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CYSTICERCOSIS OF EAST AFRICAN GAME ANIMALS

R. SACHS*

SUMMARY

This account gives details of the incidence of various types of cysticerci found in game animals of the Serengeti area in northern Tanzania, and the inter-relationship between larval tapeworm stages in wild herbivores and adult tapeworm species in wild predators is discussed. It is stressed that, in the context of meat hygiene in relation to game cropping schemes, reference to "cysticercosis" must clearly differentiate between muscular cysticercosis on the one hand and serosal cysticercosis (including other cysticercosis forms) on the other hand. This is important from the scientific, economic and public health point of view.

INTRODUCTION

During a research project dealing with the commercial exploitation of East African wildlife as an additional source of animal protein for man and the meat hygiene aspect of game utilization, a high percentage of the wild herbivore population of the Serengeti area in northern Tanzania was found to be infested with cysticerci or "measles", the larval stages of tapeworms of the family Taeniidae. As the muscle-cysticerci of game animals resemble *Cysticercus bovis* and *Cysticercus cellulosae* in shape and size, and could not be differentiated macroscopically from the larval forms of these two tapeworms pathogenic to man, a thorough investigation of the problem was considered necessary before carcases of game animals shot during cropping operations could be offered as food for human consumption.

The preliminary work was carried out at the Kirawira Veterinary Field Station in the Serengeti/Mara region, Tanzania, from 1964-1967, and was jointly sponsored by the Tanzania Game Division, the Tanzania National Parks and West German Technical Aid. The more detailed studies of the morphological differentiation of cysticerci of wild herbivores and tapeworms of wild carnivores respectively were continued at the Public Health Section of the Faculty of Veterinary Science, University College *Nairobi in 1968/69, in close co-operation with* Dr. J. A. Dinnik, Head of the Division of Helminth Diseases of the East African Veterinary Research Organization.

The investigations were conducted to establish the incidence of cysticercosis and degree of infestation in various game species, to identify the cysticerci, especially those occuring in the musculature, and to differentiate these from the cysticerci known to be pathogenic to man, to study cysticerci of herbivores and adult tapeworms of wild carnivores as well as the morphological differentiation of the various cysticerci of the various entelope species, to study the lifecycle and population dynamics of cestode species of scavenging carnivores, and the inter-relationship of cysticercosis in both wild and domestic animals.

The work has not yet been concluded. Some of the results obtained during the past years might, however, be of interest to veterinarians and game biologists, especially as the question of management and utilization of wildlife is often discussed in eastern and southern Africa and the role of game animals in the transmission of parasites to man and domestic stock is frequently raised.

RESULTS

In Serengeti, game animals were found to be affected with three forms of cysticercosis, namely:

(1) muscular cysticercosis,

(2) serosal cysticercosis, and

(3) intrasacral cysticercosis.

Muscular cysticercosis

Infestation with "measles" was extre-

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mely high. Wildebeest, hartebeest and Grant's gazelle showed an infestation rate of more than 80 per cent, topi and impala 71 per cent and 45 per cent respectively, whereas eland, waterbuck and buffalo were less often infested[1]. *Cysticercus bovis* did not occur in game animals, all muscle-cysticerci of the Serengeit antelopes so far examined being the larval stages of at least two tapeworm species of wild predators[2]. The high parasitic infestation is not surprising, as it is clear that in National Parks and Game Reserves densely populated with both herbivorous and carnivorous animals, parasites using these definitive or intermediate hosts find optimum conditions for completion of their life-cycles.

Comparison of the rostellar hooklets of some muscle-cysticerci with those of adult tapeworms parasitizing the Serengeti lion revealed that the larval form of *Taenia gonyamai* was involved. A second cysticercus species found in the flesh of wild herbivores was the larval stage of a tapeworm occurring in the spotted hyaena. This latter parasite was identified as *Taenia hyaenae sensu* Baylis[3], but further studies revealed that it more likely to be *Taenia crocutae* according to Verster's[4] taxonomic revision of the genus *Taenia*.

There seems to be a distinct inter-relationship between the parasites of wild herbivora and wild carnivora: our few attempts to infect domestic dogs and cats with muscle cysticerci of antelopes failed. We also failed to produce cysticercosis in cattle, sheep and goats by feeding them with ripe segments of tapeworms recovered from lion and hyaena. However, during a survey of cysticercosis of domestic cattle from Masailand in southern Kenya, where wild predators abound, a cysticercus with a double row of rostellar hooklets and resembling *Cysticercus gonyamai,* the larval stage of *Taenia gonyamai* of the lion was found in the muscular tissue of an ox, thus showing that infestation of cattle with this type of tapeworm species may occasionally occur[6].

