because the same milk cooled by blasting showed the minimum count.

During the stay of the Royal Party in Durban, the milk at all times showed minimum counts, i.e. complete absence of organisms in 0·01 cc.

Plate counts carried out on the pasteurised milk during this period revealed an average of total organism count of 3,000 per cc. and B. coli were always absent in 0·01 cc., the Royal Party received a very high quality milk from a hygienic point of view.

The average acidity of the milk during this period was 0·160%, whereas our local standard requires a maximum of 0·18% acidity. Here again the milk was well above the required standard.

The chemical analysis of the milk supplies to the Royal Party showed an average percentage of butter fat of 3·8% and at no time was it less than 3·6%. The legal standard is a minimum of 3% butter fat. The quality of the milk was thus of the best.

In regard to the cream supply to the Royal Party, a special product was manufactured containing an average of 41·8% butter fat, whereas commercial market cream contains from 20 to 25% butter fat.

The ice-cream supplies to the Royal Party contained an average of 15·2% butter fat, whereas in commercial ice-cream it varies from 10 to 11%.

Conclusions.

By means of clinical examination of three dairy herds, bacteriological and chemical tests on their milk, and comparing the results with our by-law standards, the Royal Party received, during its stay in Durban, the highest possible quality milk that could be produced under existing circumstances. This article also illustrates what can be achieved when milk is produced and distributed under the control and supervision of expert staff.

Acknowledgment.

Thanks are due to the City Medical Officer of Health for permission to publish this article.

BREED SMEAR CLUMP COUNTS: RAW SUPPLIES.

Herd	Dates of Counts						
	11/3/47	12/3/47	13/3/47	14/3/47	15/3/47	16/3/47	17/3/47
"A"	M†	M	M	M	M	M	M
"B"	M	30,000*	M	M	M	M	M
"C"	30,000	30,000	M	M	M	M	M

Herd	Dates of Counts						
	18/3/47	19/3/47	20/3/47	21/3/47	22/3/47	23/3/47	
"A'	M	M	M	30,000	M	M	
"B"	M	30,000	120,000	M	M	30,000	
"C"	M	M	300,000	30,000	60,000	M	

BREED SMEAR CLUMP COUNTS: PASTEURISED MILK.

M	30,000	M	M	M	M	M	M	M	M	M	M	M

† Minimum count, i.e. total absence of organisms in 0.01 cc. milk.
* Organisms per cc. of milk.

NOTE ON TECHNIQUE.

INCREASED SAFETY AND ACCURACY IN THE USE OF A FIVE ML. PASTEUR PIPETTE.

G. C. VAN DRIMMELEN,
Onderstepoort.

Owing to the war-time difficulty of obtaining suitable large teats or rubber bulbs, a 5 m.l. all-glass syringe (Becton-Dickinson) was fitted with a piece of rubber tubing at the nozzle-end, to which the ordinary bacterial glass pipettes could be easily attached. A string

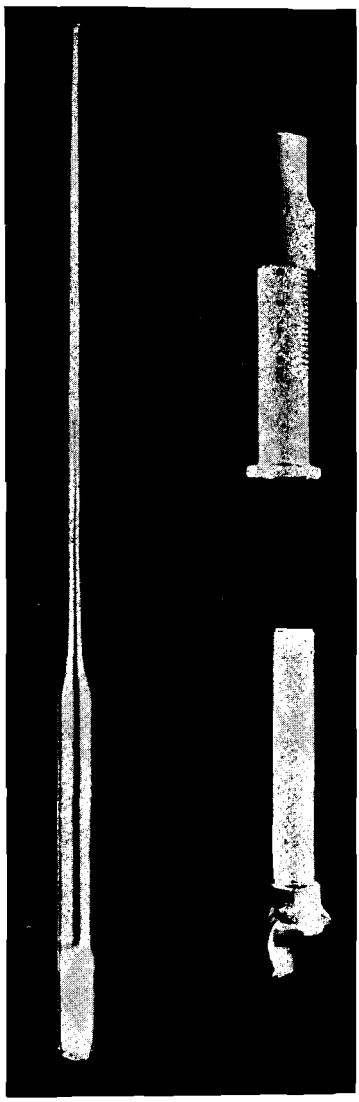


Fig. 1. — Instruments mentioned.

or rubber loop was fitted to the piston handle for attachment on the fore-finger. Glycerine was used to lubricate the piston and also the part of the rubber tube applied to the pipetes.

By means of this it was found possible to expedite the seeding of Roux flasks, which requires 2·5 m.l. liquid per flask, and to exclude the necessity of filling the pipettes by mouth. A method of measurement correct to the nearest 0·2 m.l. was obtained with non-graduated pipettes in this way.

Fig. 2. — Act of seeding Roux flask with half 2·5 m.l. of suspension of Brucella washed off agar slant in test tube.

The efficient application of the method in the production of Brucella vaccine, by Mr. D. J. Struwig, technical assistant, is acknowledged.

A NOTE ON A POSSIBLE AETIOLOGY OF SPORADIC PHOTOSENSITISATION IN CATTLE.

RICHARD CLARK,
Onderstepoort.

Two causes of photosensition in cattle are known:

1. *Hereditary Porphyrinaemia*: This condition has been described in South Africa. It is essentially a disturbance in the formation of haemoglobin where porphyrins circulate in the blood, causing the photosensitivity.

2. *Poisonous Plants*: Certain plants such as Lantana and Lippia contain a principle which paralyses the biliary tract. Erythrophyllins are normally formed in the rumen from the breakdown of chlorophyll and excreted in the bile. Biliary stasis causes a reabsorption of bile, leading not only to jaundice but also to the accumulation of erythrophyllins in the blood. These substances are chemically closely related to the porphyrins, both being fluorescent, and also causing photosensitisation.

Where photosensitisation occurs from either of the above causes, the aetiology can usually be traced from the mode of occurrence. Frequently, however, sporadic cases of photosensitisation are encountered for which no cause can be found. Such a case was reported recently to Onderstepoort and, on post-mortem, the owner found a large accumulation of gravel in the gall bladder.

It is quite conceivable that an intermittent or partial stoppage of the bile flow caused by calculi, might result in an erythrophyllinaemia sufficient to cause photosensitisation. The accompanying bilirubin aemia might be intermittent or too slight to cause visible jaundice. This very simple but rational explanation of the aetiology in sporadic cases of photosensitisation has not, to the writer's knowledge, so far been considered. It would be of great interest if a careful examination could be made for the presence of biliary calculi when post-mortem examinations are made on such cases.

Treatment is usually valueless but, if attempted, should consist in the removal of all chlorophyll containing green food, keeping the animal in the shade and the administration of cholagogues.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

Council Meeting held in the Tilsim Hotel, Pretoria, 8th May, 1947, at 2.15 p.m.

Present: J. H. Mason (President), A. M. Diesel, A. D. Thomas, R. Alexander, E. M. Robinson, A. C. Kirkpatrick, P. S. Snyman, J. G. Boswell, W. D. Malherbe and S. W. J. van Rensburg (Honorary Secretary-Treasurer).

Apology for Absence: M. C. Lambrechts.

1. *Minutes* of meeting held on 13th February, 1947, were read and confirmed.

2. *Arising* from these:—

(a) *Tuberculin Testing*: Dr. Diesel reported that a committee consisting of representatives of the Departments of Agriculture and Public Health had been appointed to investigate the tuberculosis problems. In the lengthy discussion which ensued several members strongly deprecated the apparent tendency of the Department to sidetrack and shelve this problem as much as possible. It was eventually decided to write to the Director of Veterinary Services asking the Division to come to an early decision with regard to tuberculin testing and the part to be played by private practitioners.

(b) and (c) *Amendment of Stock Diseases and Veterinary Acts*: Since the sub-branches and the relative Committee have not had sufficient time to consider the replies received from members, discussion on the proposed amendments was postponed till the next meeting.

(d) *Milnerton and South African Turf Clubs*: It was decided to submit the question of veterinary services to these two clubs to the Cape Western Branch for its views.

(e) *Reciprocity with the R.C.V.S.*: The Secretary reported that no reply had as yet been received from the Royal College. The matter was therefore left over till the next meeting.

3. *Durban Turf Club*: Correspondence submitted by the Natal branch regarding the refusal of the Durban Turf Club to accept certificates from any but the Club's official veterinary surgeon was considered. After full discussion it was unanimously agreed that a Turf Club, like any other body employing a veterinary surgeon, was acting fully within its rights in recognising only certificates issued by its official veterinary surgeon. Such action is not considered as casting any reflection on the integrity of other members of the profession. Council was further of opinion that when a horse undergoing treatment by a private practitioner was considered unfit for racing, the practitioner concerned should forward a certificate through the official veterinary surgeon of the Club.

4. *Cape Town Branch*: The formation of this branch was approved. Council was of opinion that in future the subsidy granted to branches

should only be paid in order to start the branches and that the latter should aim at eventually becoming financially independent of the parent body.

5. *Bona fide Veterinary Students*: A minute dated 18th February, 1947, from the Chairman of the Veterinary Board, was read. This drew attention to the fact that during the absence of a veterinarian on vacation, a third-year veterinary student had attended a case on his behalf. Dr. Diesel pointed out that so long as a student was not practising for gain or holding himself out to be a veterinarian, he is within the law.

Council decided that it was not in favour of students acting as locum tenens. This was to be indicated by a note in the *Journal,* which was also to quote Section 10 (1) and (2) of the regulations. The Secretary was instructed to notify the Veterinary Board accordingly.

6. *Pretoria Municipality*: A committee consisting of Drs. Thomas, Diesel and Malherbe was appointed to meet Dr. I. P. Marais in connection with the pending inquiry into the Municipal services of Pretoria.

7. *Sale of Penicillin*: A letter from Dr. Parkin was read. This suggested that manufacturers of penicillin be approached with a view to restricting the sale of penicillin to professional people. This was considered impracticable, but Council decided to appeal to members to support only those firm who conduct trade on ethical lines.

It was decided to write to the manufacturers concerned re drugs supplied through a certain firm.

8. *Salary Scales*: Council was advised that the various agricultural bodies who have been agitating for improved salary scales in the Service appeared to be under the impression that there was general satisfaction after the introduction of the new scales last year. A Committee consisting of Drs. Alexander, Parkin and Robinson was appointed to draw up a statement for publication in the *Journal,* copies of this to be submitted to the bodies concerned.

9. *General Meeting*: This was arranged for Wednesday and Thursday, 17th and 18th September. It was decided to start the first day with scientific papers and to have the business meeting in Pretoria on the evening of the 17th. The afternoon of the second day is to be free. The Editorial Committee will be responsible for the programme, and the Entertainment Committee will consist of Drs. Malherbe and De Lange.

10. *General*:

(a) *Journal*: A suggestion that the exchange list of the *Journal* be abolished was not agreed to.

(b) *Col. C. J. van Heerden*: It was unanimously decided to recommend to the General Meeting that Col. C. J. van Heerden be appointed honorary life vice-president of the Association in recognition of the services rendered by him to the veterinary profession.

The meeting adjourned at 5.30 p.m.

S. W. J. VAN RENSBURG,
Honorary Secretary-Treasurer, S.A.V.M.A.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

BALANCE SHEET AS AT 31st MARCH, 1947.

LIABILITIES.

Benevolent Fund as at 31st March, 1946		£947	10	9		
Add: Subscriptions collected		101	15	0		
Commission on Insurance Premiums		36	9	7		
Donations		27	19	6		
Interest accrued		40	4	0		
		1,153	18	10		
Less: Assistance Payments		96	0	0		
					£1,057	18 10
Prize Fund as at 31st March, 1946		341	7	2		
Add: Interest accrued		13	13	1		
Profit on Book Fund Transactions		78	7	2		
		433	7	5		
Less: Awards		10	0	0		
					423	7 5
Natal Branch as at 31st March, 1946		13	10	3		
Add: Subscriptions collected		0	10	0		
£-for-£ contribution		0	10	0		
					14	10 3
Sundry Creditors:						
Caxton Printing Works		107	1	7		
Baillière, Tindall and Cox		441	5	10		
Central News Agency, Ltd.		1	0	2		
					549	7 7
Subscriptions Reserve Account					10	10 0
General Fund as at 31st March, 1946		2,129	4	1		
Less: Excess of Expenditure over Income for 1946–47		96	12	10		
					2,032	11 3
					£4,088	5 4

ASSETS.

Investments at purchase price, plus interest:						
Union Govt. 3½% Stock, 1952-57		£405	0	0		
Union Govt. 3¾% Stock, 1954		202	14	2		
Union Loan Certificates		2,119	12	10		
United Building Society Pref. Shares		101	6	8		
					£2,828	13 8
Interest (U.L.C.) Suspense Account					68	19 8
Loans plus accrued Interest:						
To Member		50	13	5		
,, Students (two)		164	7	10		
,, Deceased Member's Widow		283	15	10		
					498	17 1
Stock of Books at purchase price					62	8 9
Sundry Debtors for Journal Advertisements					16	19 0
Due by Members:						
For Books sold	£100 15 11					
Less: Paid in advance	18 19 1					
		81	16	10		
Members' Subscriptions	240 4 0					
Less: Paid in advance	135 15 0					
		104	9	0		
		186	5	10		
Less: Insurance Premiums paid in advance		2	13	3		
					183	12 7
Cash: At Bank		420	18	7		
On Hand		7	16	0		
					428	14 7
					£4,088	5 4

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

INCOME AND EXPENDITURE ACCOUNT, 1946–47.

1945 – 46.					1946 – 47.			1945 – 46.					1946 – 47.		
£3	4	9	To	Wreaths, etc.	£3	3	0	£316	9	6	By	Subscriptions accrued	£336	17	0
3	7	6	,,	Branch Subsidies	4	17	6	76	13	8	,,	Interest	76	7	4
				Witwatersrand Branch £4 7 6				–	–	–	,,	Miscellaneous Receipts	7	7	0
				Natal Branch 0 10 0				–	–	–	,,	Excess of Expenditure over Income	96	12	10
				£4 17 6											
6	16	10	,,	Bank Charges	7	8	1								
23	15	11	,,	Cost of Meetings	8	6	4								
16	4	0	,,	Adjustments	–	–	–								
22	16	9	,,	Stationery	29	19	0								
31	14	4	,,	Miscellaneous Expenses .... (Including Honorarium, £15.15.0 and Travelling Subsistence, £32.13.8.)	64	15	10								
51	0	0	,,	Clerical Assistance and Typing	62	0	0								
211	11	8	,,	Net Cost of Printing and Distributing Journal	336	14	5								
22	11	5	,,	Excess of Income over Expenditure	–	–	–								
£393	3	2			£517	4	2	£393	3	2			£517	4	2

BENEVOLENT FUND.

The following donations have recently been received:— R. Alexander, £3.3.0; G. J. de Wet, 10s.; A. Matthew, £2.2.6; C. F. B. Hofmeyr, £1.1.0; Mrs. M. M. Neser, £9.10.8; A D Thomas, 10s; H. J. Besselaar, £1.1.0; A. C. Kirkpatrick, £1.13.4; P. S. Snyman, £5.5.0; A Matthew, £2.2.0

FOR SALE.

Microscope, Reichert, Austria, in perfect order, monocular, mechanical stage; oculars: 12, 10, 5; objectives: 10, 45, and oil immersion; finished black and chromium. Bought new December, 1946 for £50. Reason for selling: owner has bought binocular microscope. Price, £40 cash. Apply: Dr. J. G. BRANDSEN, Veterinary Surgeon, P.O. Box 141, Ficksburg, O.F.S.

PRACTICE OR PARTNERSHIP WANTED.

British veterinarian with small family, qualified 1940, desires town and country practice or partnership, or suitable appointment. House essential. Minimum £750 per annum. Air mail reply to:—

WILLIAMS-JONES,
117, High Street,
Lewes,
Sussex,
England.

SITUATION WANTED.

M.R.C.V.S., age 37 years, fit, single, wishes to leave England and obtain employment in South Africa. Reply to: R. DE BRUYN, 15 Allestree Lane, Allestree, Derby, England.

INTESTINAL PARASITES OF SHEEP

M. J. N. MEESER,

Calvinia.

Mr. President and Gentlemen, — This paper on " Intestinal Parasites of Sheep " is an attempt, in brief, to acquaint you with information collected and experience gained during the past ten years in nineteen districts in the Cape Western Veterinary Area. The information collated here emphasises two main facts. Firstly that the degree of infestation is much more severe and more widespread than generally realised. Secondly that the average farmer is not aware of the losses, both direct and indirect, sustained by him. It is now suggested that veterinary surgeons in this area pay more attention to verminosis. The State Veterinary Surgeon, in his role as animal husbandryman, should educate the farmer to the seriousness of the position and emphasise the value of correct and regular treatment. The private practitioner, by interesting himself in this subject, would not only render good service to his client, but would undoubtedly enhance his prestige.

The nineteen districts already referred to comprise the districts of Worcester, Robertson, Caledon, Ceres, Gordonia, Oudtshoorn, Ladismith, Willowmore, Uniondale, Knysna, George, Mossel Bay, Riversdale, Calvinia, Williston, Sutherland, Clanwilliam, Van Rhynsdorp and Namaqualand. In these districts one hundred and forty (140) farms were visited and one hundred and sixty-six (166) postmortems performed.

In the districts of Worcester, Robertson, Ceres and Caledon, only ten (10) farms were visited. The main problem encountered here was *Fascioliasis*. As most of the infested farms were situated along rivers this is not surprising. Concurrent with this was an extremely severe infestation of *Haemonchus contortus*. Both cattle and sheep were affected. An interesting problem, encountered in both Worcester and Robertson, was the presence of a very severe lungworm (*Dictyocaulus filaria*) infestation. Strange to relate, on the three farms, visited the animals were in very good condition. There was no other parasite worthy of mention. Since then this parasite has been observed at innumerable post-mortems. It would seem that lungworm infestation is not the problem here that it is in England and on the Continent where " hoose " or " husk " appears to cause unthriftiness and mortality.

In the district of Gordonia three (3) farms were found to be heavily infested with *Haemonchus contortus*. Two were situated on the banks of the Orange River and the other some 20 miles in the

Kalahari. Strange to relate, Gaigeriosis was never encountered in the Gordonia Kalahari although attempts were made to locate any possible infestation.

In the South Western Districts, i.e., the districts of Oudtshoorn, George, Knysna, Uniondale, Ladismith, Riversdale, Mossel Bay and for the purposes, of this paper, the district of Willowmore, forty farms were visited. The infestation present in these districts can be divided into three regions, viz., the Coastal region, the Grass or Middleveld and the Karoo. In the Karoo which consisted of the areas of Oudtshoorn, Ladismith, portion of Uniondale and the Willowmore district *Haemonchus contortus* infestation was most severe and responsible for heavy mortality. One farm, however, where only *Nematodirus spathiger* was present, the animals showed unthriftiness despite good grazing. Other species, notably tapeworm ones, were also present in the Karoo region.

The Grassveld region of the South Western Districts is that portion of the districts of Riversdale, Mossel Bay, George, and Knysna south of the Langeberg and Outeniqua mountains. The Langkloof of Uniondale is also included as the rain, climate and farming operations are similar. A typical cross-section of infestation found in this area is the following: *Dictyocaulus filaria, Haemonchus contortus, Trichostrongylus rugatus, Moniezia* species, *Oesophagostomum columbianum* infestation were very apparent. Concurrent with the parasitic species present very heavy losses were sustained. These losses were so bad in many cases that entire flocks died out. Many farmers sold their sheep as they found it unprofitable to farm with them.

The same applied to the Coastal belt of the districts of Riversdale, Mossel Bay, George and Knysna. All the parasites mentioned in the Grassveld were found and in addition *Trichuris globulosa* and *Bunostomum trigonocephalum.* The addition of this latter parasite to sheep already heavily infested with *Haemonchus contortus* and *Oesophagostomum columbianum* was like the proverbial "last straw to the camel's back." The annual sheep census, especially for the districts of George and Knysna showed a steady decline yearly. This decline, in an area not unsuited to smallstock farming, was entirely due to the ravages of intestinal parasitism.

The North West Cape, in particular the districts of Calvinia, Williston, Sutherland, Clanwilliam, Van Rhynsdorp, and Namaqualand has since time immemorial been considered an outstanding small stock area. It was believed to be free of the diseases affecting the rest of the country. In the past two years, however, the picture has completely changed. It is now known that an extreme degree of verminosis exists. In this area eighty-seven (87) farms have been visited. This area can be divided into summer and winter rainfall areas. The summer rainfall area comprises the Bushmanland of Calvinia and the districts

of Williston and Sutherland. The most important parasites in the summer rainfall area are *Trichostrongylus rugatus* and *Nematodirus spathiger*. Infestations are severe in merino, black head Persian and crossbred sheep. These two parasites have been responsible, not only for losses, but also for extreme unthriftiness, despite good grazing. It will be remembered that the same applied to the Karoo of the South Western Districts. Veterinary teaching states that *Trichostrongylus* species is only pathogenic to black head Persians and crossbred sheep. The teaching also states that *Nematodirus spathiger* is not pathogenic. It is now considered that this teaching is at fault. Experience gained has definitely inclined one to the opinion that these two parasites are decidedly pathogenic for all breeds of sheep. The opinion expressed by Ryksen and Monnig — *vide Jnl. S.A.V.M.A.*, Vol. 13 No. 4 and Vol. X No. 1 is concurred with.

The winter rainfall area of the North West Cape comprises the districts of Clanwilliam, Van Rhynsdorp, Namaqualand and the Hantam Karoo and Bokkeveld regions of Calvinia.

Only a small portion of Namaqualand has as yet received attention. This is the subdivision of Garies. Here thirty (30) farms have been visited. The investigation in this area was the follow up of the discovery of the presence of *Chabertia ovina* in extremely large numbers. Except for a few isolated instances this parasite was not considered to be present in South Africa. In the Garies area, and as it was later found in Clanwilliam and Van Rhynsdorp, the parasite is ubiquitous. The resulting investigation showed that a panverminosis existed in this area. Stock losses for the year 1943-44 which was a good stock year, amounted to 12,000 small stock in the Garies area alone. A typical cross-section of a heavy infestation is the following : *Dictyocaulus filaria, Gongylonema Monnigi, Haemonchus contortus, Ostertagia circumcincta, Trichostrongylus rugatus, Nematodirus spathiger, Avitellina centripunctata, Moniezia expansa, Oesophagostomum venulosum, Chabertia ovina, Cysticercus tenuicollis.* On the majority of these farms the infestation was so severe and so general that it was not possible to incriminate any single parasite. The most prominent parasites were *Haemonchus contortus, Ostertagia circumcincta, Trichostrongylus rugatus, Nematodirus spathiger* and *Chabertia ovina.*

The same state of affairs seems to exist in Van Rhynsdorp especially in the Sandveld area. The Sandveld and River area of Clanwilliam also are as bad. The parasitic burden is increased by the presence of *Bunostomum trigonocephalum* and *Oesophagostomum columbianum* in addition to the above named parasites.

In the Karoo, Hantam and Bokkeveld regions of Calvinia the chief parasites are the blood sucking worms, viz., *Haemonchus contortus, Ostertagia circumcincta, Trichostrongylus rugatus* and *Nematodirus spathiger.* All forms of Taeniasis are prevalent. *Taenia*

multiceps with its intermediate stage, *Coenurus cerebralis*, has been responsible for heavy mortality on at least five farms. Here, too *Oesophagostomum venulosum* is present. This parasite is comparatively harmless and does not form nodules in the small intestine.

Time does not allow of any discussion of the treatment and prevention of these parasites. In the great majority of cases judicious use of Government Nodular Worm Remedy and Tetram proved most efficacious.

INORGANIC PHOSPHORUS IN THE BLOOD OF CATTLE IN RELATION TO AGE

J. M. FOURIE AND E. A. DEACON,
Veterinary Research Laboratory, Vryburg.

Studies in connection with the inorganic phosphorus content of bovine blood show that this fraction varies with age. All the references encountered in the literature, however, only refer to inorganic blood phosphorus determinations over the first couple of months or years of life.

Green and Macaskill (1928) found that the inorganic phosphorus content of the blood of the calf, which at birth is appreciably higher than that of the mother, rises sharply within the first week and although it begins to fall during the second month, is still higher even after ten weeks. In similar determinations during the first eight weeks of life Malan and Bekker (1931) found that most of the calves had a relatively low figure for inorganic phosphorus in their blood at birth. These low values increased very rapidly sometimes and remained definitely higher than those for the dams during the experimental period. Figures published by Malan and du Toit (1932) show that there was no appreciable change in the inorganic phosphorus content in the blood of steers during the first twenty-four months of life after weaning. According to Groenewald (1935) this value is relatively higher for calves than cows and there was no drop appreciable during the first three months of life. Inorganic blood phosphorus determinations on steers 15 months old, by Hamersma (1937) at monthly intervals for a year, showed no significant variation between the monthly averages. Bisschop and others (1939) found that with calves, raised on phosphorus deficient grazing and which received no phosphatic supplement prior to weaning, the inorganic blood phosphorus remains high (i.e. about 8 mgm. %) till they are about 60 days old but after this age there is a distinct decline until weaning. When placed on a phosphorus supplement there is however again a definite upward trend.

To obtain more complete data from animals over a wider age range than covered by previous work, determinations were made on the blood of groups of male and female animals ranging in age from 6 months to 13 years. The chemical analysis for inorganic phosphorus was made according to the method described by Malan and van der Lingen (1931).

All oxen, and nearly all the cows, used in the experiment were high-grade Afrikanders, raised on the phosphorus deficient grazing of

the Bechuanaland area. Their phosphorus requirements were, however, met through supplementary feeding of bonemeal to all cattle once they were weaned.

The following tables give the average and mean mgm % inorganic P. figures obtained from two separate determinations on the blood of animals in the different age-groups :—

(*a*) *Oxen.*

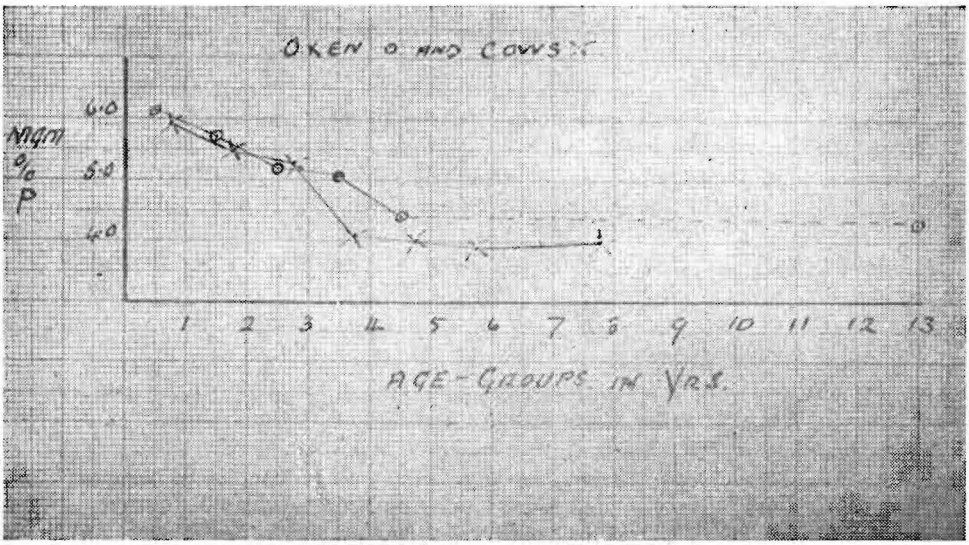
Age-groups. (No. of animals indicated.)	Average Mgm. % P. Date bled. 16/5/45.	28/6/45.	Mean.
6 months (8)	5·9	6·4	6·1
1 year 6 months (8)	5·7	5·7	5·7
2 years 6 months (7)	5·5	4·9	5·2
3 years 6 months (8)	5·0	5·1	5·1
4 years 6 months (7)	4·5	4·3	4·4
13 years (8)	4·2	4·4	4·3

(*b*) *Cows.*

Age-groups. (No. of animals indicated.)	Average Mgm. % P. Date bled. 21/8/45.	20/11/45.	Mean.
9 months (8)	5·9	6·1	6·0
1 year 9 months (6)	5·9	5·1	5·5
2 years 9 months (6)	5·8	4·9	5·4
3 years 9 months (7)	4·5	3·7	4·1
4 years 9 months (8)	4·2	3·9	4·1
5 years 9 months (9)	4·8	3·1	4·0
7 years 9 months (7)	4·3	3·8	4·0

With the second determination all the groups of heifers and cows, except the youngest, show a lower inorganic blood phosphorus value. The reason for this is a deterioration of the veld which occurred as a result of a continued drought. This should have affected all the animals in the same way, but this is not apparent in this group of heifers because their inorganic blood phosphorus content was probably raised by the bonemeal supplement which they got after they were weaned on the 1st of October. This is in accordance with the above findings of Bisschop and others.

The diagram in Figure II graphically illustrates the trend of the age-group Mgm. % P. means for the oxen and cows.



Discussion.

In the case of the oxen no material was unfortunately available to fill in age-groups from 6 to 12 years. It is nevertheless evident that for both sexes the inorganic blood phosphorus content in the blood, which was about 6 Mgm. per 100 cc. in the case of calves 6-9 months old, gradually diminished over the next four years of life when it reached a more or less constant level of slightly above 4. The figures obtained for the blood of young calves by Green and Macaskill, and Malan and Bekker are in agreement where they found the inorganic phosphorus content at birth to be about 5 Mgm. % per 100 cc. and a high point of about 8, which was reached from the second to the third weeks.

From a statistical analysis of the data it was possible to conclude that in both oxen and cows there is a significant decrease of inorganic phosphorus in the blood with increasing age up to about 6 years, after which it remains constant. The error of the experiment was found to be a little high.

Acknowledgements.

Sincere thanks are due to the officials of the Division of Biochemistry at Onderstepoort, for the analysis of the blood samples and to Dr. G. B. Laurence of the same institute, for the statistical presentation of the results.

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PROBLEMS CONFRONTING THE NAGANA CAMPAIGN IN ZULULAND

GILLES DE KOCK, R. DU TOIT AND E. KLUGE,
Onderstepoort. Zululand.

The tsetse fly problem in Africa is so vast and complicated that with the time at our disposal only some of the aspects of the epizootiology can be considered and some of the criticisms raised in respect of the nagana campaign in Zululand will be dealt with.

It is estimated that 4½ million square miles of the African continent are infested with tsetses. In Tanganyika it is believed that two-thirds of the country is infested, whereas in the Union approximately 6,000 square miles are at present probably involved. Various aspects of the tsetse fly problem have been ventilated in many contributions and scientific papers, and at conferences and investigated by commissions. As recently as July, 1946, a very representative conference was held in Lourenco Marques, and experts from many of the African States were afforded an opportunity of reviewing the tsetse fly position and the control measures being applied in Kenya, Tanganyika, Nyasaland, Northern and Southern Rhodesia, Bechuanaland Protectorate, the Union of South Africa, Angola and Portuguese East Africa. This conference noted the great diversity in conditions which exists in the different parts of Africa infested with tsetse, and considered that *no single measure* can be regarded as very superior to any other for universal or general application. The methods applied in a particular area should be those most suited to the circumstances, and this can only be assessed by the workers possessing this local knowledge.

In the Union several papers have appeared each dealing with important aspects of the problem e.g. by Curson, Harris, du Toit, Kluge, de Kock, etc. Valuable information has appeared in the official reports of officers entrusted with investigations of the nagana problem in Zululand. The tsetse fly measures adopted in the other African States have been studied and investigated by officers from here, and leading authorities from outside the Union (Buxton, Chorley, etc.) have inspected the control measures now being applied by the Union authorities.

The tsetse is a highly specialised insect and, except for one or two species, depends exclusively on warm blooded animals for its food. Its life cycle is unique, and in the pupal stage it can survive in the soil for periods up to 90 days. Potts at the Lourenco Marques conference referred to :—

(a) Primitive tsetses; and
(b) the later and more modern tsetses.

In the former they have clung on to their environment and are for the most part confined within the wetter relics (e.g. G.palpalis). The more modern tsetses on the other hand (G. morsitans, swynnertoni, pallidipes) have modified their habits, probably in an environment altered by man, who has probably produced better facilities for spread (e.g. burning early in the season, creating irregular patches of protection etc.). They are apparently more difficult to cope with than the primitive tsetses. G. pallidipes, the main tsetse of Zululand,

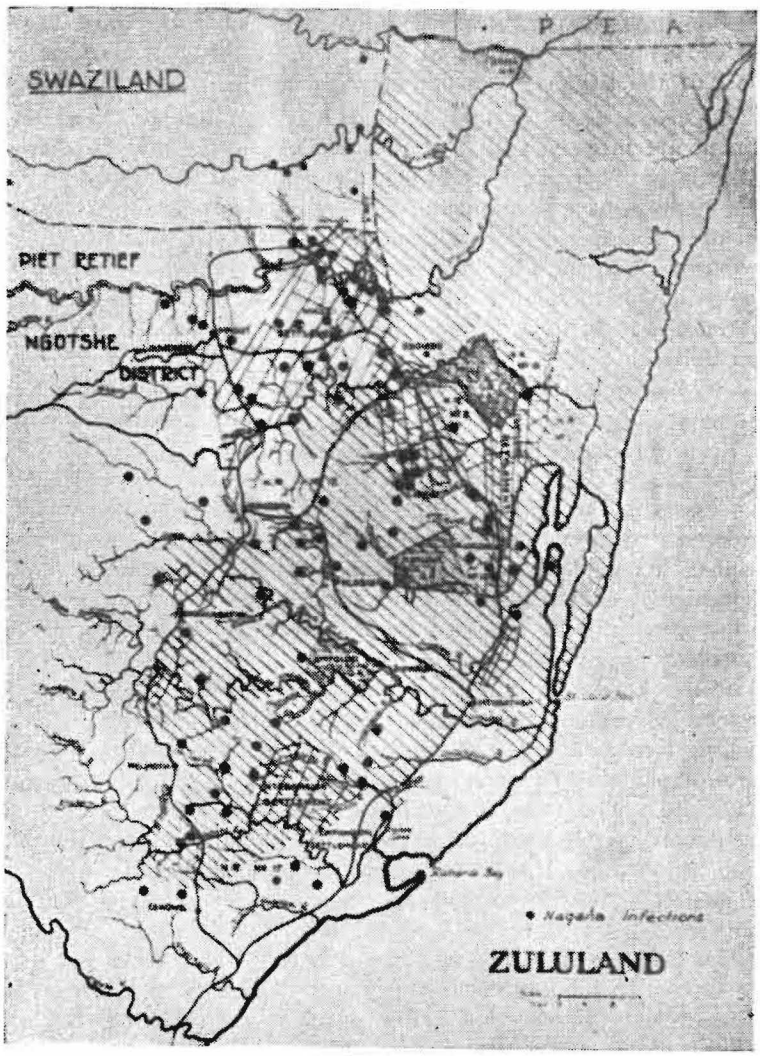


PLATE I.

Map of Zululand showing the potential fly belt and the spread of nagana since the end of 1945.

favours the bushveld thickets, whereas G. brevipalpis is dependent on forests, and G. austeni on dense shade. They are closely associated with *dependable hosts* in contra-distinction to *occasional hosts,* such as rats, monkeys, vultures, etc. G. pallidipes is usually not homophilic, but more zoophilic, and can maintain itself in the presence of small game, such as bush buck, bush pig, warthog, etc. G. morsitans on the other hand is homophilic and zoophilic and apparently is closely associated with the large game, such as kudu, buffalo and wildebeest. Game *constitutes the main food supply* of the tsetses, and also serves as the *carrier of the Trypanosomes* responsible for sleeping sickness in man, and nagana in domestic animals.

In the Union of South Africa *G. pallidipes* is causing great concern. It seems to range further than any other species of tsetse in search of its food, and it is able to exist in a thinly scattered community. It can locate small game like warthog, bush pig and bush buck as indicated above. It is considered the most difficult species of tsetse to eradicate. It is not correct to state that *G. austeni* may occur only as a migrant from Portuguese East Africa. According to the Portuguese authorities the tsetse on the Zululand border is *G. brevipalpis,* which occurs in foci along the Maputa river in Portuguese East Africa. From time to time it disperses southwards and is probably responsible for the outbreaks of nagana in the southern parts of the Ingwavuma district. No G. austeni have so far been recorded in the Ingwavuma surveys, whereas pupae casings and unhatched pupae are at present being collected in the Morrisvale area indicating a focus of G. austeni along the Mkuzi river at the junction of the Mosi Swamp, extending south for about 2 to 3 miles (Kluge's Report — May, 1947).

Tsetses are found in what is known as "*fly belts*" which vary to a very large extent on the African Continent. Harris believed that some sixty years ago the Umhlatuzi valley was densely populated with tsetses (G. pallidipes) when elephant, buffalo and other game roamed the country. With the advance of civilisation, the large animals were destroyed and the fly population became reduced to a nucleus subsisting on smaller game such as bush buck, bush pig, etc. Harris recognised in South Zululand the following fly belts : Umhlatuzi valley, the Umfolosi valley and the Hluhluwe valley and actually states that the intervening country became fly free. According to him the fly belts are clearly defined by major valleys where the highest density of fly occurs and where the larger animals roam and have their habitat. As the highest densities become reduced, dispersion becomes reduced also in proportion. The actual fly belt is in reality composed of a large number of fly belts of varied densities and there appears to be a correlation between fly density and food constancy. It seems quite likely that with the increase of bush and thickets in some of the areas

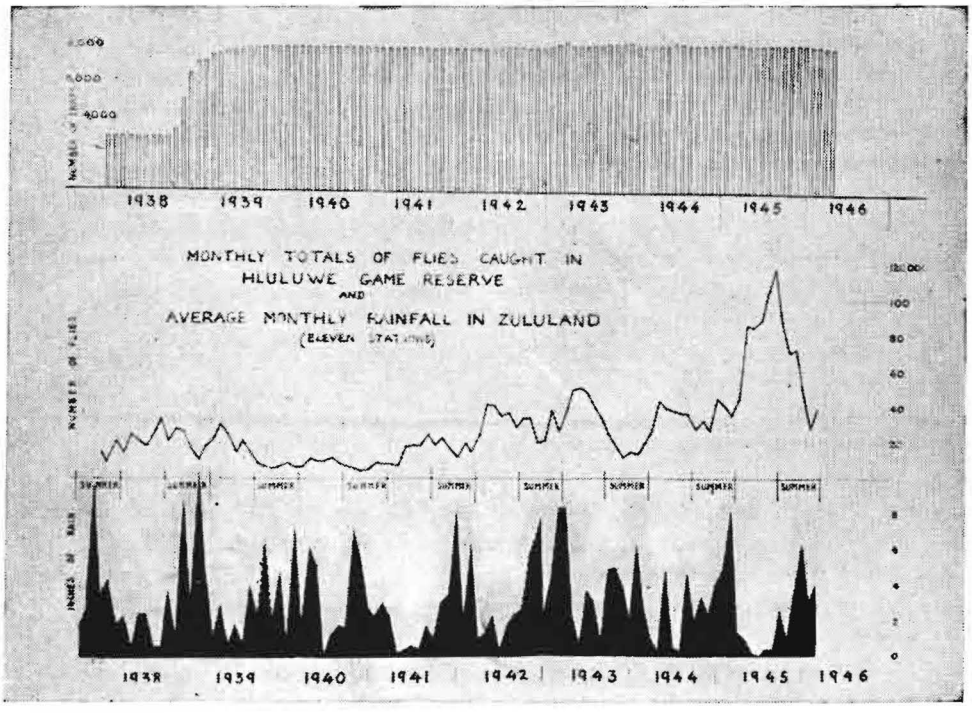


PLATE II.

A chart indicating: (1) *the incidence of tsetses as registered by the Harris trap;* (2) *the failure of the traps to control the fly since* 1941; *and* (3) *high "peaks" during periods of drought.*

in Zululand (the Enseleni valley), the dispersion areas have been converted into permanent breeding foci of flies mainly dependent on small game.

According to Harris, the northern limit of tsetses (G. morsitans) in 1836 appear to have been that portion of the Transvaal comprising the "watershed" of the Limpopo river and its tributaries. Apparently at this period, tsetses were not known to exist in any of the other provinces. Very little appears to have been known of the *tsetses in Zululand* until 1887, when Sir Charles Saunders, at the time when Zululand became a British possession, indicated that natives were dependent on game for food, and in consequence of this, little large game existed in that country, except in the uninhabited localities, like the junction of the two Umfolozi rivers, Hluhluwe and the Mkuzi valleys. Laws for the preservation of game, particularly of large varieties were then enacted and after this a rapid increase followed. Game spread to parts where they were not found when the country was annexed. With large game, nagana and tsetse fly spread and increased in corresponding degrees. Then followed the investigations

of Sir David Bruce in 1895-96 in the Ubombo district in the vicinity of the Mkuzi Game Reserve. Following the invasion of Rinderpest in 1896, stringent measures for the preservation of the remaining game were again revived with the result that it soon began to increase, at first slowly until about 1905 when nagana again made its appearance, spreading from one locality to another beyond the game reserves. From then onwards there have been ravages of nagana and during the last 15 years the disease on several occasions assumed the nature of "epizootics" or "recrudescences." Curson refers to the heavy mortality of stock following the opening up of the Ntambanana Settlement in 1919. From June, 1929, to November, 1930, 26,000 head of game had to be destroyed (more than half the number were zebras), and the animals driven back into the game reserves. This was followed by a marked decrease in nagana in the Settlements. According to Harris there was no natural check (carnivora) on the multiplication of wild animals and the natural balance was upset. The recommendations of the Game Reserves Commission in 1935 amongst others

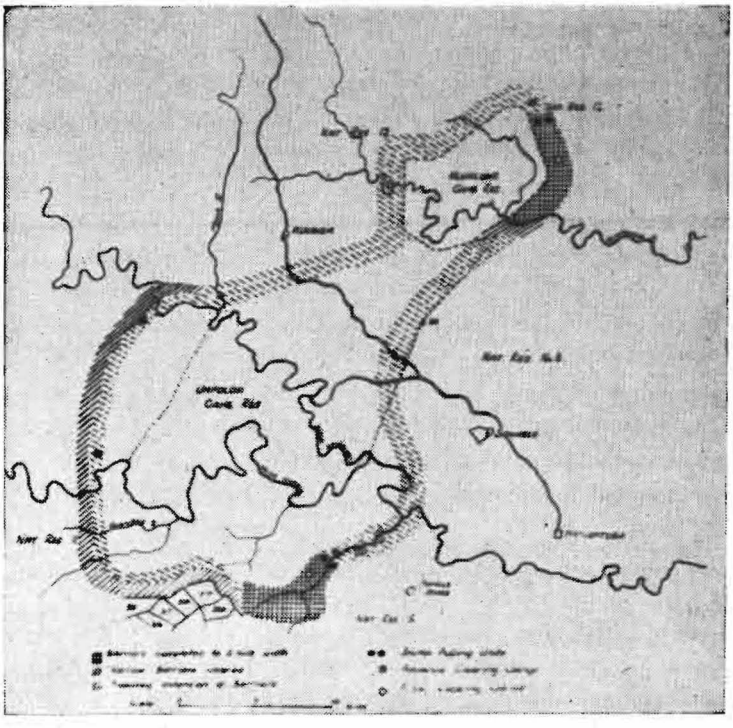


PLATE III.