As to the distribution of muscle cysticerci in the game carcase, the flesh of 32 Serengeti antelopes was cut into thin slices and examined for the presence of cysticerci[6]. It was found that the sites most frequently infested were the hind legs (100 per cent), the shoulders (75 per cent), the loin and the thoracic muscles (both 72 per cent), followed by the neck (65 per cent), the masticatory muscles (40 per cent), the heart (40 per cent), the thin abdominal muscles (22 per cent) and the diaphragm (12 per cent).

A matter of special biological interest was the low incidence of muscle-cysticerci (4.6 per cent) in the Thomson's gazelle in contrast to the high infestation rate (83.3 per cent) of the Grant's gazelle[1]. Both species are closely related, they run in the same herds and use the same food thus being equally exposed to infestation. This fact indicates that Thomson's gazelle may possess a certain degree of resistance towards infestation with muscle-cysticerci. On the other hand both Thomson's and Grant's gazelles were equally infected (44 per cent) with serosal cysticercosis.

Serosal cysticercosis

As regards serosal cysticercosis, where cysticerci develop in the subserosa of the viscera in both the abdominal and pleural cavities, it was previously believed that the cysts frequently found (40-60 per cent) on the mesenteric fat, intestines, heart-sac and pleura of game animals were the same as those seen in the abdominal cavities of sheep and goats. The term "serosal cysticercosis" is prefereable to "visceral cysticercosis" in order to clearly differentiate, for instance, between the (muscle-) cysticerci found in the heart and the (serosal-) cysticerci attached to the heart-sac, as both pertain to "viscera".) The serosal cysticerci recovered from a variety of wild Serengeti herbivores were examined and compared with *Cysticercus tenuicollis* from sheep and goats. Due to marked differences in number, form and size of the rostellar hooklets it is considered that they were not C. *tenuicollis* but rather the larval stages of one or more tapeworm species of wild canids or felids living in the area[7]. This assumption is supported by the fact that we have not yet been able to demonstrate *Taenia hydatigena* in any of the wild carnivores of the Serengeti area examined so far, and the presence of the larval stage of a parasite is clearly dependent on the presence of its adult form. The number and size of the rostellar hooks of a large number of serosal cysticerci collected from the viscera of wildebeest, topi and hartebeest suggest that these were the larval forms of *Taenia regis* of the lion,

wheras it has not yet been possible to identify those serosal cysticerci occurring in smaller antelope and warthog.

Intrasacral cysticercosis

A third type of cysticercosis (according to site of development of the tapeworm larvae in the intermediate host's body) was revealed by the finding of cysticerci in the epidural space of the sacrum bones in antelopes of the sub-family Alcelaphinae, with an infestation rate of 60-90 per cent. We considered biological-ecological factors when investigating its probable life-cyle. As the hyaena with its massive jaws and teeth is the most likely animal to crack and devour the bones of its prey — including the sacrum the tapeworms occuring in the intestines of this scavenger were studied intensively. During these investigations a new tapeworm, *Taenia olngojinei* — the adult form of the intrasacral cysticerci — was found in the bone-eating spotted hyaena[8], thus demonstrating the close relationship between host, intermediate host, and parasite.

Other forms of cysticercosis according to localization of the cysticerci

a) Cerebral cysticercosis

Although this form of cysticercosis was not observed in game animals in the Serengeti, the incidental finding of 4 cysticerci with rostellar hooklets in the brain of a bovine[9] should be mentioned here; most certainly the tape worm of a wild carnivore was responsible for the condition. It is, however, not yet possible to express any opinion on the cysticercus species involved.

b) Cysticerci in lymph nodes and internal organs

The exact grouping of the cysticerci found occasionally in lymph nodes, lung or liver tissue of antelopes is not definite according to tissue preference. They certainly belong to one of the two main groups, the muscle-cysticerci or the serosal cysticerci, even though they have been arrested in other tissues during their distribution via the blood stream, as is most probably the case with cysticerci recovered from the brain. We found the larval stage of *Taenia gonyamai,* which develops mainly in the musculature of its intermediate host, in lung tissue and lymph nodes. Pellegrini[10] reported that *Cysticercus dromedarii* — as he named the larval stage of *Taenia hyaenae* — was found to occur in musculature of various herbivores, but primarily invaded the mesenteric lymph nodes of bovines.