Barrier clearing (only partly completed) around the Umfolozi and Hluhluwe Game Reserves to counteract the dispersion of fly from high density valleys in the reserves. (This map was prepared by the Division of Soil and Veld Conservation.)

favoured the use of the Harris trap on a large scale. Harris considered his trap essentially a visual impression based upon the tsetses reacting to light and shade value. *During 1938 the tsetse fly position appeared very favourable,* and this was considered probably due to the extensive use of the Harris trap (25,000) in the high fly density areas. In spite of these extensive trapping operations, *fly commenced to increase from 1941,* and reached peaks not yet encountered in the game reserves since trapping was commenced. Experiments indicated that there is "*another factor*" or "*factors*" besides "*sight,*" which stimulates the fly and accelerates the catch in the Harris fly traps, which only account for a percentage of the fly actually present in the fly belt (experiments of Kluge).

The deterioration in the nagana position in Zululand which became evident about that time was a matter of grave concern to the Government, and in 1943 the Union Government embarked upon its present nagana campaign, the main objects of which were:—

1. The eradication of tsetse fly by *the elimination of the host animals in certain areas,* and bringing the food supply of the fly to a level where it can no longer maintain itself.
2. Direct attack upon the breeding grounds of the fly by *discriminative bush clearing,* grass fires, etc., etc.
3. Limiting the spread of the fly from high density areas by means of effective *barrier clearings* of bush.

A further extensive "recrudescence" occurred towards the end of 1945 and the fly spread beyond the extreme limits of the potential fly area in Zululand, as well as to areas in the Ngotshe and Piet Retief districts, and the south-eastern corner of Swaziland.

In view of this serious spread the Government decided to intensify the measures adopted in 1943, by the following:—

(a) more intensive and extensive bush clearing to control dispersion of fly from high density areas;

(b) curative treatment of infected stock;

(c) control of the movement of stock from infected areas.

The use of insecticides such as DDT was explored from October, 1945 onwards. According to Du Toit and Kluge, tsetses, by virtue of their life history, could be brought into contact with insecticides only in the adult stage, and it would be impossible to influence the larval or pupal stages in any way. This necessitated *repeated applications of DDT at intervals within the gestation period of the female* to prevent further depositions of larvae and conducted over a period sufficient to allow of the hatching of all pupae present in the ground at the time of first application.

The following were explored before an adequate method was established: degree of susceptibility of G. pallidipes to DDT, the

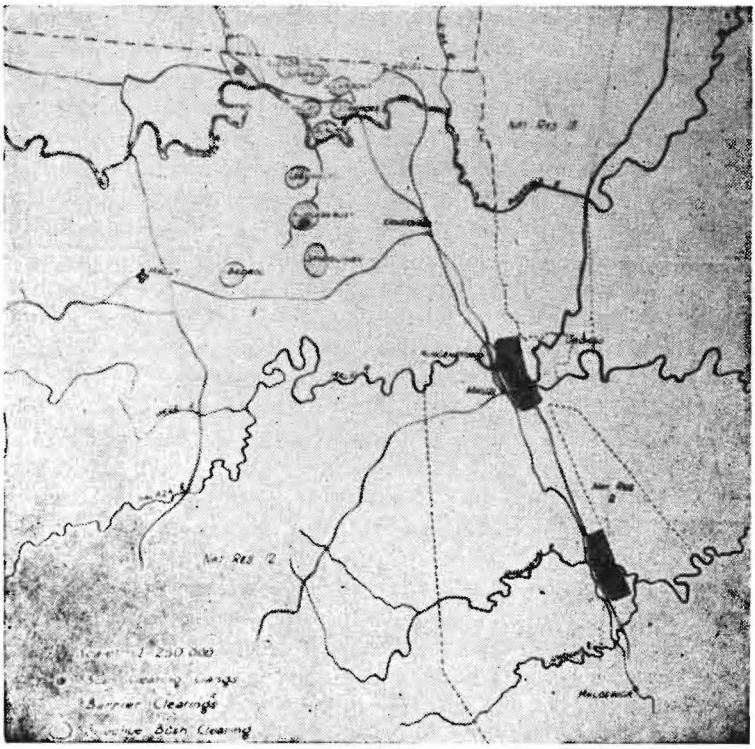


PLATE III(a)

Selective bush clearing in the Ngotshe and Piet Retief districts, and barrier clearings across the Umfunduzi and Mkuzi Rivers.

most suitable solution and aircraft, the method of delivery from aircraft, speed, height of the flying, the influence of wind, thermal, the width of the swath to be effective, the application of a smoke or aerosol method of dispersion of DDT instead of an atomised spray, best time of the day to spray, etc., etc. From the experiments carried out in the Mkuzi game reserve over an area ± 40 square miles the density of the fly (as revealed by ± 350 Harris traps) has been reduced from 8,000 per week to about a dozen per week since the investigations were commenced in November, 1945.

Reference should be made (a) to the prominent part played by Dr. Orchard of the Division of Chemical Services in evolving the DDT smoke generator and (b) to the investigations of a team of workers under Dr. Ripley of the Division of Entomology to study the effects of DDT on other insects, including useful ones.

In respect of the present campaign criticism has recently appeared in the press and in the "Bulletin of the Natal Society for the Preservation of Wild Life and Natural Resorts." This will be briefly referred to.

Bayer (1947) in his paper indicated that Henkel estimated that *the total area for the permanent breeding grounds* of G. brevipalpis and G. pallidipes in the Hluhluwe game reserve *was about 300 acres.* According to Kluge (report — May, 1947) the present pupae and fly surveys in the Hluhluwe, Mkuzi and Umfolozi game reserves, and also in the Magut area, indicated a very wide spread and wide distribution of breeding places of G. pallidipes, although these can be associated with the major valleys of each area. In the Hluhluwe game reserve unhatched pupae casings are being found in numbers up to two to three miles from the Hluhluwe River area, and it can be definitely stated that the breeding areas in the Hluhluwe game reserve are considerably more than 300 acres, and more likely to be in the vicinity of several thousands (Kluge suggests ± 15,000 acres). Would the Park authorities agree that the natural flora in the Hluhluwe game reserve be interfered with to such an extent? According to Bayer, periods, including winter droughts, are a very critical factor in the life of the fly, and because of it fly can maintain itself permanently only in certain limited areas near the river banks, and these form the foci from which the fly spreads during favourable seasons, and to which it becomes restricted during droughts. Kluge, however, reports that according to the literature it is generally considered that favourable rain periods are necessary for the successful breeding of tsetse flies, but the experience in Zululand has been that *during dry conditions* the tsetse fly flourishes and reaches a very high peak. The highest fly densities were recorded during the years of drought, according to the experience of Mr. Foster, who has been associated with the problems in the reserves for the last 15 years. In a chart reflecting the average annual rainfall for Zululand and the incidence of fly in the Hluhluwe game reserve revealed by approximately 8,000 traps since 1937, it will be seen that the highest peaks usually occurred during the months of August and September. It is estimated that in East Coast fever areas (*e.g.* Zululand, Ngotshe, Piet Retief) 95% of deaths are actually covered by smears. In the chart submitted, a *sudden increase of mortality* (now believed to have been nagana) is indicated on three farms under good control in the Ngotshe district. This occurred from October, 1945, onwards during a particularly dry season.

Bayer further states that it is well known that attempts to control the Zululand tsetse by *game slaughter* have failed, and attempts are now being made to control the fly by the *clearing of vegetation* and by *the use of DDT. The clearing of a two-mile strip of vegetation* and the permanent fly belts may help to prevent the spread of the fly, but will not reduce or control fly within these belts. *He is of the opinion that this form of vegetation clearing is a great waste of money* and that it would be cheaper and more effective to limit the clearing to the shrubs in the permanent breeding areas. According to Bush "consistent" with game slaughter, nagana has spread enormously

(presumably since the end of 1945). He cannot see how certain areas can be reached by planes, and he further refers to the cost of the *quite possibly useless DDT experiment.* During the course of the experiments in Tanganyika about 1,000 square miles were freed from one species or another. Yet in spite of these reclamation works referred to by Bush, the Colonial Office has as recently as 1946 effected an organisation by means of which a team of workers under Symes was sent to East Africa to carry out extensive experiments. The view was expressed that DDT in its different forms, including smoke generators, is a formidable weapon against the tsetse and it *only remains to devise correct methods.*

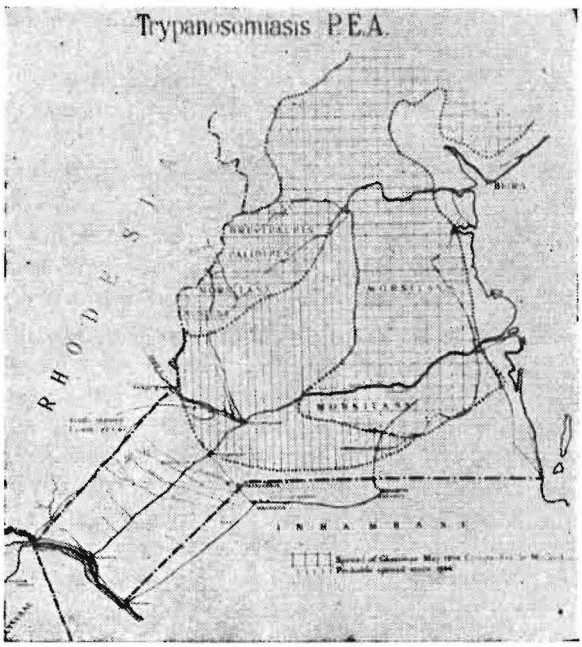


PLATE IV.

The spread of G. morsitans *in Portuguese East Africa across the Sabi River towards the Limpopo.*

It was realised that aircraft would not be able to cover the whole area and adequate provision has been made to deal with the breeding places in the narrow valleys by means of DDT smoke generators. In fact the greater part of the Hluhluwe Game Reserve has been treated twice by smoke generators combined with aircraft.

The further criticisms against the campaign in Zululand will be briefly considered:—

(a) Reclamation work in Tanganyika has freed about 1,000 square miles from *one species of tsetse or another.*

(b) The value of *Barrier clearings* is doubted.

(c) Consistent with game slaughter, *nagana has spread* enormously.

(a) As regards the general policy of bush clearing in Tanganyika (Report of Dr. Kluge *re* visit to East Africa, 1946) it can be stated that the East African workers are achieving something with discriminative clearings against *G. morsitans* at Abercorn. At Shinyanga *five exclusion and selective clearings* were the control measures against *G. swynnertoni* in Block 11, 50-60 miles in extent, but as fire was excluded since 1932, the bush has thickened to such an extent (this also occurred in the Umfolosi Game Reserve), that one end of Block 11 is now harbouring *G. pallidipes* along a water course where specimens were collected and *G. swynnertoni* has not yet disappeared. Both these control measures against *G. swynnertoni* and *G. morsitans* are still in their experimental stages, and although the results are promising, no finality has yet been reached. *Nothing has been done about selective clearings against* G. pallidipes.

At Shinyanga an experiment was conducted with discriminative clearings against *G. pallidipes not under fire exclusion.* The first thicket clearing confined almost wholly to the riverine thickets was a failure, and *the method was to be applied more drastically.*

As regards the effect on *G. pallidipes* of *discriminative clearings of thickets* Bax (1944) states that it has not gone far enough to enable the results to be assessed. The only control measure against *G. pallidipes* is the *destruction of thickets.* By this means success is claimed against *G. pallidipes* at Mpapwa. As regards the 1,000 square miles reclaimed, Bax (1944) further states that thousands of square miles on balance have been lost to the territory during those years. By the Shinyanga research workers *G. pallidipes* is generally accepted as being the most difficult species to deal with and no *effective economical measures* for either eradication or control are yet known According to Buxton the clearing of bush in game reserves presents special difficulties, for whereas it is desirable to reduce thicket as a way of attacking the fly, one must preserve a good deal of it as a shelter for game (and food supply for browsing animals).

(b) *The barrier clearing of a mile and more wide* for a distance of 40 miles along the border of the Melsetter district, Southern Rhodesia opposite Portuguese East Africa (where a high density of *G. pallidipes* exists), has undoubtedly mitigated against the " epizootics " of nagana in the Melsetter district as far as Chipinga. It was a long-range policy which was commenced in 1933 and those of us who visited the area appreciate the magnitude of this undertaking with its hardships and drawbacks (" coppicing "). *The barrier clearings in Zululand* commenced in 1943 with native labour and now being assisted mechanically,

were commenced to prevent *the dispersion of fly* from high fly density areas in the Hluhluwe and Umfolozi (white rhino sanctuary) Game Reserves. It was never intended to deal with permanent breeding foci.

(c) In respect of Game slaughter in Zululand the following remarks of Prof. Buxton who inspected the control measures in Zuland in 1946 are of interest : " In the Hluhluwe Game Reserve there is no shooting of game and in the Mkuzi Game Reserve there is still a considerable amount of game in the central area, though along the periphery game has been much shot out. The reduction of game in the Umfolozi Game Reserve (with the exception of the white rhino) has gone further and most of the larger animals (zebra, kudu, wildebeest) have been destroyed. A large proportion of small game (bush buck, bush pig, warthog) have remained as is shown by the monthly returns. *He regards this as justifiable and a necessary policy.* The scientific basis for it is that game animals are proved to be the

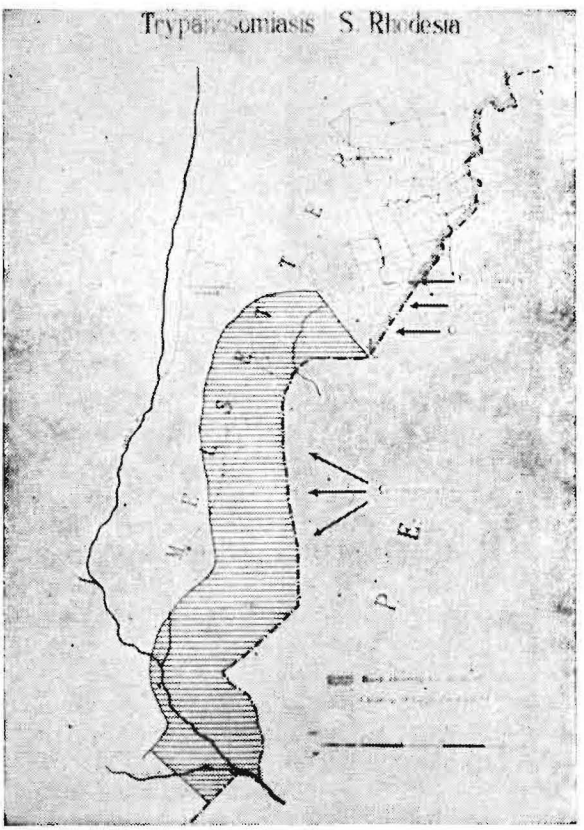


PLATE V.

Barrier clearing along the Melsetter border in Southern Rhodesia to prevent dispersion of G. pallidipes *from Portuguese East Africa.*

reservoirs of the three Trypanosomes (*T. congolense, T. Brucei* and *T. vivax*) which attack stock and *that most of the game are a favourite food of Glossinae.* It was noted that the destruction is entirely organised shooting by armed natives under European rangers. There is no doubt that this is the only effective and proper way of doing this work. As *G. pallidipes* feeds partly on small game, its complete extermination may prove very difficult, perhaps impossible."

It has been maintained that as a result of the shooting operations in the Umfolosi Game Reserve *since 1943, some of the white rhino have scattered* from their habitat in the Umfolozi Game Reserve. If the map of the distribution of white rhino prepared by Foster *in 1940* is referred to it will be seen that rhino at that time were found in three areas —

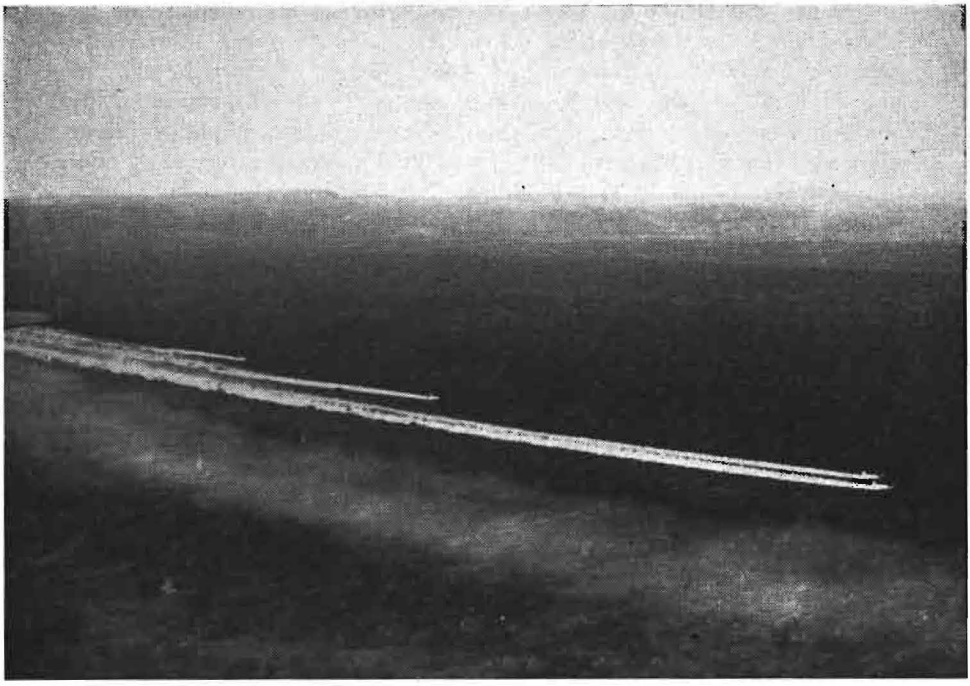
(a) in the western portion of the Umfolozi Game Reserve in which they regularly dwell and breed;

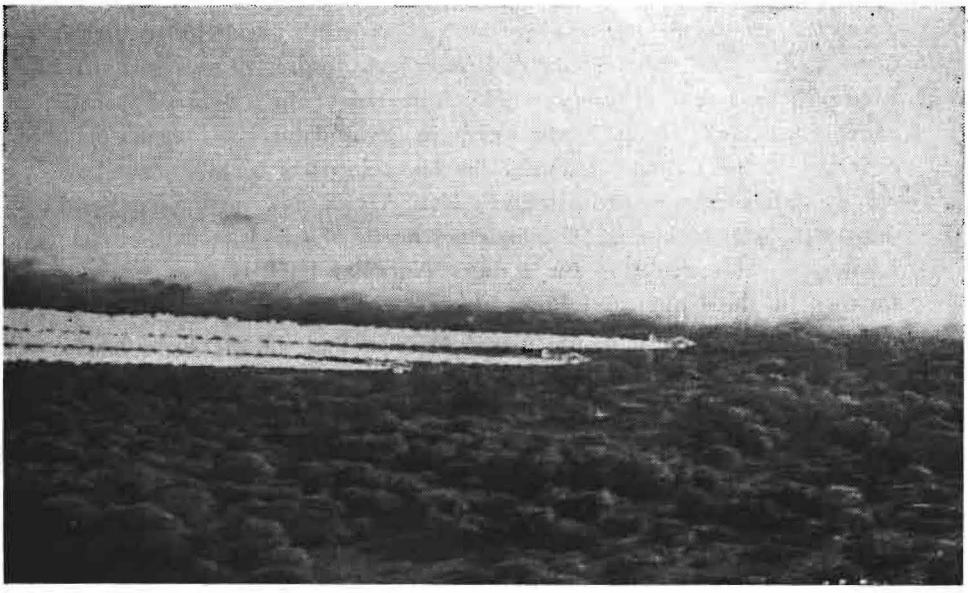
(b) in the rest of the Game Reserve and beyond the banks of the Black and White Umfolozi Rivers where they are usually found, but do not breed;

(c) in the Crown lands corridor and Native Reserve No. 11, where odd small numbers as outcasts are found.

According to Chorley (Lourenco Marques Conference, 1946) *6,000 square miles have been wrested from G. morsitans in Southern Rhodesia by game destruction measures* which have been operative for more than twenty-five years. Another 4,000 square miles is in the process of being freed. They are of the opinion that in respect of *G. pallidipes,* especially in respect of the kind of animals this fly usually feeds on, game destruction as a control measure is only of real value when employed in conjunction with some clearing of vegetation.

The unprecedented simultaneous spread of tsetse fly to the extreme limits and even beyond certain areas (Ngotshe and Piet Retief districts and Swaziland) of the potential fly belt in Zululand in 1946 cannot be attributed to any undue migration of game as a result of these operations (DDT spraying and destruction of game in certain areas). *Periodic dispersions of fly from high density areas* of certain valleys have been observed on former occasions. Some are inclined to believe that it stands in relation to the periodic droughts. The extensive increase of bush throughout the fly belt (e.g. corridor) has undoubtedly widened the dispersion areas. Nagana has been diagnosed south of the Eshowe–Empangeni road, to the west in the districts of Mahlabatini and Hlabisa, and north-west in the Ngotshe district beyond the Magut–Nongoma road and in Swaziland. The chief route of dispersion of *G. pallidipes* from high density areas is along bush clad riverines from the major valleys in the game reserves. Unfortunately the barrier clearings have not progressed far enough to have controlled this dispersion of fly.





PLATES VI AND VII.
The application of DDT by aircraft in the Mkuzi Game Reserve in 1946.

When the Hluhluwe Game Reserve with its high density of fly is considered (*in which game has not been disturbed and where until recently no DDT operations had taken place*), the outbreaks of nagana in its vicinity can only be attributed to the dispersion of fly along the important rivers and their tributaries (the Hluhluwe river with its tributary the Enzamane river, the Umseneni river, etc.) On the east the farms in the Hluhluwe Settlement and native reserve No. 12 have become infected, to the north native reserve No. 12 and the Mkuzi Settlement, and to the west and south tank areas 525, 694, 524, 528, 519, 518 and 526, where heavy mortality from nagana occurred since the middle of 1945.

According to Harris, *waves of infestation and outbreaks of nagana coincided with the peak increases in fly densities in major valleys* (see chart). According to the Shinyanga research workers flies fluctuate apparently through a long term cycle and such natural fluctuations may reduce the populations by as much as 90% from peak to trough. *This unprevented spread seems to have been universal in Southern Africa.* According to a report from Southern Rhodesia *G. morsitans* has been caught within a mile of the Portuguese-Southern Rhodesia border in the Sabi area during October, 1946. Most of them had been taken on the Portuguese side, but on the Rhodesian side more had been taken in three days than in the previous three years. Six or eight years previously there had been many cattle on both sides of the border, but within the last five years there has been a cycle of expansion of the fly and during this period many hundreds of cattle have died. The Bechuanaland Protectorate representative (at the Lourenco Marques conference, 1946) referred to the extensive spread of *G. morsitans* within recent years in Ngamiland and nagana has occurred in the Caprivi. Within the last ten years *G. morsitans* has spread across the Sabi in Portuguese East Africa and Nagana has been diagnosed at Babadine $\pm$ 90 kilometres north of Chicualacuala on the Limpopo. This threat to the Kruger National Park is being closely watched by the Union and Portuguese authorities.

From the above it would therefore seem that the measures taken by the Government are justified in attempting to cope with a menace of far-reaching dimensions to the stock industry not only of Zululand, Natal, and the Transvaal, but also of Swaziland. The pioneer farmers in the fly belt have suffered severe losses and a large number have been completely ruined by the ravages of nagana.

A coordinate effort is being made by the Departments of Agriculture and Defence, the Provincial Administration of Natal and last but not least by the farmers themselves to stamp out the fly in the Union of South Africa.

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A Note of Appreciation.

Reference must be made to the keen interest shown by, and the whole-hearted support and co-operation of the Division of Soil and Veld Conservation (entrusted with bush clearings), the Division of Chemical Services, the Division of Entomology, and last, but not least, the S.A.A.F., without the aircraft a nagana campaign of such magnitude could not have been launched.

THE USE OF "GAMMEXANE" IN VETERINARY PRACTICE

J. A. THORBURN,
East London.

Introduction.

This paper details the results obtained by the use of "Gammexane" against infestations of ectoparasites that directly or indirectly menace animal health in South Africa.

In order that the Veterinarian may have a fuller understanding of this product, its uses and method of application, a brief statement will be given on its history and general properties.

Crude benzene hexachloride was first prepared by Faraday in 1825 by chlorinating benzene. Andre Dupire claims the discovery of its insecticidal properties in 1941, but it was the scientific team of the Imperial Chemical Industries, Ltd., Great Britain, who from 1941 carried out the important research work on this product during the war. They determined its isomeric composition and examined its physical, chemical and insecticidal properties. They proved that it was the gamma isomer which was almost entirely responsible for its insecticidal activity and gave this isomer the descriptive name of "Gammexane."

Physically and chemically, the chief properties of benzene hexachloride are:—

(a) It possesses a characteristic musty odour.

(b) Is slightly more volatile than D.D.T. but does not oxidise on exposure to air.

(c) It is practically insoluble in water, but is readily soluble in a number of organic solvents.

(d) Is stable to the action of acids but not so stable to the action of strong alkalies.

(e) It is stable to heat and so can be volatilised and used in vapour form.

It is of interest to record, however, that the gamma isomer of B.H.C., in its pure form, consists of colourless crystals which have a bitter taste but are without odour.

Insecticidally, the following properties of benzene hexachloride are of significance to the veterinarian:—

(a) Like D.D.T., its deposits are capable of persistent effect and the period of this persistency is dependent on the type and

concentration of the formulation used, the nature of the surface it is applied to and the climatic conditions prevailing during the time of test.

(b) It has no apparent repellent effect on insect pests and so acts as a true insecticide.

(c) In addition to it's being a contact and stomach poison, it also acts as a fumigant poison because of its volatility. As a poison it affects chiefly the nervous system of the susceptible parasite and although slow acting compared with the pyrethrins, it is muck quicker than D.D.T.

(d) It is of low toxicity to warm blooded vertebrates but besides being lethal to a wide range of insect pests, it is effective against these pests at very low concentrations. Repeated exposures to these concentrations are tolerated by the animal host without any indication of any cumulative toxic effect.

The percentage content of the gamma isomer in solid benzene hexachloride can vary widely according to the methods of manufacture. For this reason only the gamma isomer or " Gammexane " concentration used, will be given in this paper, particularly as a number of manufactured products, including dispersible paste and powder dips, emulsion dips, dusting powders and handdressing washes, oils and greases were used in the work described.

These products were used over a wide range of dilutions against a variety of arthropod infestations on stock, to determine the " Gammexane " concentration required for the effective control of such infestation when applied at given intervals.

The methods of application of these preparations, to any species of stock host, for the control of any ectoparasitic infestation, were carried out in accordance with established South African procedure, being safe and easy to apply to the host animal and best suited to control their arthropod infestations.

THE APPLICATION OF " GAMMEXANE " TO ARTHROPODS OF VETERINARY IMPORTANCE.

A. *Lice Infestations of Domestic Stock.*

(a) *Lice on cattle*: The two species of the sucking louse *Linognathus vituli* (Linné) and *Haematopinus eurysternus* (Nitzch), found infesting cattle, were eradicated by regular 7 and 14-day interval dippings, in washes at concentrations 0·0040% and 0·0056%.

(b) *Lice on goats*: Control over severe infestations on goats of the biting louse, *Bovicola caprae* (Gurlot) and the sucking louse *Linognathus stenopsis* (Burmeister) was effected by three dippings at 8-day intervals, in dipwashes at 0·005% and 0·006% concentrations.

(c) *Lice on pigs*: Control over an infestation of the pig sucking louse *Haematopinus suis* (Linné) was effected by (i) one good dusting with a 0·1% dusting powder, and (ii) a single wash in a 0·005% dipwash. (J. W. Shoebotham, 1946.)

(d) *Lice on dogs*: Effective control over severe lice infestation on kennel dogs was effected by a single washing of the dogs and a spraying of the infested kennels and bedding with an 0·0025% emulsion wash.

(e) *Lice on sheep*: Sheep lice have been effectively controlled by a single dipping in a 0·01% wash.

B. *Flea Infestations of Dogs and Poultry.*

(a) Control of the dog flea *Ctenocephalides canis* (Curtis), was effected by weekly immersions in a 0·01% wash, and by weekly dustings with a 0·5% powder. Powders at the 0·1% and 0·2% concentrations gave a 4-day and 5-day complete protection, respectively.

(b) Control of the poultry flea *Echidnophaga gallinacea* (Westwood), infesting the comb, wattles and eye-lids of fowls, was effected by weekly dippings of heads and necks of infested birds in a 0·005% wash, or by weekly dustings with a 0·2% powder.

C. *Fly Infestations.*

(a) House and dairy premises were given two months active protection against infestations of the house fly *Musca domestica* (Linné), and the stable fly *Stomoxys calcitrans* (Geoffrey), by a single application of a 0·1% "Gammexane" wash, when applied at the rate of 1 gallon to every 1,000 square feet of surface 4·5 mgms. of B.H.C. per square foot. When applied at the rate of 20 to 25 mgms. B.H.C. per square foot it provided an active protection for over three months.

(b) Effective control of the hornfly *Lyperosia irritans* (Linné) resulted from regular weekly dipping of cattle in emulsion washes at concentrations as low as 0·002%.

(c) Effective control over infestations of the so-called "Horse fly" *Hippobosca rufipes* (Olfers), on cattle was given by weekly dippings and sprayings with 0·005% washes.

(d) The sheep ked *Melophagus ovinus* (Linné) has been effectively eradicated by a single dipping in a 0·01% wash.

(e) Against the sheep blowfly (*Lucilia* and *Chrysomyia* spp.) six weeks' protection has been given by 0·5% washes (Harbour and Watt, 1946), and a two weeks protection by 0·05% washes (W. McHardy, 1946-47).

D. *Mite Infestations of Stock.*

(a) Sarcoptic mange of cattle caused by the mite *Sarcoptes scabiei bovis* was effectively eradicated by regular dippings in a wash of 0·005% concentration. Three dippings at the 8-day interval eradicated infection from 95% of a herd of over 200 infected head, but it took seven additional weekly interval dippings to effect complete eradication. No handdressing was done.

(b) Sarcoptic mange of goats caused by the mite *Sarcoptes scabiei caprae* (Fürstenburg) was eradicated from a flock of 800 goats by three dippings at a 9-day and 8-day interval, in a wash at a 0·006% concentration. No handdressing was done and the goats were immersed for 30 seconds.

(c) Sarcoptic mange on dogs, caused by the mite *Sarcoptes scabiei canis* was eradicated by four weekly dippings in a 0·004% emulsion wash (D. J. Louw, 1947).

(d) Psoroptic mange of cattle, caused by the mite *Psoroptes natalensis* was eradicated from a herd of cattle by two 10-day interval dippings in a wash containing 0·005% "Gammexane." (J. W. Shoebotham.)

(e) Psoroptic scab in sheep, caused by the mite *Psoroptes communis ovis* (Railliet) was eradicated in sheep flocks in the Argentine by single dippings in 0·01% washes. (C. N. Ault, 1946.) It is of interest to mention that the Argentine Veterinary Authorities have now officially approved of "Gammexane" preparations for scab control, prescribing two dippings in a 0·01% wash at the usual interval.

E. *Tick Infestations of Stock.*

Extensive spraying, dusting, dipping and handdressing tests have been carried out with "Gammexane" preparations against infestations on stock of the following tick species. The one-host Blue Tick and its arsenic-resistant strain, *Boophilus decoloratus* (Koch), and the two-host ticks, the Red Tick, *Rhipicephalus evertsi,* Neumann, and the Bont-legged tick, *Hyalomma impressum rufipes,* Koch, and the three-host ticks, the Brown Tick *Rhipicephalus appendiculatus,* Neumann, the Cape Brown Tick *Rhipicephalus capensis,* Koch, the Black-pitted tick, *Rhipicephalus simus,* Koch, the Tropical Dog Tick, *Rhipicephalus sanguineus* (Latreille), the Dog Tick *Haemaphysalis leachi* (Audouin), the Transkei Cattle Tick, *Haemaphysalis silacea,* Robinson, and the Bont Tick, *Amblyomma hebraeum,* Koch.

SPRAYING TESTS.

Cattle infested with the blue, red and bont tick were given a thorough spraying with "Gammexane" washes at the 0·5%, 0·05% and 0·005% concentrations.

(a) The 0·5% wash effected a complete kill of all infesting stages of these three tick species, including the engorged adult females without oviposition and the moulting stages of the blue tick. It provided a complete persistent protection for three weeks against reinfesting blue and red tick larvae and for two weeks against reinfesting adult red and bont ticks.

(b) The 0·05% wash effected a similar kill against all infesting stages but only provided one week's complete protection against reinfesting stages of these ticks.

(c) The 0·005% wash effected a kill of all infesting stages except the adult semi to fully engorged females, and the moulting stages of the blue tick.

DUSTING TESTS.

Dusting powders containing a 0·5% concentration effectively protected dogs against infestations of the Dog Tick and Tropical Dog Tick, when applied at a regular weekly interval.

DIPPING AND HANDDRESSING TESTS.

Tick-infested stock were subjected to regular interval dippings in "Gammexane" washes at concentrations ranging from 0·0012% to 0·02% and regular interval handdressings with preparations containing "Gammexane," at concentrations ranging from 0·01% to 0·5%. The results showed:—

(a) Emulsion washes at 0·002% and dispersion washes at 0·0035% effectively controlled infestations of the blue tick and its arsenic-resistant strain, when regular 7-day and shorter interval dippings were carried out. It took at least three dippings to obtain full control.

(b) Washes at concentrations as high as 0·02% failed to effect full control over blue tick infestations when regular 14-day interval dipping was carried out.

(c) Emulsion washes at 0·002% and dispersion washes at 0·0035% were lethal, at these low concentrations, to all stages of these one, two and three host ticks except their adult semi to fully engorged female stage and the moulting stages of the blue tick. At these concentrations a large percentage of engorged females oviposited and larvae emerged from the eggs, but a time lag was observed in the pre-oviposition period of these females. A concentration as high as 0·02% still failed to effect full control over these stages but a 0·05% wash did.

It is this difficulty in fully controlling engorged females and the blue tick moulting stages that explains why it takes at least three regular weekly interval dippings to effect full

control over blue tick infestations and why 14-day interval dipping fails to provide this effective control, even when a 0·02% wash is used.

(d) Dip-washes at the low concentration of 0·0025%, ear dressings at 0·05% and tail dressing at 0·1% gave effective control over all body, ear and tail infesting stages of the one, two and three host ticks, when 5-5-4-day interval dipping and handdressing was carried out.

(e) Dip-washes at concentrations ranging from 0·0025% to 0·006%, ear dressing at 0·1% and tail dressings at 0·25%, at a regular 7-day interval of dipping and handdressing, effected control over all infesting stages of these one, two and three host ticks, *except* the *body infesting bont tick nymphae,* and the *brown tick larvae and nymphae* (an important practical point in Heartwater, Redwater and East Coast Fever control).

(f) Handdressing preparations containing 0·25% concentration of "Gammexane" gave a 7-day effective control over tick infestation of the coronary bands and between the claws of the feet of ruminants.

(g) Dip-washes at concentrations up to 0·02% failed to effect control over any stage of these ticks at the 14-day interval dipping.

(h) No effective control was obtained over ear and tail infesting stages of these ticks by regular 5-day or 7-day interval dippings, because dipping did not adequately wet the ears, and defoecation rapidly removed the dip-wash residue from under the tails.

(i) Comparable trials carried out with similar concentrated "Gammexane" washes alone and with a 0·16% Arsenic content, against these tick infestations, indicated that this arsenical addition to a "Gammexane" wash, neither increased its efficacy against tick infestation nor effected any preservative effect on the wash used. It is also of interest to record that careful observations kept over tank units at the 7-day interval of dipping showed that a 0·0030% "Gammexane" wash effected as *good* a control over infesting two and three host ticks as an arsenical wash at the 0·16% strength, and the 0·005% "Gammexane" wash gave a *better* control.

REMARKS ON "GAMMEXANE" PREPARATIONS.

(a) *Stability of Preparation* : Chemical analyses so far carried out, have shown no apparent deterioration of benzene hexachloride in the spray washes, dip washes, dressings and powders used and these findings have been borne out by the biological control effected by them.

In the spray and dipping tests carried out, all types of water were used and even when dip-washes became badly soiled through usage, there was no tendency for such washes to become alkaline.

Analyses of samples of all emulsion type dip-washes and some of the dispersible powder dip-washes showed that the dipping of stock did result in a gradual preferential removal or exhaustion of the benzene hexachloride concentration of the tank wash. Two of the dispersion type dips, however, did not show any noticeable loss in strength although large herds of cattle were regularly dipped every 7-days in these washes.

Once the minimum effective "Gammexane" concentration of a dip-wash has been determined, an allowance must be made for factors that influence the wetting properties of the dip-wash, such as small dipping tanks, short swims, hard and saline waters and dirty dip-washes. Extensive tests have shown that a "Gammexane" concentration, 30% stronger that the determined minimum, provides this allowance. For this reason a 0·005% "Gammexane" dip-wash has been recommended for general dipping purposes against tick infestations. Higher concentrations can be used with perfect safety, but results show that protection against infestation does not proportionately increase with the "Gammexane" concentration used.

On account of the settling out process that takes place with all dispersion type dip-washes, the simple practical procedure of passing through some 20 to 30 head of cattle at the commencement of every dipping and then immediately re-dipping these head ensures an effective re-dispersion of all possible B.H.C. particles that may have settled out in between dippings. This re-dipping of the first lot of cattle through the tank should only be done if the tank contains no arsenic. If arsenic be present, plunging of the tank contents prior to dipping should then be carried out.

(b) *Reaction of Stock*: (i) Stock have been dipped and sprayed under conditions which would have caused severe scalding if an arsenical wash had been used, yet no species of domestic stock have shown authenticated instances of adverse effects caused by the "Gammexane" preparations used, even when 0·05% washes have been used. In an extreme test a spray wash containing 0·5% was used without causing any scald or toxic effect, but the general application of such a high concentration cannot be recommended.

(ii) Stock definitely benefited from the regular sprayings, dustings and dippings given them with these "Gammexane" products. There was a noticeable improvement in their general appearance and condition. Working oxen and horses could be worked without showing any signs of distress, and the milk yield and fertility of the stock was in no way affected.

RECOMMENDED USAGE OF "GAMMEXANE" IN VETERINARY PRACTICE.

Consideration has been given to the arthropod infestation, its life cycle and habits in prescribing these measures for their control by the use of preparations containing "Gammexane."

(a) *Lice*: The control of lice infestation on stock will be effected by two sprayings or dippings in a 0·005% wash or by two applications of a 0·5% dusting powder, given at a 14-day interval, or by one single dipping in a 0·01% wash.

(b) *Fleas*: The control of flea infestation on stock will be effected by regular weekly applications of a 0·005% to a 0·01% wash or a 0·5% dusting powder.

(c) *Fly Control*: (i) Fly control of house and dairy premises will be effected by four applications a year of a 0·5% wash applied at the rate of 200 mgms. B.H.C. per square foot of surface treated. (ii) Regular weekly dipping of cattle in a 0·005% wash will effect control over infestations of the hornfly, stable fly and horse fly. (iii) The sheep ked will be effectively controlled by a single spraying or dipping in a 0·01% wash. (iv) Blowy pretection for two weeks will be given stock by dressings or washes at the 0·05% concentration.

(d) *For Mange Control*: Effective control will be given by regular weekly dipping in a 0·005% wash.

(e) *Tick Control*: (i) Regular weekly dipping in a 0·005% wash will effect control over the blue tick and its arsenic-resistant strain. (ii) Regular 5-5-4-day interval dipping and handdressing in a 0·005% dip-wash and with a 0·10% hand-dressing preparation will effect control over all infesting stages of the one, two and three host ticks mentioned in this paper. (iii) Regular weekly interval dipping and hand-dressing in a 0·005% wash and with a 0·25% handdressing preparation will effect control over all infesting stages of these ticks, except the body-infesting larval and nymphal stages of the brown tick and the nymphal stage of the bont tick. (iv) Regular weekly applications to dogs of a 0·01% wash or 0·5% powder will effectively control all infesting stages of these ticks.

GENERAL CONSIDERATIONS.

The interval of application and the concentration of "Gammexane" used against arthropod infestations, must not only be sufficient to control the adult stage, but prove lethal to the emerging stage of lice, keds, etc., contained in eggs or puparia on the host at the time of treatment.

Similarly, consideration has been given to the short feeding time of most stages of the two- and three-host ticks. For this reason any

interval of dipping longer than one of 7 days, even when washes of a 0·02% concentration were used, did not effect full control over any species of tick infestation.

Tick infestation and tick-borne diseases are of major importance to the veterinarian. So it is not only important that he should know the life cycles and the stages of the ticks capable of transmitting disease to stock but take into account the fact that transmission of disease by the infected stage of the tick can take place within a few hours of attachment. The bont tick can transmit heartwater within 24 hours of attachment, whereas it takes from 60 to 72 hours for the East Coast Fever infected ticks to transmit infection.

Then it must be remembered that "Gammexane' exerts no repellent effect on ectoparasites so that re-infection is to be expected if the infesting parasite is still present.

All these factors play their part in determining the measures of control to carry out for the effective control of Arthropod infestation. Thus, for the effective control and eradication of any active infection being transmitted by the two- and three-host ticks, a regular 5-5-4-day interval of dipping and handdressing with the prescribed strengths "Gammexane" wash and dressing, must be carried out. For the effective control of the one-host tick and the three diseases, redwater, gallsickness and spirochaetosis that it can transmit, a regular 7-day interval of dipping will be sufficient.

For the general control of tick infestation, provided there is no active tick-borne infection, a routine programme of 7-day dipping and handdressing will prove satisfactory.

The correct usage of "Gammexane" in Veterinary practice should result in the effective control and eradication of those arthropod infestations mentioned and the diseases and diseased conditions in stock directly and indirectly caused by them. Recent research has now indicated that it may also play a major role in the control and eradication of other important arthropod infestations of concern to the Veterinarian.

The serious loss in stock caused directly and indirectly by the arsenic resistant blue tick since its appearance in 1936, has shown what can happen, so that the successful control of all arthropod infestations is of paramount importance to the stock industry of South Africa. This control will not only prevent an annual loss of millions of pounds worth of stock but will also ensure that stock improvement can be carried out along safe and economical lines.