DISCUSSION

Muscular cysticercosis is of special importance in the context of meat hygiene, and infested meat may be judged unfit for human consumption during veterinary meat inspection. The other main condition, namely serosal cysticercosis, does not affect valuable edible parts of the animal carcass and is of far less significance, as is also the occurence of the various other cysticerci in sacrum, lymph nodes, or internal organs.

For judgment of the actual meat production potential of game populations and in order to avoid misunderstandings when using the term "cysticercosis", it is essential to clearly differentiate between the cysticerci as to their localization in the body, i.e. tissue-prefernce. The general statement, that "cysticercosis" was observed in game animals should be avoided, and it should be clearly mentioned what type or types of cysticercosis were found in the species examined. Knowing more about the interrelationship of parasites, hosts and intermediate hosts is of utmost importance when attempts are made to solve meat hygiene problems in future game cropping operations. It is for this reason that it is so extremely important to throw more light on to the life-cycles of tapeworms of wild predators.

The fact that the larval stages of human taenias have not yet been found in wild herbivores in the Serengeti region is no proof that "measly" game meat is not dangerous, as there are some reports on the occurence of *Cysticercus bovis* in African game animals[11,12,13], and *Cysticercus cellulosae* is known to occur in the European wild boar[14]. There is, therefore, the possibility that wild life at one time or another may become infected with cysticerci pathogenic to man, especially where contact between man and game animals becomes closer. Further investigations into cysticercosis of wild herbivores are consequently necessary and important from scientific as well as the public health points of view.

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BOOK REVIEW

SMALL ANIMAL DERMATOLOGY

GEORGE H. MULLER AND ROBERT W. KIRK

W.B. Saunders Company, Philadelphia, London, Toronto. 1969.

pp xvi — 487, Figs 379 (184 in colour). Price $28.

This beautifully printed and superbly illustrated book is the first to be devoted entirely to this subject. Dr. Muller is an ex-small animal practitioner serving since 1958 on the staff of the Dermatology Department, Stanford Univeristy Medical School, while Dr. Kirk, of *Current Veterinary Therapy* fame, and Professor of Small Animal Medicine at Cornell University, spent a sabbatical leave with Dr. Muller at Stanford to produce this book. In the foreword special mention is made of the expansion of existing knowledge of veterinary dermatology occasioned by the close contact between these veterinarians and those working in the same field. "There is but one medi ne."

The earlier sections are devoted to skin anatomy and physiology, the morphology and distribution patterns of skin lesions and the laboratory procedures required to supplement clinical findings. Chapter six, on the valuable diagnostic assistance to be gained from recognition of the distribution patterns of skin diseases, deserves special mention as a valuable aid to more accurate diagnosis. In the next section the diversity of aetiological factors concerned in skin disease are well presented. In particular, it was pleasing to note the plea for the elimination of the old labels "eczema" and "eczematous dermatitis" for pruritic dermatoses and their substitution with more specific terms for the type of allergy involved.

Thirty-seven canine and feline dermatoses are clearly described and extensively illustrated with outstanding photographs and diagrams. This is undoubtedly the most interesting portion of the book for student and clinician, contai[illegible] all essential details regarding lesions, di[illegible]ential diagnosis and clinical management of each condition. Skin tumours are fully discussed and illustrated in a further comprehensive section and the book is imaginatively completed by two fascinating chapters on comparative dermatology and the history of veterinary dermatology. A useful glossary and index are included. After years of attempting to teach this subject to undergraduates your reviewer is delighted to report that here — at last — is a most comprehensive, thoroughly scientific and magnificently presented account of the facts regarding those often puzzling conditions which comprise some 20% of small animal practice. R.K.L.

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USE OF COEFFICIENTS TO CALCULATE THE DILUTION RATE OF BOVINE SEMEN

N. A. VINHA* AND R. I. COUPLOUGH**

SUMMARY

This paper discusses the calculation of coefficients which greatly simplify semen-dilution rate determinations.

INTRODUCTION

With the extensive use of A.I., much has been done to simplify and improve the techniques used. For many years a simple formula, based on the total number of live spermatozoa and the density of the ejaculate, was used to calculate the dilution rate. Dilution rates calculated on this basis ensured that an adequate number of live spermatozoa were obtained on thawing a frozen sample. Using this formula, coefficients have been worked out for several degrees of dilution, thereby greatly simplifying the calculation of the dilution rate.

Dunn and Hafs[1] found that losses of between 40-50% of live spermatozoa could be expected during the process of dilution, freezing and thawing of semen. Salisbury and Van Demark[2] consider a loss of no more than 20% to be quite satisfactory after the freezing of semen.