In the past, arsenic, although so dangerous to man and stock, has been the main active ingredient used for the control of many of the most important ectoparasites. To-day "Gammexane" will not only replace it but prove of greater value since it is both comparatively safe to use and lethal to a wider range of insect pests. The discovery of In a majority of herds 26 to 50 per cent. of the lactating cows were powerful weapon for pest control.

A SURVEY OF BOVINE MASTITIS IN DAIRY HERDS SUPPLYING MILK TO THE WITWATERSRAND AREA

P. J. MEARA AND I. MOWAT,
Municipal Abattoir and Livestock Market, Johannesburg.

The grave incidence of mastitis in South African dairy herds has been brought to notice previously. In thirteen dairy herds selected at random by van Rensburg (1942) the percentage of infected cows varied from 27·3 to 100 per cent. Pullinger (1944) too, revealed a very high incidence of infection. His ten month survey, based on Breed smear examination of herd milk samples, indicated that only 7·9 per cent. of herds failed to show gross signs of mastitic infection. In a majority of herds 26 to 50 per cent. of the lactating cows were infected. A subsequent report confirmed this alarming incidence of mastitis, only 1·8 to 6·7 per cent. of milk produced showing no signs of mastitis over a survey of several years' duration (Pullinger, 1946).

The survey of bovine mastitis has been continued by compiling additional Breed smear records of milk supplies coming into the Witwatersrand area. Over a period of nine months, bi-weekly milk samples, representing the whole bulk milk from 81 individual producers, were submitted to Bred smear examination.

Analysis of these records gives an idea of the extent to which herds are infected (Table 1).

TABLE 1.

Monthly incidence of mastitis in a survey based upon Breed smear examination of bulked milk samples

Month	No. of samples examined monthly	No. of samples showing mastitis	Percentage of mastitis contaminated samples
August, 1946	202	54	26.7
September	421	182	43.2
October	461	172	37.3
November	370	179	48.4
December	197	80	40.6
January, 1947	244	96	39.3
February	293	110	37.5
March	198	66	33.3
April	83	17	20.5

Of the several hundred samples examined each month the lowest recorded monthly incidence of mastitis was 20·5 per cent., and the highest 48·4 per cent. Thus commercial bulking of all the milk supplied ensured that virtually no milk free of mastitis contamination was delivered to the consumer, the proportion of contaminated to sound milk varying between a ratio of 1 : 4 and a ratio of 1 : 1.

An idea of the extent of mastitis-tainted milk submitted by individual producers is given in Table 2.

TABLE 2.

Analysis of records of producers whose bulked milk was examined for mastitis by Breed smear examination of bulk milk samples.

Percentage of bulk milk samples showing evidence of mastitis	No. of producers	No. of samples examined	No. of mastitic samples	Percentage of producers represented in group
0 to 10 per cent.	4	106	7	5% of producers
10 to 20 per cent.	12	318	55	15% of producers
20 to 30 per cent.	15	379	101	19% of producers
30 to 40 per cent.	14	453	155	17% of producers
40 to 50 per cent.	21	684	311	26% of producers
50 to 60 per cent.	6	194	108	7% of producers
60 to 70 per cent.	5	175	116	6% of producers
70 to 80 per cent.	3	85	61	4% of producers
80 to 90 per cent.	1	49	41	1% of producers
SUMMARY:—	81	2443	955	2443 samples were examined, of which 39% showed signs of mastitis.

In interpreting the results it should be remembered that the positive findings recorded refer to grossly mastitic milk. As examination of smears for mastitis was briefly conducted, the incidence recorded must be regarded as a minimal estimate. Nevertheless, it is shown that 77 per cent. of the producers tested submitted milk in which the incidence of mastitic contamination varied between 10 to 50 per cent. of samples examined.

The largest representation of producers (26 per cent.) fell within the group supplying milk from which 40 to 50 per cent. of samples were contaminated. Thus a large group, comprising approximately one quarter of dairymen, was supplying milk of which roughly half the amount showed contamination with pus and mastitis streptococci.

A small group, comprising 5 per cent. of the producers, sent milk from which less than 10 per cent. of samples were mastitic. However this was offset by the large proportion of producers (18 per cent.) exhibiting a greater than 50 per cent. contamination in their bulk supplies.

Thus far analysis has been confined to the degree of milk contamination. Nothing has been said concerning the cows which supply this contaminated milk.

In order to establish the extent of mastitis within herds, milk samples were collected from the individual cows in many different herds. The presence of mastitis was determined microscopically after incubation of these samples (van Rensburg, 1941). Analysis of these data is presented in Table 3.

TABLE 3.

Analysis of records of producers whose herds were tested for mastitis by microscopical examination of incubated cow samples.

Percentage of cows in herd which secrete mastitic milk.	No. of herds.	No. of cows in herds.	No. of infected cows in herds.	Percentage of herds represented in group.
0 to 10 per cent	12	469	32	16 per cent of herds
10 to 20 per cent	18	841	132	25 per cent of herds
20 to 30 per cent	11	465	112	15 per cent of herds
30 to 40 per cent	16	906	309	22 per cent of herds
40 to 50 per cent	7	351	155	10 per cent of herds
50 to 60 per cent	7	385	222	10 per cent of herds
60 to 70 per cent	1	122	85	1 per cent of herds
80 to 90 per cent	1	37	30	1 per cent of herds
SUMMARY:—	73	3576	1077	73 herds were tested, and contained an average of 30% infected cows per herd.

Seventy-three herds comprising roughly 3,600 cows were selected at random from urban and rural areas. Over the whole series the average incidence of mastitis was 30 per cent. of cows infected per herd. Within the individual herds the percentage incidence varied from 0 to 81 per cent. There is little difference between the proportion of herds falling within each of the first four arbitrary groupings used for purposes of classification. Considered together these four groups constitute 78 per cent. of herds. In other words, eight out of ten herds had less than 40 per cent. of the component cows infected with mastitis.

For purposes of comparison records were also compiled of the incidence of mastitis in cows offered for sale at a weekly dairy cow market held in Johannesburg (Table 4). An average of 39 per cent. of cows were found to be infected over a series of ten sales. This mean incidence is slightly higher than that recorded for commercial dairy herds. As dairymen customarily dispose of uneconomic and

diseased cows it is surprising that the percentage of mastitis was not much larger than the figure recorded. Possibly many mastitic cows are sold in a "dry" state, when imperfections of udder are less likely to be observed. As only lactating animals were utilised for purposes of test, such "dry" cows would fail to be included in the record.

TABLE 4.

Analysis of records of cows tested for mastitis at a weekly dairy cow market in Johannesburg.

Sale No.	No. of cows tested.	No. of infected cows.	Percentage of infected cows.
1	47	11	23
2	35	9	26
3	45	12	27
4	42	13	31
5	23	8	35
6	34	14	41
7	37	16	43
8	23	11	48
9	38	19	50
10	44	29	66
SUMMARY:	368	142	39

Nevertheless the very high proportion of cows with diseased udders offered for sale on occasion (41, 43, 48, 50, 66 per cent.) indicates the need for some form of control. Preferably cows showing advanced clinical mastitis should be sold for slaughter purposes only, and measures might be instituted to establish and to declare the soundness of udders before offering cows for sale.

There is no doubt that the high incidence of mastitis in our South African dairy herds is responsible for grave economic loss. It is not proposed to discuss the responsible factors, such as herd wastage, loss of milk, expense of feeding unprofitable milkers, production of substandard milk, etc.

From the public health viewpoint the mastitis problem is largely concerned with the unsuitability of mastitis milk for human consumption. Measures are necessary to prevent gross pollution of the milk supply with pus. Fortunately simple tests are available, which if regularly employed enable the dairyman to detect those udders furnishing a grossly abnormal secretion (colour and appearance, strip cup).

In order to overcome the unenlightened state of a proportion of the milk producers it is necessary to make periodical visits and

demonstrations, and these are of considerable benefit. In addition, however, coercive measures are necessary to stimulate certain individuals to action.

Looking to the future, it is certain that there is no measure as likely to bring about strenuous effort to improve udder health and hygiene as the introduction of a scheme for paying producers on a sliding scale according to the quality of the product produced by them. In the meantime the spread of udder disease continues almost unchecked.

Summary.

1. A Breed smear survey of milk supplied to the Witwatersrand area revealed a very high degree of contamination with mastitis. Between 20·5 per cent. and 48·4 per cent. of the milk samples examined each month were mastitis-contaminated.

Only a small proportion of producers (5%) supplied milk showing infrequent contamination, i.e. to the extent of less than one in ten samples examined.

2. An average mastitis incidence of 30 per cent. infected cows was encountered in a series of commercial dairy herds examined by means of incubated milk samples. At a weekly dairy cow market an average of 39 per cent. of the cows offered for sale were infected with mastitis.

Acknowledgement.

Thanks are due to the Director of the Abattoir and Live Stock Markets, Johannesburg, for permission to publish this report.

Acknowledgement is made of the services rendered by the Johannesburg Town Dairy Inspectors, and by the Municipal Biochemical Laboratory, in assisting to collect milk samples and prepare Breed smears for examination.

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SIMON VAN DER STEL ON BRANDSIEKTE

(From "Rambles through the Archives of the Colony of the Cape of Good Hope, 1689-1700" by Hendrik Carel Vos Leibrandt, Keeper of the Archives and Acting Librarian of the Parliamentary Library. J. C. Juta & Co., Cape Town, 1887.)

This extract forms a small part of the instructions left by Governor Simon van der Stel for the information and guidance of his son, Willem Adriaan, who succeeded him in office (10th March, 1699).

"And whereas the free butchers, although permitted by the Lord of Mydrecht to kill and sell at a fixed price, often sit with folded arms for four or six months, with the excuse that they have been unable to obtain any or a sufficient number of cattle for slaughter, and then suddenly again commence to kill for a short time for burghers and soldiers all kinds of meat, sound and unsound — a proceeding that should not be allowed — and whereas such conduct arises purely from their selfish natures, as they do not only obtain cattle in a detestable manner, but likewise do not hesitate to buy whole troops of unsound and scurvy* sheep, whose disease is of such an evil and poisonous nature that it can never be healed, infecting, as it does, not only the pastures over which they roam, but also the sheds in which they pass but a single night, with such a virulent contagion, that all other flocks brought on the same grounds and sheltered in the same sheds are immediately infected; an evil which we have endeavoured to prevent expressly by placcaat, viz. that scurvy sheep shall not be depastured with healthy ones, although, to our regret, very little effect has been given to it — and whereas it has been found that neither those sheep nor those sheds, although washed a hudred times, and even white-washed with lime, can again be disinfected — and whereas such sheep, brought to fresh and good pastures, seemingly get rid of the scab and drop its crust, gaining flesh finely, but retaining within them the infection, so that, as soon as the pasturage becomes indifferent, and they are pinched by the winter cold, the evil at once again reveals itself — and whereas the said free butchers use such sheep, mixed up with many mad and a few good ones, for killing, and sell the meat to the garrison and the burghers, so that, in consequence of this incurable infection, only heavy sickness and ill-health must result for the people — therefore, it will be necessary to examine and approve of all slaughter cattle before they are killed."

NOTICE TO MEMBERS.

The attention of all members is drawn to Section 10(1) of Government Notice No. 925 of 6th July, 1934: "Employing as an assistant or locum tenens any person not registered...." Such an act by a registered veterinarian shall constitute conduct of which the Veterinary Board may take cognisance under Section fourteen of Act No. 16 of 1933.

Pertinent to the above is the following extract of a notice posted for the information of students by the Secretary of the Faculty of Veterinary Science.

"Students are warned that they are not allowed to accept *locum tenens* posts until they are qualified and registered. When students are attached to practising veterinarians in order to gain experience, they should, as far as possible, carry out the work under the supervision of the veterinarian. If a student has to attend to a case in the temporary absence of the veterinarian he should carry out the instructions of the veterinarian and report back to him as soon as possible.

The supervision by a veterinarian is considered by the Faculty as essential even though the Faculty recognizes that at times such supervision is indirect. Whenever a student is attending cases in the temporary absence of the veterinarian, he should exercise great care not to expose himself to a charge of infringing the Veterinary and other Act.

For general information of students, two sections of the Veterinary Act are quoted:—

Section 16: No person shall be entitled to recover any charge in any court of law for any veterinary advice or attendance unless he is registered under the Act as a veterinarian or under the Medical, Dental and Pharmacy Act as a medical practitioner.

Section 17(1): Any person not registered under the Act as a veterinarian who pretends or who by any means whatever holds himself out to be a veterinarian.... shall be guilty of an offence and liable on conviction to a fine not exceeding fifty pounds.

An authorized veterinarian under the Medical, Dental and Pharmacy Act is a veterinarian holding a certificate issued to him by the Minister of Public Health. Only by an authorized veterinarian can poisons and habit-forming drugs as listed in this Act be supplied, sold, etc. Commonly used drugs such as chloroform, nux vomica, mercuric chloride, tartar emetic, etc., appear as poisons in Division I and II of the fourth schedule."

(Signed) P. J. J. FOURIE,
Secretary: Faculty of Veterinary Science, Onderstepoort,
8th October, 1947.

W. D. MALHERBE,
Honorary Secretary-Treasurer, S.A.V.M.A.
30th October, 1947.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

Minutes of Council Meeting held at the Tilsim Hotel, Pretoria, on September 16th, 1947, at 7 p.m.

Present: J. H. Mason (President), E. M. Robinson, A. C. Kirkpatrick, J. G. Boswell, G. C. van Drimmelen (*vice* M. C. Lambrechts), D. G. Steyn, R. A. Alexander, W. D. Malherbe, A. D. Thomas, P. S. Snyman, A. M. Diesel and S. W. J. van Rensburg.

Apologies for absence: P. J. du Toit and M. C. Lambrechts.

1. *Minutes* of the meeting on August 14th, 1947, read and confirmed.

2. *Arising from these*:—

(a) *Amendments to Stock Diseases and Veterinary Acts*: The Secretary had found it impossible to summarize views already received on account of their divergence. Decided that the views should be collated by the subcommittee previously appointed and presented to Council. The suggestion from the Cape Western Branch that members should accept no unadvertised post would be discussed by Council at a special meeting to be convened for consideration of all the suggestions from the above subcommittee.

(b) *Distemper Immunization*: Since no replies were available from the Branches the matter was held over.

(c) *P.D.S.A.*: After a brief resumé by the President of the activities and organization of the P.D.S.A., and some discussion, it was resolved to obtain information from Cape members during the Conference and to resume consideration of this matter at the next Council meeting.

3. *New Members*: The following additional names were to be recommended to the General Meeting for acceptance: F. J. Weir, N. J. G. da Camara, A. Ayres.

Resignation: J. H. N. Hobday: The Secretary reported that this resignation had been withdrawn. *Decided*: That consideration should be given at the next meeting to a suggestion that there should be a reduced membership fees for non-Union members.

4. *Finance*: *Auditors' Report*: This was presented by Dr. Alexander, together with comments, explanations and resolutions from the Finance Committee. These were accepted by Council with the exception of the matter of disposal of Book Fund money. It was decided that this Fund be consolidated at £250 (the interest on which would provide for the Book Fund Prize) and that the residue should retain its identity as a fund to be used for special purposes by a combined committee consisting of Book Fund and Finance Committees: *e.g.*, Loans to Students.

Applications from two fourth-year veterinary students for assistance to complete their course were presented by the Secretary. *Decided*: that £25 would be made available immediately and £50 next year to each of the applicants as loans under the usual conditions. This money would be derived from the newly established fund.

5. *Arrear Subscriptions*: Finance Committee's recommendations accepted.

6. *Standing Committees*: The following were elected:—

Finance: R. A. Alexander (convener), B. S. Parkin, S. W. J. van Rensburg and A. D. Thomas.

Editorial: R. Clark (editor and convener), P. J. du Toit, E. M. Robinson, C. Jackson and G. C. van Drimmelen.

Library: D. Coles (convener), E. M. Robinson and W. D. Malherbe.

General Purposes: A. M. Diesel (convener), R. A. Alexander, P. S. Snyman, A. C. Kirkpatrick and P. J. J. Fourie.

Book Fund: M. de Lange (convener), A. D. Thomas and D. A. Haif.

The S.A.V.M.A. representative on the National Health Council, Dr. Alexander, reported on the inaugural meeting held in Bloemfontein, under the chairmanship of Dr. Gluckman, Minister of Public Health. Matters such as the power of condemnation of meat, control of milk hygiene, control of tuberculosis had been referred to the Technical Committee and proposed future legislation would be submitted to the S.A.V.M.A. before presentation to Parliament.

7. *General*:

(a) Letter from Col. Van Heerden in appreciation of his nomination as Honorary Life Vice-President read.

(b) Importation of Veterinarians by the Department of Agriculture. It was decided to ask the N.V.M.A. to advise members of the Royal College who were thinking of joining the Union Service to write to the Secretary before doing so in order to be made aware of conditions in this Service. Council felt that this would be only fair to intending immigrants.

(c) *Complaint from a Member*: An excerpt was read from proceedings of a Commission of Inquiry in which allegedly derogatory statements had been made by one member about the professional capabilities of another. As this appeared to be a matter to be dealt with under par. 15 of Government Notice No. 925 of 6/7/1934, it was decided to refer the complaint to the Veterinary Board. The Board should be requested to inform Council as to action taken.

The meeting adjourned at 10.50 p.m.

W. D. Malherbe,
Honorary Secretary-Treasurer, S.A.V.M.A.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

Minutes of the 42nd General Meeting, held at Onderstepoort, on September 17th and 18th, 1947.

Present: J. H. Mason (President), A. Tarr, D. Coles, V. Cooper, J. S. Watt, A. M. Diesel, J. Nicol, J. A. Thorburn, L. L. Daly, P. S. Snyman, J. G. van der Wath, J. R. Scheuber, G. D. Sutton, R. Clark, R. du Toit, G. de Kock, P. J. J. Fourie, J. I. Quin, E. M. Robinson, J. G. Williams, C. v. E. Maré, W. J. Ryksen, G. F. van der Merwe, L. W. van der Heever, F. W. Langbridge, B. C. Jansen, T. A. T. Louw, J. A. de Kock, J. S. van Heerden, J. D. Smit, S. A. R. Stephan, O. T. de Villiers, W. O. Neitz, C. J. van Heerden, C. Jackson, T. Hellberg, R. Alexander, H. Holtz, M. H. V. Brown, T. F. Adelaar, C. W. A. Belonje, H. P. A. de Boom, W. H. G. Schatz, C. F. B. Hofmeyr, R. Datnow, J. R. Frean, G. J. de Wet, J. L. Dickson, R. B. Osrin, P. H. Brown, C. H. Flight, P. L. Uys, R. A. Painter, A. J. Louw, P. J. Goosen, S. L. Snyders, M. Bergh, G. C. van Drimmelen, A. Albertyn, W. J. Wheeler, L. W. Rossiter, M. J. N. Meeser, M. W. Henning, D. G. Steyn, C. C. Wessels, Jac. Louw, A. L. Wessels, E. de V. Erasmus, J. D. Neethling, D. E. Truter, G. L. Muller, H. Graf, M. de Lange, J. M. de Wet, L. Stonier, J. W. A. Brookes, Campbell Dickson, C. Jackson, N. C. Starke, J. H. R. Bisschop, M. H. V. Brown, V. R. Kaschula, R. E. Hartig, T. N. Osborn, K. Schultz, W. H. B. Buhr, J. P. van der Merwe, L. L. Hansmeyer, T. Veenstra, J. L. Doré, D. A. Haig, A. D. Thomas, F. B. W. du Casse, J. G. Townsend, R. K. Reinecke, I. Mowat, G. Watt, L. T. Edwards, U. von Backström, J. H. Schoeman, H. P. Steyn, L. R. Morford, C. J. Erasmus, W. G. Barnard, I. P. Marais and W. D. Malherbe.

Apologies for Absence: S. T. Amos, P. J. du Toit, H. H. Curson, W. C. Viljoen, J. Keppel, T. Threlkeld.

Obituary: A motion of condolence with the relatives of the following members who had died during the year, was passed, viz., H. Theiler and T. Ziehn.

Opening: The President thanked the Acting D.V.S. for the facilities granted at Onderstepoort for the purpose of this meeting. He also drew attention to the instructive exhibits set up by the following firms for the duration of the Conference: Messrs. Cooper & Nephews, African Explosives and Chemical Industries, Bayer Pharma, Otley-Jardine, Abbott Laboratories, Smith & Nephews, Westdene Products, British Drug Houses, Cook, Troughton & Sims, Reckitt & Colman, May Baker, Agricura Laboratoria, Scherag, Klipfontein Organic Products, S.A. General Electric, Optical Instruments, Millborrow.

The President welcomed the following visitors: Drs. da Camara and Ayres of Portuguese East Africa, and Dr. Georgakis of Greece.

The following papers were then submitted and discussed:—

Dr. L. L. Stonier: Agricultural production and possibilities of the North-West Cape.

Mr. P. M. Bekker: Benzene Hexachloride dips.

Dr. C. C. Wessels: The need of tuberculin testing. This paper launched a very full discussion, culminating in a resolution as given later.

After lunch the following films were shown:—

"Nagana" and "Foot and Mouth Disease" by the Division of Veterinary Services in co-operation with the Film Unit of the Education Department. "Stader Splint" by S.A. General Electric.

Business Meeting: At Technical College, Pretoria, at 8 p.m.

1. *Minutes of General Meeting* held on September 24th and 25th, 1946, were confirmed.

2. *Matters arising* from these: None.