By and large, most authors concur on the number of live spermatozoa required to be inseminated to ensure optimum fertility. Salisbury and Bratton[3], Salisbury and Van Demark[2] and Maule[4] consider that the minimum number of spermatozoa consistent with optimum fertility lies between 5-10 million per insemination. Bratton, Kellgren and Patrick[5], working on the number of spermatozoa required in relation to semen quality and fertility, found that each ml had 6 million or more motile spermatozoa. Bratton, Foot and Henderson[6], Dunn and Hafs[1] and van Rensburg[7] hold that the optimum number of motile spermatozoa per ml necessary for fertilisation, is approximately 10 million. Willet[8], Willet and Larson[9] and Olds, Seath, Carpenter and Lucas[10], working with various dilution rates, found that 12 million spermatozoa per insemination gave the best results. Inseminations with fewer spermatozoa resulted in a decrease in the non-return rates in relation to the different spermatozoan concentrations inseminated. Milovanov and Sokolovskaja[11], on the other hand, suggested that a total of 300 million spermatozoa per insemination was needed for fertilization.

MATERIALS AND METHODS

In this country the regulations require that each dose of semen inseminated should contain at least 20 million live spermatozoa. Considering the percentage loss during the whole freezing process, therefore, the initial dilution rate is calculated to ensure 50 million live spermatozoa per ml. The density of bovine semen used in the evaluation of the semen samples is based on the following scale[12]:

Density	No. of spermatozoa/ml.
Thick creamy	1600 million
Creamy	1300 million
Thin creamy	1000 million
Thick milky	700 million
Milky	400 million
Thin milky	200 million

The calculation of the coefficients based on these factors is as follows: e.g.

(1) *Semen with density classified as "thick creamy" and with 75% of live spermatozoa:*

$100\% \text{ — } 16\times10^8$

$75\% \text{ — Total live sperm } (x)$

$\therefore\ x = \frac{75\times16\times10^8}{100}$

Now dilution rate (DR) $= \frac{x}{5\times10^7}$

* Escola de Veterinária Universidade Federal Rural Do Rio de Janeiro, Brazil.
** Department Genesiology, Faculty Veterinary Science, Univ. Pretoria, P.O. Onderstepoort.

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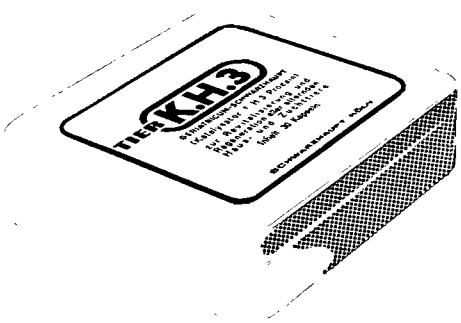

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Thus DR $= \frac{75 \times 16 \times 10^8}{100} \times \frac{1}{5 \times 10^7}$

$\therefore$ DR $= \frac{75 \times 16}{50} = 75 \times 0.32$

(2) *"Creamy" — 80% alive:*
DR $= 80 \times \frac{13}{50}$ $\therefore$ DR $= 80 \times 0.26$

(3) *"Thin creamy" — 60% alive:*
DR $= 60 \times \frac{10}{50}$ $\therefore$ DR $= 60 \times 0.20$

(4) *"Thick milky" — 70% alive:*
DR $= 70 \times \frac{7}{50}$ $\therefore$ DR $= 70 \times 0.14$

(5) *"Milky" — 75% alive:*
DR $= 75 \times \frac{4}{50}$ $\therefore$ DR $= 75 \times 0.08$

(6) *"Thin milky" — 60% alive:*
DR $= 60 \times \frac{2}{50}$ $\therefore$ DR $= 60 \times 0.04$

The above examples were calculated using 75, 80, 60, 70, 75 and 60 percentage live spermatozoa respectively, but the coefficients calculated apply in the same way, irrespective of the percentage live spermatozoa.

CONCLUSIONS

The coefficients are obtained using the following formula: $\frac{\text{No. of spermatozoa/ml}}{n \times 100}$ where "n" is the basic number of spermatozoa required to ensure that, with a loss of 40-50% spermatozoa during the freezing process, the number of live spermatozoa specified for A.I. by a specific country, will be obtained on thawing. Calculations made for all densities, using values of 50 and 20 million live spermatozoa for "n", gave the following values:—

Density	No. of spermatozoa/ml	Coefficients	
		50 million sperm/ml	20 million sperm/ml
Thick creamy	1600 million	.32	.80
Creamy	1300 million	.26	.65
Thin creamy	1000 million	.20	.50
Thick milky	700 million	.14	.35
Milky	400 million	.08	.20
Thin milky	200 million	.04	.10

Thus by multiplying the percentage live spermatozoa in a given semen sample by the specific coefficient, the dilution rate may be easily and rapidly calculated.