3. The following *New Members* were accepted: A. Ayres, M. Bales, P. Casserly, N. J. G. da Camara, R. Datnow, J. A. de Kock, W. P. S. Edwards, L. L. Hansmeyer, A. V. May, J. D. Neethling, B. H. Pappin, W. E. Pearson, G. Pfaff, R. K. Reinecke, J. Schuss, T. Threlkeld, A. L. Wessels, E. O. le Riche, T. Veenstra, H. E. G. Holtz, E. J. Wadley and F. J. Weir.

4. *Resignation*: J. A. Schutte accepted.

5. *Notification of Election of Council*: The following were declared elected for 1947-48:—

President: J. H. Mason.

Vice-President: A. M. Diesel

Honorary Secretary-Treasurer: W. D. Malherbe

Members: R. Alexander, J. G. Boswell, P. J. du Toit, A. C. Kirkpatrick, P. S. Snyman, D. G. Steyn, A. D. Thomas, S. W. J. van Rensburg.

6. Col. C. J. van Heerden was elected as Honorary Life Vice-President.

7. The President gave his address.

8. *Standing Committees*: Reports were presented by Dr. Alexander on Finance and Dr. Robinson on the Journal.

Reports were also presented by Dr. Quin on the National War Memorial Health Foundation and one from the committee dealing with salary scales.

9. *Arrear Subscriptions*: As Council had deatl with these, there was no discussion.

10. *General*:

(a) Tributes were paid to the services rendered by Drs. A. D. Thomas and J. Quinlan to students in the Veterinary Faculty, and by Dr. J. Nicol (as Senior Veterinary Officer) to newly qualified veterinarians in his area.

(b) Registration of Stock Remedies: In the course of a discussion on this matter, Dr. Parkin gave some particulars of Act 36 of 1947.

(c) Other matters discussed were the forthcoming standardization of stock feeds by the Bureau of Standards; the activities of animal welfare societies, and the liaison as to Glossina distribution in African territories.

The meeting closed at 10.25 p.m.

Second Day: 18*th September*, 1947.

The following papers were presented and discussed:—

Dr. Groenewald: Bone Diseases in Horses.

Drs. Ortlepp, Laurence, Quin and Mr. Bosman: The influence of diet on worm infestation in sheep.

Dr. R. Alexander: Heartwater.

Dr. W. O. Neitz: Certain aspects of chemotherapy.

Dr. H. P. Steyn: Application of the Stader splint.

Resolutions: The following were passed unanimously:—

1. This meeting of the S.A.V.M.A. considers that the making of films for instructional purposes should form an important activity of the Division of Veterinary Services. For this reason the Government is urged to appoint the necessary staff and to supply the necessary equipment for the making of such films on a larger scale than heretofore.

2. This session of the S.A.V.M.A.:—

   (a) records its appreciation of the growing importance of animal production in the north-western areas of the Cape Province, despite continued periods of drought and hardship;

   (b) realizes that this increased production is achieved only as a result of improved breeding, the provision of better feed supplies and more effective control of animal diseases;

   (c) realizes further the urgent necessity of greater publicity and general enlightenment of the public regarding animal health matters throughout South Africa;

   (d) urges the establishment of a district veterinary publicity committee with the specific object of co-ordinating existing publicity work as well as extending it to the fullest extent by the use of all the modern methods, including the press, radio, film, pamphlet and personal contacts with owners.

3. This session of the S.A.V.M.A.:

   (a) records its concern at the constantly increasing significance of malnutrition as a primary factor menacing both animal health and production throughout South Africa;

   (b) realizes that without adequate control of nutritional factors, otherwise effective veterinary measures are largely jeopardized if not actually frustrated, thus seriously limiting the efficiency of the veterinary profession in South Africa;

(c) urges more widespread appreciation in Government, farming and Veterinary circles of the true importance of animal nutrition and the need for the production and conservation of animal feeds in whatever form possible;

(d) records its appreciation of the work done by the animal feeds section of the Department of Agriculture during the war years in rationing the available supplies;

(e) welcomes the re-establishment of a central committee for the promotion and co-ordination of research work on animal nutrition and supports all efforts made to further knowledge in this vitally important branch of science.

4. This conference of the S.A.V.M.A., having discussed the subject of tuberculosis at length, is of the opinion that:

(a) tuberculin be made available immediately to private practitioners and municipal veterinary officers to enable them to undertake diagnostic tests and the testing of herds, on the understanding that no costs be incurred by the Department of Agriculture;

(b) the Minister be requested to institute at the earliest possible date a scheme for the control and eradication of tuberculosis;

(c) and that in such a scheme the private practitioners should play an active part.

The Conference adjourned at 3.20 p.m. with a vote of thanks to the Chair.

W. D. MALHERBE,
Honorary Secretary-Treasurer, S.A.V.M.A.

NOTES

During September, Dr. L. de Blieck, Professor of Infectious Diseases at the Veterinary School in Utrecht, Holland, visited Onderstepoort and spent a month studying the various aspects of the research work. Dr. Blieck is Secretary to the International Veterinary Congress and will organize the next meeting which is to be held in London in 1949.

Dr. N. Georgakis, sub-director of the Government Veterinary Research Laboratory at Athens, Greece, is spending a few months at Onderstepoort. He has been sent by the Greek government to study methods of research and vaccine production.

OBITUARY

C. H. STRACHAN

We regret to announce the death on October 7th, 1947, of Charles H. Strachan, M.R.C.V.S. The deceased passed away suddenly on his farm "Hlani," in the Mount Currie district of East Griqualand, at the age of 65. He was the youngest and only surviving son of that grand old East Griqualand pioneer, Donald Strachan, of Umzimkulu. He qualified in London in 1906, and held the rank of Captain in the S.A.V.C. in the first World War. "Charlie," as he was familiarly known to his friends, was of a genial and kindly disposition and was a great lover of sport. He was in the government service for a short period before taking up farming. He is survived by his wife, to whom sympathy has been tendered.

Their one and only child, Kelvin, died under tragic circumstances in World War II while serving with the S.A. Forces in Italy. His untimely death was a severe blow to his parents, so much so that it affected his father's health.

G.T.H.

DR. HANS THEILER

We regret to record the death at Onderstepoort on August 6th of Dr. Hans Theiler at the comparatively early age of 53 years. Hans, as he was affectionately called by his colleagues, was the elder son of the late Sir Arnold Theiler. He qualified as a veterinary surgeon at the Royal Veterinary College in London, subsequently going to the United States of America, where he worked first at the Animal Diseases Laboratory of the Rockefeller Institute, and then for some years at Harvard. After ten years in America, he returned to South Africa in 1935 and joined the staff of the Onderstepoort Laboratory. While in America he married, and his return to South Africa was mainly on account of his wife's health. He nursed her devotedly until her death two years ago. His own death was very sudden and unexpected and occurred after a short illness, from which he was apparently well on the way to recovery.

To his mother, Lady Theiler, and his sisters and brother we tender our deepest sympathy in their sad loss.

E.M.R.

EDITORIAL.

THE VETERINARIAN IN THE GOVERNMENT SERVICE IN THE UNION OF SOUTH AFRICA.*

THE Minister of Agriculture honoured the South African Veterinary Medical Association by attending the 39th annual meeting of the Association held at Onderstepoort in September, 1944. During the course of his reply to a few words of welcome, the Minister announced that he had decided to appoint a committee to inquire into and report upon the whole question of veterinary services in the Union. A strong committee representative of the universities and of agricultural, veterinary and medical interests under the chairmanship of Mr. J. J. Adams, Under-Secretary of Agriculture, was appointed in March, 1945, held its first meeting on 2nd May, 1945, and commenced the collection of evidence in June of the same year. The report was signed in November and was made public about the middle of 1946.

When the terms of reference of the Committee were announced, great disappointment was felt that an inquiry into the remuneration of veterinarians in government employ was not specifically included. The reason for this omission was apparently that the Public Service Commission of Inquiry, then sitting, had been entrusted with the task of inquiring into the emoluments of the Public Service. Nevertheless evidence on the important matter of remuneration was laid before the Minister's Committee. No actual recommendations were made, but in keeping with the thorough manner in which the Committee set about its task, it felt constrained to report (Chapter XV, paragraph 3) that " The shortage of veterinarians in the Government Service is due, first and foremost, to the inadequacy of the salaries and the unsatisfactory conditions of service." Further the Committee could not refrain from stating that " in its opinion the present unsatisfactory conditions obtaining in the Division of Veterinary Services and in regard to veterinary services generally will never be remedied unless a substantial improvement is brought about in this fundamental matter " and " it will be impossible to carry out the recommendations of the Committee unless a substantial improvement in the scales of salaries is introduced ".

Since the publication of the Report of the Minister's Committee the scales of salary of veterinarians in the Government Service have been adjusted in accordance with the recommendations of the Public Service Commission of Inquiry. Responsible authority continually makes the statement that this adjustment represents a considerable

* This editorial was submitted for publication by the Council of the South African Veterinary Medical Association.

improvement in the emoluments of public servants (including veterinarians) thereby implying that one of the shortcomings to which the Minister's Committee was constrained to direct attention had been remedied. The Council of the Association, in a concise survey of the position, indicated to the Minister of Agriculture, *inter alia*, that not only had no improvement in fact been made, but that no attention had been paid to the question of promotion. Attention was directed to the fact that the new salary scale for veterinarians is in effect a combination of the scales applying to Grades V, IV and III of all officers of the Higher Professional Division (excluding medical officers) with all the disadvantages of a single scale and none of the advantages, notably the possibility of promotion from a lower to a higher grade. It is futile to advance the argument that machinery does exist for increasing the rate of progression within the scale by awarding additional increments should such advancement be deemed necessary. Though this machinery does exist on paper it has never been set in motion as far as the Division of Veterinary Science is concerned, notwithstanding that there have been many instances of outstanding achievement. In the case of professional officers other than veterinarians there are many instances of rapid advancement due to early promotion from lower to higher grades of a series of salary scales.

The Public Service Commission of Inquiry reported that the recommended salary of £450 should only operate until such time that a number of veterinarians became available for appointment to the state service, when the commencing salary should be reduced to £350 per annum. Apparently the Public Service Commission did not agree with this quite remarkable recommendation, because no mention is made of it in Treasury Circular No. 11 of 1946, in which the commencing salary is fixed at the £450 notch of the composite scale. The reply which was received from the Minister as the result of representations made by the Council of the S.A.V.M.A. to him was to the effect that the commencing salary of veterinarians would be fixed at £450 in place of the recommendation by the Public Service Commission of Inquiry that the £450 granted should be regarded as an interim measure, the ultimate aim being £350. The other points dealt with in these representations have, up to the present, not been replied to.

No good purpose would be served by discussing at length the inadequacy of the veterinarian's scale, but a few salient points should receive attention. There is complete agreement on all sides that the scale in operation at the end of 1945 was intolerable. When it is borne in mind

(a) that the average age of qualifying as a veterinarian is over 24 years,

(b) that on the new scale, the maximum of £960 — on account of the painfully slow progression — would not be reached until the age of 42,

(c) and that a salary of £600 would not be attained until the age of 30 years,

it is difficult to believe that the accepted principle of a " marriageable wage at a marriageable age " has even been considered. The remuneration of veterinarians as early as 1925 was approximately twice that recommended now by the Public Service Commission of Inquiry, for then many veterinarians were appointed at £500 plus free quarters. That period was one of keenness in the Division of Veterinary Services. The maximum of the present scale for such veterinarians has now been elevated, after an exhaustive study of the position, from £800 to £960, i.e. veterinarians of 20 years ago received £800 plus free quarters as against the present £960. It is difficult to appreciate that any improvement has taken place. For the sake of completeness it may be mentioned here that in 1932 the remuneration of certain veterinarians was reduced by depriving them of free quarters in a manner which may be regarded as arbitrary, though the Minister's Committee referred to the action as being " unfortunate ".

Finally, a comparison of the present scale, commencing at £450 per annum with increments of £25 to £30 per annum and pension deductions of about 7%, with those of neighbouring African territories, would be of interest.

In Northern Rhodesia and Tanganyika the veterinarian starts at £600 per annum, earns approximately £1,500 more in the first ten years and receives an estimated additional emolument of several hundred pounds in the form of free quarters, free medical services, free passage to coast and to England, etc.

In Southern Rhodesia he starts at £550 per annum, earns also abolt £1,500 more in the first ten years and receives in addition marriage and children's allowances while his basic salary is less than £660 per annum.

In the High Commission Territories (Swaziland, Basutoland, Bechuanaland) he starts at £500 or £550, earns over £1,000 more in the first ten years and receives free quarters, free ordinary medical services and free biennial railway tickets to the coast.

It is quite apparent that veterinarians, even though by birth South Africans, will seek employment outside the Union services in those services which are, at present, far from the saturation point. The Union will not be able to cope with even normal wastage and veterinary services in the Union will continue gaily on the downhill path. Agriculture is only now waking up to the effect the depletion of the veterinary services has had on the economy of the country as evinced by the discussions at and resolutions passed by meetings of agricultural unions.

Let it not be thought that the question of salary is the one and only cause of the present regrettable state of affairs. Conditions of service, lack of hope of promotion with its attendant sence of frustra-

tion and stifled ambition are but a few of the points which will be apparent from a critical review of the Minister's Committee Report. But over and above all this, what is the main cause of the trouble? The matter has received the most careful consideration and the opinions of many veterinarians have been examined and it is believed that possibly an indirect and all-important bone of contention is the classification of a veterinary officer as a "professional officer". Anomalies and injustices arising directly from the rigid enforcement of this classification have undoubtedly been a cause of the steady decline in the status of the veterinarian, and the chief reason for the failure to devise a formula to overcome the present dissatisfaction among all members of the group. As a class the professional officers include matriculants and non-matriculants, holders of diplomas of simple agricultural courses, university graduates and officers holding recognized professional degrees. The elevation of this class to the status of professional officers has resulted in the degradation of those having professional qualifications in the accepted sense of the word. Yet it is striking that this group or class does not include medical officers who are correctly designated apart from the "professional" officers, merely as medical officers. The veterinarian is a member of a statutorily recognized profession. He has earned for himself in the Union an honourable and an honoured place in the scheme of things and has an earning capacity outside the government service out of all proportion to that inside the service. All this is tacitly admitted by responsible authority in that a distinct scale for veterinary officers has been promulgated. Comparisons are odious, but it is submitted that many veterinarians on a comparatively low notch of the scale regularly shoulder a greater responsibility, for example in the preparation of vaccines, in the diagnosing and controlling of infectious diseases, etc., than other, even though higher graded "professional" officers.

The medical course is a year longer than the veterinary course, and the subsequent earning capacity of the medical graduate, especially in private enterprise, is in most cases greater. These differences are appreciated, but the functions of the veterinarian more closely approximate those of the medical graduate than those of his so-called co-professionals. Let the veterinarian take his rightful title as a "veterinary officer" and receive official recognition as a veterinarian. If effect be given to this principle, the way is open for the rehabilitation of the veterinary services in the best interests of the country as a whole; if not, it is long-suffering agriculture that will be called upon to shoulder the burden. This is no idle speculation. It is sound reason mirrored in the decline in the Union of South Africa of State veterinary services as a whole and Onderstepoort in particular.

The medical graduate appointed to a post in the Government service in the neighbourhood of Pretoria as a medical officer commences on a remuneration which can be conservatively estimated at

£810 (£600 per annum plus free quarters and service allowance). The veterinarian appointed to Onderstepoort would not reach the salary notch of £810 until he is about 38 years of age. And the difference in length of the two courses is one year.

The Council of the S.A.V.M.A. will continue to do everything in its power to protect the veterinary profession, and it certainly needs protection, but in its dealings with the State it has met with little success. A reply to only one point of the representations made to the Minister of Agriculture, namely, the commencing salary, has been received as yet.

It is desired to take this opportunity of thanking the South African Agricultural Union and its affiliated associations for their valued interest and support. Finally, the Council wishes to place on record its appreciation of the fine piece of work carried out by all the members of the Minister's Committee of Inquiry.

It seems regrettable that so few changes as the result of this enlightened report have been brought into operation and as far as the Council is aware none of these affect the rank and file of the State Veterinary Service.

CERTAIN ASPECTS OF CHEMOTHERAPY*

W. O. NEITZ
Onderstepoort

When I undertook to discuss certain aspects of chemotherapy, I intentionally chose a general title so as to be free, not only to touch on various observations that have been made on the curative value of remedies, but also to stress the importance of the provocatory influence of certain chemotherapeutics on several micro-organisms. The times in which we live are characterized by the great advances that have been made in the production of synthesized drugs. These medicaments are continuously placed at the disposal of veterinarians and medical men for the treatment of infectious diseases. The results have generally speaking been astounding, but at times rather disappointing. Before attempting to discuss the significance of the provocatory influence of chemotherapeutics, I wish to briefly enumerate a series of observations, which should be remembered by those of you engaged in treating patients suffering from infectious diseases.

The systematic studies of chemotherapy during the last decades, have brought several characteristic properties of numerous drugs to our notice. The investigations have clearly indicated that apart from the direct interaction of drugs with infectious organisms, the rôle played by the tissues of the treated host in destroying the parasites is of great importance, and to-day special attention is being paid to this phenomenon. These observations have given biologists and chemists indications how to proceed in order to synthesize more efficient remedies. The literature dealing with chemotherapy is very extensive, and the available information may be briefly summarized as follows :

1. An extremely large number of chemical compounds have been prepared, which have no influence on the pathogenic and non-pathogenic micro-organisms. Generally speaking, it can be stated that the non-pathogenic parasites are not influenced at all by chemotherapeutics, with one exception, which will be mentioned later.
2. Several drugs, which have a specific action on pathogenic micro-organisms harboured by laboratory animals, fail partially or completely to exert their influence in the natural host — man or domestic animal. The reverse process has also been observed. The antimony — arsenic compound Sdt 386 B, has no influence on *Leishmania tropica* infection of the mouse, whereas the same disease in man is influenced

* Read at the Annual Meeting of the South African Veterinary Medical Association at Onderstepoort, September 18, 1947.

beneficially. In the case of the American form of oriental boil caused by *Leishmania tropica* var. *americana*, the influence of this drug is very specific. Then again chemotherapeutics are known (Bayer 205 and tryparsemide) which have a specific action on the *Trypanosoma gambiense* group parasites in the natural host, as well as in the laboratory animals. These observations show that the tissues of the treated hosts must play an important rôle in combating diseases.

3. Some chemotherapeutics, especially those prepared from arsenic and antimony, possess comparatively large "dispersion cones," i.e. their specific influence extends to a whole series of pathogenic micro-organisms belonging to the Protozoa, Spirochaeta, Bartonella, Vira, Bacteria and Helminths. One of these compounds, the antimony-arsenic compound Sdt 386B has even got a specific influence on the non-pathogenic parasite, *Trypanosoma lewisi* of the rat, perhaps the only non-pathogenic parasite that has ever been influenced.

4. The specific action of the drug Certuna on the gametocytes of human and bird malaria is not demonstrable in the vertebrate host. Its influence is only observed in the vectors (*Anopheles* spp. and *Culex* spp.), where either the development of the micro- and macro-gametocytes or the oocysts is inhibited completely. Mosquitoes infected by such influenced protozoa fail to transmit malaria. It should be possible to employ this as a method for the separation of a virus from malaria parasites in cases where the vertebrate host harbours both, e.g. equine encephalomyelitis virus and *Plasmodium* spp. which are both transmitted by *Anopheles* sp.

5. Drug resistance, which is associated with chemotherapeutic interference, has been observed particularly in trypanosomiasis. It has been established that drug resistance is not only retained by parasites maintained by serial passage in the vertebrate host, but that this acquired characteristic is also retained after several passages through the *Glossina* sp. It should be remembered that drug resistance is not specific for a certain drug only. Experiments, particularly those of Warrington-Yorke, have shown that trypanosomes, which have become neosalvarsan resistant, are also resistant to other arsenical compounds as well as to other medicaments such as trypaflavin and antimony preparations. The practical importance of this phenomenon is well known to medical men engaged in combating sleeping sickness in the tropics. We are being warned to-day not to use penicillin indiscriminately, in view of the possibility of producing penicillin-resistant bacteria. Whether other drugs such as sulphonamides, neosalvarsan,

etc. can produce drug-fast bacteria is not known. It should, however, be remembered that bacteria may respond to chemotherapeutics in the same way as *Trypanosoma.*

6. The chemoprophylaxis of Bayer 205 in *Trypanosoma gambiense* infection, of bismuth preparations in *Treponema pallida* infection, of quinine and atebrine in malaria, and that of uleron in *Rickettsia ruminantium* infection are well known and need, therefore, not be considered in detail.
7. Certain drugs such as atebrine and methylene blue used for the treatment of malaria, and phenanthridinium 1553 for the therapy of nagana produce photosensitisation.
8. Several chemical compounds which exert a specific action on some parasites or on a certain development stage of a parasite, may have a provocative influence on other micro-organisms or on another stage of the developmental cycle. It is of interest to note that in the case of *Schistosoma* sp. Bayer 205 has a provocative influence on the egg production. The administration of this drug can be used for diagnostic purposes in Bilharzia infections.

The first seven manifestations have been carefully reviewed in the modern textbooks on chemotherapy published by Fischl and Schlossberger (1934), Findlay (1939), Oesterlein (1939) and in articles by Kikuth (1935, 1937 and 1939). These need, therefore, not be considered in detail. The last mentioned manifestation is also mentioned in the literature, but the practical importance is not sufficiently stressed.

Those of you interested in the history of biology will remember the controversy that arose about the use of antimony in the treatment of diseases. Paracelsus (1493-1541) regarded antimony and some of its derivatives as very useful remedies. The general and frequently indiscriminate use of this mineral, however, was unfortunately often followed by bad and even fatal results. In view of this the medical faculty of the University of Paris and later the one of the University of Heidelberg, started agitating against the use of chemicals containing antimony. In 1566 a parliamentary decree was passed in Paris, forbidding the use of antimony preparations. Medical students taking the oath of Hippokrates at the Paris University had also to take an oath, that they would not prescribe antimony to any of their patients. Despite the law, investigations based chiefly on the experience of Paracelsus, were continued. Antimony compounds were secretly prepared and prescribed chiefly for the treatment of cancer, leprosy and syphilis. Marked progress was made and in 1666 the Paris edict was not only withdrawn, but the medical faculty strongly recommended the use of antimony preparations. At that time no less than 500 different chemical compounds were registered at the University of Paris. From the historical records it is quite evident that in many instances

the treated patients were poisoned. It is, however, possible that some of the bad and even fatal results may have been due to the provocatory influence on micro-organisms responsible for leprosy, louse and murine typhus.

The reason why I became interested in antimony and arsenic preparations, was because at the time when I was searching for a remedy for heartwater (*Rickettsia ruminantium* infection), the antimony-arsenic compound Sdt 386B prepared by Hans Schmidt was placed at my disposal for these studies. The drug had been shown to have a remarkable chemotherapeutic index of 1 : 2500 to 1 : 5000 in the case of *Bartonella muris* infection of the rat by Kikuth (1937). This drug was also found subsequently (Neitz, 1937) to have a very specific action on *Eperythrozoon ovis* infection of sheep. In this disease it was observed that the parasites disappeared completely from the peripheral circulation as early as half an hour after the administration of 1.0 gm. per Kg. bodyweight. The wide " cone of dispersion " possessed by this compound suggested that it may have a specific action on *R. ruminantium.* On administering this drug to sheep reacting to the " Mara " strain of heartwater, I was struck by the fact that the clinical symptoms were aggravated, and that practically all the treated sheep died. The examination of the intima smears prepared according to the method described by Jackson (1931), showed that there was a marked increase in the number of *Rickettsia* colonies. At times as many as 10 to 20 and even 30 colonies could be demonstrated in a single microscopic field.

In a review on the comparison of the chemotherapeutic active elements, Schmidt (1933) points out that the three consecutive elements arsenic, antimony and bismuth in Group Vb of the periodic system possess fundamental chemotherapeutic characteristics, which resemble each other. These observations suggested that further investigations on heartwater should be undertaken with chemicals prepared from the mentioned minerals. These studies showed that several arsenic, antimony and bismuth preparations (neosalvarsan, antimosan, fouadin, neo-olesal and casbis) also possess a provocative influence on the heartwater organism. These unexpected results clearly indicated, that more attention should be paid to other groups of synthesized drugs, with the result in the beginning of 1938 I established that one of the sulphonamides " uleron " had a specific action of *R. ruminantium.* (Uleron possesses a chemotherapeutic index of 1 : 20 to 1 : 25 and sulphapyridine an index of 1 : 6 in heartwater.)

In the literature several references are made about the provocatory influence of chemotherapeutics. Kopanaris (1911) provocated *Plasmodium relictum* of the canary with neosalvarsan. Fischer (1920) provocated *Pl. vivax* in soldiers suffering from *Treponema pallida* with neosalvarsan. Low and Gregg (1925) enhanced the virulence of *Pl. vivax* with the antimony-mercury compound " Smalarina." Du Toit (1927) produced a relapse of *Anaplasma marginale* in cattle with

large doses of trypan blue, and Kikuth (1927) activated *Pl. knowlesi* of the monkey with the same drug. Gomez (1930) provocated *Bacillus leprae* with neosalvarsan, and Paldrock (1932) activated this bacterial infection with fouadin and neostibosan. According to Napier and Das Gupta (1930) *Leishmania donovani* is activated by neostibosan and to a mild degree by tartar emetic. James and Tate (1938) provocated *Pl. gallinaceum* with quinine.

All the enumerated parasites with the possible exception of *A. marginale,* undergo a developmental phase in the cells of the reticulo-endothelial system, which has always been regarded as one of the chief defensive mechanisms of the body. The phagocytosis of Bacteria, Protozoa and cells of the body by monocytes, macrophages, histiocytes and giant cells is well known. Investigations, particularly those during the last few decades, have also shown that the cells of the reticulo-endothelial system, may also act as host cells of certain Protozoa, Rickettsia, Bartonella and even Bacteria. The administration of the mentioned drugs has revealed yet another function, which has not been considered carefully in the past. From the available information it may be concluded that the reticulo-endothelial system permits that the development of the histotropic parasites is provocated by certain drugs, which are known to have a specific action of the haemotropic stage of the parasite.

No satisfactory explanation can be given to this interesting and important phenomenon at present. In the case of *A. marginale,* where extremely large doses of trypan blue were administered, it is assumed that the activation of the parasites is due to the blocking of the reticulo-endothelial system. The same explanation has been given for the activation of *Pl. knowlesi* with trypan blue. This explanation may be correct. In the case of the other parasites one has to assume that the provocation is brought about by the direct action of the drug and the indirect influence of the treated host cell. This supposition may also be applicable to the activation of *Pl. knowlesi* with trypan blue. The inability to destroy the histotropic parasites, particularly those belonging to the *Plasmodia* and *Rickettsia* groups of organisms with the chemotherapeutics at our disposal is well known. *Rickettsia ruminantium* and *Leishmania donovani* are exceptions. In the case of the last mentioned parasite the provocation is of a temporary nature only.

A question that arises out of this discussion is — what is the practical importance of the provocation phenomenon ? From accounts given about the control of malaria in many parts of the world one must conclude that this manifestation is a very important one. Raffaele (1946) states that quinine as a prophylactic agent caused much preoccupation during the first world war, in the course of which malaria claimed many victims among troops particularly in the Middle East. James, who was intimately associated with the malaria problem summarized his impressions as follows : " Every one who had actually taken part in efforts to deal with malaria in different parts of the

world during the war came home with the uncomfortable feeling, that we knew much less about the disease than we thought we did, and that it might be a good plan to sink our pride and to begin again in all humility and with greater respect and reverence to fathom some of its mysteries." Wenyon who worked among troops operating in Salonica arrived at the conclusion that the expense and work entailed in administering quinine for prophylaxis on a large scale was not in any way justified by the results obtained.

The puzzles associated with malaria compelled biologists to undertake further studies on the aetiology of malaria. James was led to formulate the hypothesis that sporozoites inoculated by mosquitoes did not penetrate the erythrocytes, but like those of other *Haemosporidia* penetrated the reticulo-endothelial cells, where they underwent a cycle of development, from which would originate the red blood cell parasites.

This theory was very sound. Although the pigment-free malarial parasites had been demonstrated by Ziemann (1898) in the hooded finch harbouring a *Plasmodium* sp. and by Anschütz (1909-1910) in a canary suffering from a chronic infection of *Pl. relictum*, it was only from the time when Raffaele (1936) and Huff and Bloom (1935) described the histotropic parasites in birds suffering from malaria that careful studies on the life-cycle of *Plasmodia* sp. in birds and mammals were undertaken. Since then Raffaele (1937) described the histotropic parasites in man suffering from *Pl. vivax, Pl. malariae* and *Pl. falciparum*. Schwetz (1938) described the histotropic parasites in monkeys suffering from malaria.

Once this stage of the life cycle of the malarial parasite had been established, extensive chemotherapeutic studies were undertaken in many laboratories. James and Tate (1938) found that the histotropic forms of *Pl. gallinaceum* of the fowl are provocated by quinine. To-day nobody doubts that quinine has a provocatory influence on the histotropic forms of the malarial parasites of man. The bad results following quinine chemoprophylaxis can be satisfactorily explained in this way. I am of the opinion that the provocation of the exo-erythrocytic parasites by quinine has in many instances also been one of the contributing factors towards the production of black-water fever in man.

Malarial therapy in general paresis of the insane is practised all over the world. I have often wondered whether some of the bad results mentioned in the literature can be ascribed to the provocation of the histotropic parasites of the various *Plasmodia* sp. harboured by the patient with neosalvarsan.

In the case of our animal diseases chemoprophylaxis plays a minor rôle. It is at present applied to a certain extent with uleron in the heartwater immunization process (Neitz, 1941) and in *Babesia caballi* infection with trypan blue in Russia (Enigk, 1944). The dangers of provocation become apparent when tartar emetic and antimosan are

applied for the treatment of *Trypanosoma congolense* infection in nagana areas, in which heartwater occurs. An incorrect diagnosis of nagana in an animal suffering from heartwater may terminate fatally when antimony medicaments are administered.

I have attempted to give you a very brief review on certain aspects of chemotherapy. From a practical point of view, chemotherapy resembles an injured centipede lame on many legs. The study of these defects has stimulated research workers not only to improve the chemotherapeutics, but also to study the life cycle of the malarial parasites more carefully, with the result that the histotropic forms were found. It is possible that the relapses of malaria following the infection of virus diseases can be attributed to the interaction of the virus with the histotropic parasites, or to the direct or indirect influence of the virus on the infected host cell.

Your attention has been drawn to the three functions of the reticulo-endothelial system. The provocation of parasites that develop in cells of this system by several chemotherapeutics, which are known to have a specific action on another developmental stage of the same parasite, or micro-organisms belonging to another class is discussed. The importance of making a correct diagnosis and of establishing whether the patient harbours a latent infection of a disease, when chemotherapeutics are to be administered, is stressed.

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AN INDICATION OF THE PRODUCTION AND POSSIBILITIES OF THE NORTH WEST CAPE FROM A VETERINARY POINT OF VIEW*

L. STONIER
Kimberley

The object of presenting this paper is to focus attention on a part of this country which has been looked upon for so long as of little importance.

The area under consideration is that part of the North West Cape falling directly under the control of the Government Veterinary Officer stationed at Kimberley, as figures for the rest of the area were too difficult to obtain. In any case what is stated here will, to a large extent, apply to the whole of the North West.

The Veterinary Area consists of the Magisterial districts of Kimberley, Herbert, Hay, Barkly West and Jacobsdal. Some remarks are added with regard to the Western Free State, formerly falling within the area, and adjacent districts.

The area is 16,366 square miles in extent, the rainfall varies from ½" to 16" per annum from West to East, i.e. from the Kalahari proper to the Western Free State.

The vegetation varies considerably within the area, from the typical grass and camelthorn of the Kalahari to the grassy sand veld of the Western Free State.

In between these extremes the vegetation and formation is very variable. You pass from the Kalahari over the Langberg range, which runs North and South, across a flat, chiefly sandy area with driedoorn the predominant vegetation, to the Gaapse Plateau, an extensive lime stone deposit stretching from the junction of the Vaal and Orange Rivers right up to Vryburg which is many miles in width. The vegetation on this plateau is chiefly vaal and rosyntjiebos, with areas of swarthaak and Karroo veld. There is a sharp fall from the plateau down to the valleys of the Vaal, Harts and Dry Harts rivers, the predominant vegetation here being swarthaak. From here one passes through varying vegetation of vaalbosch, swarthaak, etc. to the grassy sand veld of the Free State.

The veld is so variable that it often changes from farm to farm and totally different types of veld may be found on one and the same farm. The response this veld makes to even the slightest rain is amazing.

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STOCK

The area is passing through its fourth and worst year of drought, yet in spite of this the following stock were in the area early in 1947 :

228,854 cattle
964,578 sheep
196,528 goats.
50,411 equines

Total 1,440,371 head of stock.

During the year 1946 the Meat Control Officer in Kimberley issued permits for the introduction of the following livestock into Kimberley for slaughter purposes, i.e., 22,241 cattle ; 94,748 sheep and 7,276 pigs.

Much of this meat was sent to various parts of the country such as Durban, Port Elizabeth and Cape Town.

The various auctioneering firms within the area handled 14,417 head of catle and 189,360 sheep and goats.

PRODUCTS

Butter. — The average annual butter production for the two creameries in the area over the period of ten years up to 1946 was 1,894,691 lb. Production figures show a steady increase up to 1943-44 followed by a marked falling off in 1945 and 1946 due to drought conditions, the production in 1946 being 40% lower than in 1944. With the return of normal conditions production figures will again reach the previous high or even a higher level.

Besides the above, a large amount of cream is sent to places as far afield as Klerksdorp and Bloemfontein.

Cheese. — There are four Cheese factories within the area. One of these was only opened in 1945 and in that year received an average of 400 gallons of milk per day which had increased to 1,000 gallons per day by the end of 1946. This factory produced 38,000 lb. of cheese in 1945 and 115,000 lb. in 1946 an increase of 200% in twelve months. The production is still increasing in spite of the drought, as the farmers are going over to milk production in the area served by the factory. From 1943 to 1946 one factory actually sold an average of 27,477 gallons of surplus whole milk per year, the figures for the four years being : 75,733 ; 777 ; 806 and 32,593 respectively.

The average cheddar cheese production per year for the four factories for the period of from two to nine years depending on the length of time they have been in production was 299,127 lb. from 323,109 gallons of milk. One factory besides cheddar cheese, produced an average per year of 502,705 lb. of process cheese and 31,135 lb. of Mayonnaise over the five year jeriod up to 1946.

Two factories keep pigs and the yearly average of pigs sold by the two during the four and five year periods for which figures were obtainable was 704.

From the above figures it will be seen that the animal products of the area are considerable and when climatic conditions are normal, show definite increases from year to year. The large irrigation schemes under development and the power schemes to be undertaken will have a marked effect on the productivity of the North West.

During the last ten years there has been a remarkable improvement in the quality of breeding stock, owing to the gradual enlightenment of the resident farmers and the infiltration of progressive farmers from other parts. Instruction by Officers of our Department and the declaration of cattle improvement areas have contributed to this advance. The value of land has risen demanding better farming methods and better bred stock.

For the greater part the farming is mixed, but as the vegetation varies and methods of disease control improve so the type of farming practised alters to suit the different or new conditions. For example, owing to bonemeal feeding, combined latterly with the use of Lamsiekte vaccine in cattle, the Lamsiekte danger has been reduced to a minimum and cattle farming has increased enormously. In fact some farmers are now trying to farm with cattle on veld totally unsuited to this type of stock. In time no doubt they will realise their folly and farm in accordance with the demands of the veld and not with the species of animal they themselves prefer. Before the value of bonemeal was known, farmers were forced to farm with sheep even though the veld was unsuitable.

The small stock returns for the period June, 1930 to June, 1947, show a gradual increase up to 2,000,000 and over at June, 1938. This indicated the gradual settlement of the area and its maintenance at this figure until June, 1940 followed. From then on there was a steady drop until 1947 to 1,285,429. This is a clear indication that the area has passed over to farming more suited to the vegetation, and is a direct result of the overcoming of the great mortality caused by one condition alone, i.e. lamsiekte. The drought has not made an appreciable difference to the numbers of small stock, as losses in wet seasons from internal parasites, etc., are heavy. This year the small stock have been remarkably healthy and have maintained their condition.

With the growth of creameries and cheese factories the farmers are going over to the milk breeds, and are becoming interested in high production, with the result that the value of feeding is being brought home. Where, in the past, stock have had to subsist solely on the veld, owners of better class stock are now beginning to make provision for feeding, many producing green feed for themselves, especially those farming along the rivers.

The north-west, including the Boshof district, is the chief mule breeding area of the Union, and the Indian Purchasing Commission and U.N.N.R.A. together purchased thousands of equines from here. All

the outstanding mules, of which the Western Province farmers are so proud year after year at the Rosebank Shows, come from the north-west.

Since the war a number of stallions and mares, consisting of Thoroughbreds, Percherons and Clydesdales, have been imported from overseas by various farmers.

As is seen from the figures sheep are an important factor, especially in the Hay district. These are chiefly black-head Persians, but Karakul breeding is carried on on a large scale and the number of farmers using English mutton rams is surprising.

Falling within the area are three irrigation schemes.

The largest and most important is the famous Vaalharts Settlement stretching from Warrenton to Taungs, a distance of some 20 miles, and will consist eventually of some 1,150 plots of 20 to 30 morgen each, all irrigable. The number of plots so far occupied, and in various stages of development, is approximately 700, leaving approximately 450 still to be issued. The scheme is approximately 160,000 morgen in extent, of which about 130,000 morgen is communal grazing and 30,000 morgen irrigable.

Hundreds of mules, oxen and cows have been purchased for the settlers and hundreds more will be required. The purchasing is done by a board consisting of the Superintendent and a Government Veterinary Officer. Apart from the oxen, which in the beginning were used for ploughing, etc., and have now been replaced by mules, each settler is allowed a total of ten head of cattle, consisting of young and dry stock, which he is allowed to run on the communal grazing. The number of stock a settler is allowed to keep on his holding is not limited, but care is taken to see that the holding is not overstocked. The settlers keep cows on their holdings chiefly for the production of milk, cream and butter for their own use. Their is nothing to prevent them developing this side of their farming operations so as to produce milk for cheese factories or cream for the creameries. This no doubt will be a later development. Suitable bulls are supplied by the Department of Lands for use by the settlers.

The stock on the settlement at June, 1947, including that not yet issued to settlers but already purchased by the Department for the Probationary Lessees shortly to be placed, was 4,905 cattle ; 1,600 horses ; 3,401 mules ; two donkey Jacks ; 2,891 sheep and 68 goats. Besides these there are large flocks of poultry, only the best having been issued to settlers.

The stock population when the scheme is completely settled will be considerable, and when the settlers have been taught the value of better breeding the quality of stock must improve and the production increase.

In time the area must contain many well-bred animals and will be a large source of milk supply to the associated milk processing factories.

As an indication of the possibilities of the Vaalharts Settlement the amount of baled lucerne handled by the Settlers Cooperative Society alone amounted to 15,000 tons during the 1946-47 season. To this must be added the amount sold out of hand, that produced by private plot holders on the scheme and that used by all producers in feeding their own stock on the plots. A conservative estimate of 20% can safely be added to the above figure, making the total production some 18,000 tons.

Besides the lucerne, during the same season, about 80,000 bags of wheat were produced as well as ground nuts, potatoes and tobacco. It is almost certain, that in time to come, ground nuts will become one of the main crops of the scheme as they have given excellent yields. When considering the above figures one must bear in mind the fact that this is about half what the potential production will be when the whole settlement is in full production.

Associated with this scheme is the canal, under construction running from the west canal near Warrenton over many farms to the Barkly West Township, a distance of some 40 miles. Each farm is to receive water for the growing of feed, and this will have far reaching effects on stock and animal production on all farms supplied by the canal.

The second scheme is the Riet River Settlement, near Modder River station, consisting of approximately 80 holdings of 20 to 30 morgen in extent. Already 40 plots have been issued, these are of two types (a) plots of river soil 20 morgen, and (b) plots of sandy soil 30 morgen in extent. The total irrigable land will be approximately 1,600 morgen. This settlement is in its early stages and in time, when the canal has been enlarged and all the necessary water can be supplied, will also be a very important settlement. This settlement has already produced amazing quantities of the finest potatoes and has made a name for itself in the production of seed potatoes. The totals of stock to be issued to settlers and other details have still to be settled, but no doubt will be similar to the conditions at Vaalharts, depending upon available communal grazing and other factors.

East of this scheme extending right back to the Kalkfontein dam at Koffiefontein, a distance of some 50 miles, the farmers are supplied with water for irrigation. In time the whole area served by the canal must become one of great importance. Well bred dairy herds no doubt will be kept, and the area should become one of the most important in fat lamb and fat stock production.

The third and oldest settlement is that of Bucklands, associated with the Douglas erven. These people are being encouraged to keep better stock, especially cattle, and the presence of the Douglas Cheese Factory has been a very important factor in stimulating this desire for cows of high production. No doubt the lucerne, etc., produced on these holdings will be marketed through their stock, and will not be sold as such, on the various markets, as in the past.

Associated with the Vaal Harts Scheme is the experimental farm run by the Department of Agriculture. The results of the experimental work done here are available, not only to the settlers, but to all farmers, and are of especial value to those farmers along the rivers in the area, i.e., the Vaal, Riet and Modder rivers where extensive farming under irrigation is carried on.

An electrification scheme has been approved serving the Vaal, the Riet and portion of the Modder Rivers and this, when completed, will assist materially those farmers served by it in the production of feed and other products under irrigation. It will revolutionise farming practice along the rivers.

The Vierfontein Power Scheme on the Vaal River, which is to be proceeded with, using the poor quality coal deposits of the north-western Free State, for electric power production, will supply a large part of the north-west Cape with cheap electric power, and this will also have a very marked influence on farm production and management on the whole Vaal Harts Settlement and the associated area.

The production of hides and skins as well as Karakul pelts within the area is great, but no figures are obtainable as there are many channels through which they pass. To indicate the number it may be mentioned that the erection of a tannery in Kimberley has been mooted and is definitely indicated.

DISEASES

East Coast Fever, Heartwater, Swine Fever and Newcastle Disease have not as yet made their appearance, but the last two may do so at any time.

Dourine is controlled by testing. The stock inspectors in this area have a good knowledge of the disease and do most of the bleeding. Owners make application for the testing of their troops or odd animals as the case may be. An agreement is signed whereby, as the result of testing, a farm is cleaned and is then considered a dourine free farm for permit purposes, as long as the agreement is adhered to. The farmers are gradually learning the value of breeding from clean stock and most of the dealers are now insisting on the test before purchase, and this fact helps us considerably in dealing with the disease.

Internal parasites of sheep are a great economic factor, causing enormous animal losses.

To convince farmers of the value of the various remedies and methods of control, personal contact is essential but, under present conditions, impossible. Many farmers seem to be perfectly satisfied with their losses and only an intensive propaganda campaign can

convince the majority of the benefits of modern methods of prevention and treatment. The high mortality necessitates the keeping of excess stock which in turn causes veld impoverishment and erosion.

We veterinarians have a big and important part to play in this area. The farmers are looking to us more and more for help and guidance as farming becomes more intensive. We, together with agricultural experts in other lines, will have to guide and educate the farming community in disease control and veld management, if this highly productive area is not to be overtaken by disaster through bad farming methods.

AN UNUSUAL OUTBREAK OF ANTHRAX IN CATTLE WITH SPECIAL REFERENCE TO TREATMENT WITH PENICILLIN

C. C. WESSELS AND J. A. DE KOCK
Durban

On 15th January, 1947, the owner of a dairy herd at Umlaas Road, Natal, inoculated 114 head of cattle against Gallsickness, the vaccine used being blood infected with *Anaplasma centrale*. Ninety head of cattle in Durban, belonging to the same owner were also inoculated, the same instruments being used. At Umlaas Road the first animal died about 48 hours after the inoculation.

By the 18th, when the farm was first visited, 15 animals had died, all of which had been skinned and several eviscerated. The dead animals showed large swellings at the inoculation site, tumor splenis and fluid blood. *B. anthracis* was found in blood and organ smears. Many of the live animals also showed large swellings at the inoculation site and temperatures as high as 108° F. The herd at Durban was also visited the same day, where it was found that no animals had died but several were showing symptoms similar to those seen at Umlaas Road. Fluid from the swellings was forwarded for laboratory diagnosis and proved to contain a typical virulent strain of anthrax. The origin of the infection is obscure but it was undoubtedly introduced during vaccination. As a large number of doses of the same issue were used in many parts of the country without any complications, it is probable that the vaccine was contaminated locally. This disaster emphasises once more the extreme necessity for thorough sterilisation of all instruments when carrying out such inoculations.

TREATMENT

On the evening of the 18th, 20 animals in the Umlaas Road herd showing clinical symptoms were injected with 100,000 units of penicillin in saline, the dose being repeated after four hours. The injections were made above the swellings. Two of the treated animals died during the night, while several of the others which had appeared healthy the previous evening also died. The treatment was continued the next day by six hourly injections, all new cases also being treated. A further 25 deaths took place but owing to the chaos on the farm it is impossible to state how many of these received treatment.

Treatment was commenced in the Durban herd on the evening of the 19th, before any deaths had taken place. Penicillin in saline (100,000 units) was given locally and in addition 125,000 units in nut oil and beeswax were administered intramuscularly. These doses were

repeated every eight hours for 72 hours when the temperature was found to be normal and the swellings considerably reduced. No deaths occurred in this herd.

Discussion

Although full details are not available in connection with the Umlaas Road herd, it can definitely be stated that all the animals which showed clinical symptoms and were not treated, died of anthrax. On the other hand a large number which showed similar symptoms and received penicillin recovered.

In the Durban herd where the treatment was initiated before any deaths had occurred, all the animals were saved. It would therefore appear that the treatment with penicillin had a definite beneficial effect on the course of the disease.

Acknowledgements.

In conclusion we wish to express our appreciation for the services rendered and assistance given by Major L. Daly, Senior Veterinary Officer, Natal, Dr. Kaschula of the Allerton Laboratory, and Dr. Viljoen of Durban.

Summary.

An outbreak of anthrax in cattle following inoculation with anaplasmosis vaccine is described. Treatment with penicillin appeared to have a beneficial effect.

THE EFFECT OF SIMULTANEOUS INJECTIONS OF ANTHRAX AND BLACK QUARTER VACCINE ON A GROUP OF CATTLE

G. D. SUTTON
Onderstepoort

The question is frequently asked whether Anthrax and Black Quarter vaccines can be injected into cattle at the same time with safety. An opportunity to observe the results of doing this occurred recently at Onderstepoort.

A group of cattle used for the production of Gallsickness vaccine were injected with both vaccines. These cattle are kept under highly artificial conditions, being stabled at night and run in a small paddock during the day. They had all been inoculated previously with both vaccines about a year before the present injections were given. Anthrax avirulent, saponin, spore vaccine was injected subcutaneously on the left side of the neck and Black Quarter vaccine consisting of a formalinized culture containing alum given under the skin of the right side of the neck a few minutes later. No special precautions were taken with the injections. The syringe and needles were sterilized by boiling. Different syringes and needles were used for each vaccine. The injections were given without clipping the hair over the injection site or applying disinfectant. A separate needle was used for each animal.

Local and systemic effects were set up. The former consisted of slight swellings. Of the 47 animals injected, eight gave no local reaction, eleven reacted locally to both vaccines, 24 gave a reaction to the Anthrax vaccine but not to the Black Quarter Vaccine and four reacted locally to the Black Quarter Vaccine but not to the Anthrax one. The swellings produced by the vaccines appeared to be at their maximum 24 hours after the injection and then regressed. The Anthrax vaccine swelling at 24 hours was firm, hot, painful, usually convex, sometimes flat with a base varying in size from 5×8 cm. to 12×16 cm. and a height varying between 2 to 10 cm. At 36 hours the swelling was smaller, flatter, harder and very much less painful. At 84 hours it was still smaller and harder. Twelve days after the injection small hard lumps were still present at the infection sites, but had disappeared after 30 days. The Black Quarter Vaccine swellings were similar but tended to be flatter and regress faster. At 24 hours the size varied with a base of 3×4 cm. to 10×16 cm. and a height of 3 to 5 cm. Regression took place by the swellings becoming smaller and harder. After 12 days there was still a small hard lump at the injection site which had disappeared after 30 days.

No apparent influence on the size or type of the swelling produced

by either of the vaccines could be ascribed to the injection of the other vaccine. Animals giving a local reaction to one of the vaccines only or to both of them showed the same type of swellings.

The systemic reaction consisted of a sharp rise in temperature of 3 to 5 degrees reaching its peak 24-36 hours after the injection. All 47 animals reacted irrespective of whether there was a local reaction or not. The size of the local reaction or whether the animal gave a swelling to one or both of the vaccines did not appear to be correlated with the intensity of the temperature reaction in any way. The two reactions appeared to be independent of each other.

There was no other visible systematic action such as loss of appetite. As none of the animals were in production, the effect on milk yield could not be studied.

Six cattle kept under identical conditions in the same group were not inoculated as they were being used for vaccine production. They served as controls and did not show any of the reactions described above.

Summary.

The effects of simultaneous injections of Anthrax and Black Quarter vaccines on cattle have been described.

Acknowledgments.

My thanks are due to Dr. W. O. Neitz of Onderstepoort, for placing the cattle at my disposal and for his assistance.

A NOTE ON THE OCCURRENCE OF PUERPERAL HAEMOGLOBINAEMIA OF CATTLE IN SOUTH AFRICA

A. TARR
Pietermaritzburg

As far as can be ascertained Puerperal Haemoglobinaemia has not been recorded in South Africa. Bovine piroplasmosis is so widespread and so common in this country that the symptom of haemoglobinuria often leads to a diagnosis of piroplasmosis being made without confirmation by microscopic examination of blood smears.

Hutyra, Marek and Manninger (1938) describe Puerperal Haemoglobinaemia as occurring in the Scandinavian countries and in Austria and Scotland. Wester and Beyers (1923) record its occurrence in Holland under the name "Puerperal Anaemia" and do not consider haemoglobinuria to be a typical symptom. Beyers (1939), however, records his investigation of nine cases, all of which exhibited haemoglobinuria.

The object of this communication is to record the occurrence of Puerperal Haemoglobinaemia in several districts around Pietermaritzburg, Natal. These cases all occurred during the winter, i.e., July and August. The animals were from well kept herds, were in good condition and had all calved recently. The interval between calving and the onset of symptoms was from about 2 to 3½ weeks. The ages of the affected animals were from 2½ to 10 years. All the outbreaks were associated with the feeding of root crops such as turnips and mangel wurzels.

Symptoms.

The following symptoms have been noted : Haemoglobinuria, slight elevation of temperature (up to 104° F.) increase in pulse rate (up to 120) icterus, anorexia, weakness and decrease in milk yield.

Diagnosis.

Naturally the first condition to be excluded, where haemoglobinuria is a symptom, is piroplasmosis. In all cases blood smears were examined and found to be negative. Furthermore the cases all recovered without any specific treatment for piroplasmosis. Although negative for parasites the blood smears showed marked anaemic changes such as the presence of megeloblasts, normoblasts, jolly bodies, anisocytosis, polychromasia and punctate basophilia.

Haemoglobinuria may also be caused by the drinking of very cold water, calves being particularly susceptible in this respect. This

possibility was investigated but eliminated by the fact that only post parturient cows were affected although all the animals, including the calves, partook of the same water.

Treatment.

In mild cases a change of diet, entailing removal of the root crops from the diet, was sufficient to bring about recovery. Severe cases were treated with the intravenous injection of 1,000 cc. of 20% Glucose solution and the transfusion of two litres of blood. This was followed by camphorated oil intramuscularly and the dosing of strong black coffee.

References.

Beyers, J. A. (1939) : Puerperale Haemoglobinurie bij het rund. *Tijd Diregeneesk* 66 bl. 811-822.

Hutyra, Marek and Manninger (1938) : Spec. Path. and Therap. of the diseases of Domestic Animals, Vol. III, Bailliere, Tindall and Cox, London.

CASE REPORT

HYDRO-ALLANTOIS IN A COW

L. W. VAN DEN HEEVER
Pretoria

The subject was a multiparous Friesland cow, in a fair condition. On a previous occasion she had given birth to normal twins. At about eight months gestation the owner had noticed an abnormal increase in the size of the cow's abdomen ; this he thought to be due to the presence of twins or even triplets. Eventually, after two weeks, the cow's abdomen became so large that she fell and could not rise. The author was then consulted.

On examination, the cow's abdomen was found to be enormously distended bilaterally. She was groaning, and drank only small amounts of water and ate only a little food. The temperature was normal, and the pulse soft and slightly accelerated. A vaginal examination revealed a still intact cervical plug. Rectal palpation disclosed a large balloonlike mass which made any further examination impossible. A diagnosis of Hydramnios or Hydro-allantois was made.

As the cow was of considerable value, Caeserian section was decided on ; and she was placed on her left side. The right flank was shaved, washed with soap and warm water, scrubbed well, and lastly rubbed with alcohol for five minutes. Paravertebral anaesthesia, blocking the last thoracic and first three lumbar nerves, was employed. An almost perpendicular incision about sixteen inches long was made through the skin and muscles. Vessels were ligatured as the operation proceeded. The uterus bulged through the incision, and was punctured with a medium bore trocar and canula. Between 45 and 50 gallons of slightly turbid fluid were drained, the groaning of the cow becoming less as the intra-abdominal pressure decreased. The canula was withdrawn and the uterine incision extended to aproximately the size of the skin incision, care being taken to avoid the cotyledons. Exploration of the allantoic cavity disclosed the calf, still enclosed in the apparently normal amnion. The calf, which was dead, and the placenta, were then removed. At this stage shock was rather severe. Eight ounces glucose and 10 cc. coramine were given intravenously, with gratifying results.

A double row of Lembert sutures with No. 3-20 day chromic catgut was employed to close the uterine incision. The peritoneum and various muscle layers were closed with separate continuous sutures, and No. 6 silk was used for the matress skin sutures. A small opening was left at the bottom of the incision for drainage. Sulfanilamide was liberally used in the wound during suturing, and the wound was sealed with collodion and iodine.

As the uterus still contained a fair amount of debris and fluid, and as the cervix was still closed, 45 mgms. stilboestrol in oil was given intramuscularly, and one ounce fluidextract of ergot was prescribed twice daily for four days.

Comment.

The removal of the placenta presented the major difficulty during the operation. As parturition was still approximately two weeks distant, dehiscence had not yet commenced. Moreover the left uterine horn was entirely devoid of cotyledons, and the right horn also had large smooth areas. In the right horn many of the areas denuded of normal cotyledons had been covered by a great number of wartlike adventitious placentae. To make things even more difficult, there were extensive subplacental haemorrhages over these adventitious caruncles, and upon removal of the placenta a large amount of this almost black tarry blood was liberated.

When a case like this is encountered and an expensive operation such as caesarian is suggested to the owner as practically the only treatment, he will invariably ask whether the cow will ever be able to reproduce normally again. As it is almost impossible to ascertain beforehand what the cause of the condition is, one has to give an extremely guarded prognosis. Williams gives the following reasons for the development of dropsical conditions of the placental membranes and cavities : (a) Twins. (b) Inbreeding and hybridization. (c) Torsion of the umbilicus. (d) Foetal monstrosities. (e) Diseases of the foetal organs. (f) Destruction of the uterine caruncles after a previous calving, with the subsequent formation of adventitious caruncles and the development of subplacental haemorrhages and circulatory disturbances.

The last cause seems the most likely, and it is obvious that normal reproduction could never take place in the case in question. A post-mortem was held on a second case of Hydro-allantois some weeks later, and despite a careful search, no obvious cause could be found. Had the second case received successful treatment she might subsequently have bred normally.

Conclusions.

Caesarian section is probably the only rational treatment for Hydro-allantois or hydramnios. With able assistance it is not a difficult operation. One should be prepared for shock, as this is bound to occur during a long operation where there is a tremendous reduction of intra-abdominal pressure. Adequate measures should be taken to ensure that the uterine debris is expelled. A careful examination of the uterus gives a good indication of the chances of future reproduction.

References.

Williams, W. L. : Diseases of the Genital Organs of Animals.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

Minutes of Council Meeting held at Tilsim Hotel, Pretoria, at 2.15 p.m. on Thursday, November 20th, 1947.

Present: J. H. Mason (President), J. G. Boswell, A. C. Kirkpatrick, R. Alexander, A. D. Thomas, S. W. J. van Rensburg, R. Clark, C. F. B. Hofmeyr (*vice* A. M. Diesel), J. G. Williams (*vice* P. S. Snyman), W. D. Malherbe (Hon. Sec.-Treas.).

Apologies for Absence: A. M. Diesel, D. G. Steyn, P. S. Snyman.

1. *Minutes of Meeting on Sept. 16th*: As these had been circulated, they were taken as read, and confirmed.

2. *Matters arising therefrom*:

(a) *Amendment of Stick Diseases and Veterinary Acts*: Decided that the available proposals be handed to the sub-committee, previously appointed, to assemble suggestions and report back to Council.

(b) *Distemper Immunization*: As replies had not been received from all the branches, Dr. Alexander and the Secretary were to collate information and send a factual statement to branches.

(c) *Welfare Society*: The President reported on correspondence with members of the Cape branch. The matter was held over pending information on overseas legislation.

(d) *Importation of Veterinarians*: The Secretary reported having received a number of requests for information from overseas veterinarians and gave particulars of information supplied to them.

(e) *Reciprocity with R.C.V.S.*: As it was felt that some liaison was necessary between Council and the Faculty of Veterinary Science, it was decided that Faculty should be requested to appoint some of its members to form a liaison committee with Drs. Thomas and Van Rensburg (representing Council).

3. *Branches*:

(a) It was formally noted that the Witwatersrand branch was now financially independent of the parent body.

(b) It was noted with pleasure that a new branch had been established in South West Africa.

(c) Council considered that the designation "President" should be limited to the President of the S.A.V.M.A. and that branches should be informed accordingly.

4. *Representation on the Veterinary Board*: The Secretary reported that Dr. Diesel had been elected as the S.A.V.M.A. nominee on the Veterinary Board at the recent ballot. Decided that a letter of thanks be sent Mr. Amos for services rendered and one of congratulation to Dr. Diesel.

5. *Specialization*: Only two replies had been received on the Secre-

tary's requests for information from overseas countries. Matter held over pending further information, after which, incorporation in the Veterinary Act would have to be considered.

6. *Bona Fide Veterinary Students*: The Secretary reported on the circular to students and the similar one to members, which was being published in the *Journal*.

7. *Agricultural Unions*: Council expressed appreciation of the continued efforts of the S.A.A.U. and its branches in bringing to the notice of the Government the serious position of the State veterinary services and the reasons therefor.

8. *Penicillin*: The Secretary reported that the omission of veterinarians from those allowed to prescribe penicillin under Government Notice 1028 of 17/5/46 had been referred to the Veterinary Board for the necessary action.

9. *National War Memorial Health Foundation*:

(a) On request of the regional secretary of the Cape Eastern Region for a S.A.V.M.A. nominee on the Regional Council, Dr. C. H. Flight was nominated.

(b) Reciprocal Membership: The request of the Foundation for reciprocal membership was sympathetically received. As the S.A.V.M.A. Constitution allowed for Associate Members, who were not veterinarians, this request would be acceded to.

10. *Turf Club Appointments*: A letter of thanks from a member was read. Decided to investigate further what could be done.

11. *Membership Fees outside the Union*: A suggestion that membership fees should be reduced for members outside the Union was fully discussed. Decided that if it were to become necessary to increase the annual subscription, the suggestion would be strongly considered.

12. *Chicken Producers' Association*: Dr. Coles kindly came to explain the implications of a proposal received from the S.A. Poultry Association that private practitioners play an important role as check inspectors in this scheme. The proposal was sympathetically received by Council, and it was resolved that the branches would be approached for names of practitioners who would be interested.

13. A resolution by the Annual Meeting concerning the establishment of a committee for co-ordinating publicity about more efficient production methods in farming was fully discussed. Decided that this matter would be further considered at the next Council meeting.

14. *General*:

(a) Proxies at Council Meetings: An amndment to Section 8(f) of the S.A.V.M.A. Constitution should be discussed at the next General Meeting.

(b) The Secretary reported that as the insurance company concerned (S.A. Mutual) ahd intimated that the collectioin fees of 5% would not be applicable to policies taken out after October 1st, 1947,

the new scheme had been turned down. Conditions governing policies taken out before this date would remain the same. Council noted this with regret and approved the action taken.

(c) An appreciative letter from a member (Dr. Frean) concerning all arrangements at the recent General Meeting was read and noted.

(d) A suggestion that branches should send copies of the minutes of their meetings to the other branches was approved.

The meeting adjourned at 5.45 p.m.

W. D. MALHERBE,
Hon. Sec.-Treas. S.A.V.M.A.

J. H. MASON,
President, S.A.V.M.A.

OBITUARY

HEINRICH GEORG JOACHIM FRANZ

Through the sudden death of Heinie Franz on November 30th, 1947, after a short illness, the profession has suffered another grievous loss.

Franz was born on 4th September, 1904, in the Pietersburg district. He obtained his B.V.Sc. degree in 1927 and was on May 1st, 1928, appointed government veterinary officer, in which capacity he served for short periods at Pretoria, Allerton, Umtata, Rustenburg and Estcourt.

On January 5th, 1930, he was placed in charge of Southern Zululand with headquarters at Eshowe. For over 14 years he rendered most excellent service controlling stock diseases in this area.

In 1944 he was transferred to Greytown, where he continued his untiring and unselfish service to the public generally and the farming community in particular.

Colleagues will long remember his generous nature and that streak of eccentricity, an almost puckish humour, which so endeared him to his many friends.

His lively, inquisitive brain and a first-rate ability to use his hands at first seemed to indicate a future research worker, but his innate love for the country and the open air led him to join the Field Service.

He had a natural aversion to any form of publicity or personal aggrandisement. Loyalty was to him a primary instinct and this quality, together with his strong sense of duty, made him a conscientious, painstaking officer, for whose loss the Department and the country are the poorer.

To his wife and young family we extend our sincere sympathy in their grievous loss.

C. J. v. H.

OBITUARY — (Continued.)

DR. MAUD BALES

The veterinary profession in South Africa has lost one of its most promising and enthusiastic young members by the sudden and unexpected death of Maud Bales on the 16th December, 1947. It was only a year ago that she realised her life's ambition in graduating as a veterinary surgeon.

What pluck and determination this entailed, we can only guess at, as, though she had been in poor health from the latter part of her school days, she never complained and very few realised how seriously she was handicapped.However, by sheer willpower and grit she fought her way through and passed her final examinations with flying colours.

Miss Bales was born in Johannesburg, where she matriculated at the Parktown Girls' High School with a 1st class pass. After leaving school she wished to study Veterinary Science, but she met with many difficulties and turned to Medicine. She spent two years at the University of the Witwatersrand and then found an opening at Onderstepoort and started her studies where her heart really lay. She graduated in 1946 and embarked on her career which, though short-lived, was full of promise.

Her love of animals, particularly horses, her continued devotion to her duties, her courage in facing up to difficult situations despite her sex and lack of strength aroused the admiration of all who knew her.

To her bereaved mother, brother and sister we extend our deepest sympathy.

B.H.P.

PERSONAL

ENGLISH STUDENT, qualifying July, desires contact practitioners to widen experience. Keen worker. Write: Lovegrove, Royal Veterinary College, Streatley, Berks., England.

M.R.C.V.S., BRITISH: Single, experienced General Practice, wishes post South Africa. Particulars on request. Apply to: The Lodge, Nedderton Village, Bedlinton, Northumberland, England.

BRITISH VETERINARIAN with small family, qualified 1940, desires town and country practice or partnership, or suitable appointment. House essential. Minimum £750 per annum. Air mail reply to: Williams-Jones, 117, High Street, Lewes, Sussex, England.

WANTED: One copy of Volue 15 No. 1 of the *S.A.V.M.A. Journal* in order to complete the series. As this number is out of print will anyone willing to supply it please communicate with: Dr. L. W. Rossiter, P.O. Box 94, Barberton.

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