ACKNOWLEDGEMENT

The authors are grateful to Dr. R. Souza Varges for her advice and help.

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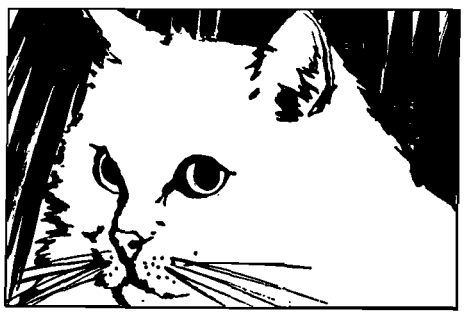

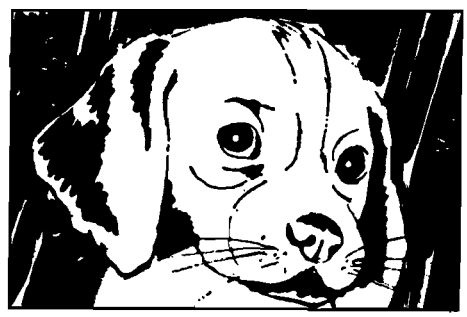

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THE USE OF DOMESTIC PIGS IN MEDICAL RESEARCH IN SOUTH AFRICA 1. Liver and Anaesthetic Research

J. TERBLANCHE*, R. HICKMAN*, D. M. DENT*, H. SPILG*, G. G. HARRISON*, S. J. SAUNDERS*

SUMMARY

The pig is a valuable experimental animal in medical research, and its advantages over the usual surgical laboratory standby, the dog, have not been sufficiently appreciated.

Results of a study of the pig as an experimental model for liver homotransplantation are presented. The problem of gastric ulceration in pigs with liver transplants is discussed, and a solution to the problem is presented. Reference is made to the increasing volume of veterinary literature on the problem of gastric ulceration in pigs. Malignant hyperpyrexia, which is a recently recognised hazard of anaesthesia in man, has been demonstrated to occur in twenty-five per cent of a group of Landrace pigs in the Western Cape. The use of the pig liver in an isolated perfusion circuit to study liver physiology, and to attain storage for liver transplantation is presented. The pig's liver in a similar circuit has also been used to treat patients with fulminating liver failure.

INTRODUCTION

For many centuries the pig has been the servant of man. To most people, however, the pig's only value appears to be as a source of meat. It is interesting to recall that the pig has also served in other ways. Bustad has reminded us that for thousands of years it has been a mainstay of civilisation. Apart from providing food it has been used in the past as a beast of burden, to tread seed into the soil in ancient Egypt, to seek out lost burials by the Polynesians, and to grub for truffles and retrieve game. He recounts the story of Slut, the famous English sow who was used to find, point and retrieve game at the beginning of the last century[1].

Until recent years, the pig has been neglected as an experimental animal by the medical profession. This is unfortunate as it resembles man in many ways. In fact, a major problem in medical research is the difficulty experienced in extrapolating the observations in the experimental laboratory to man, because the animals used so often differ in many respects from humans. Hickman et al.[2] have indicated that the biochemical and haematological values in the pig are similar to those in man. In addition, like man, the pig is omnivorous, has a tendency to over-eat and become obese, can adapt and live in slovenly surroundings, and has a tendency to develop peptic ulcers! Furthermore, the pig is readily obtainable from local farm breeding lines in almost unlimited quantities, is cheap to maintain, and for experimental surgery has the added advantage that blood for transfusion is readily obtainable from the abbatoir.

Because of its many advantages we have used the pig in our research laboratory, accepting that it might still be difficult to extrapolate the results to man. At the beginning of 1968 we set out to study liver transplantation in the pig and various research projects have grown out of this study.

LIVER TRANSPLANTATION

Our initial aim was to prepare a team for human liver transplantation. However, we were also interested in one fascinating aspect of liver transplantation in pigs, namely, that the pig, unlike other animals with liver homotransplants from unrelated donors, usually demonstrates minimal evidence of rejection of the transplanted liver, even when no immunosuppressive drugs are administered to prevent rejection[3,4,5,6]. The technique of orthotopic (total replacement) liver homotransplantation evolved in our

* The Liver Research Group and the Departments of Surgery, Anaesthetics and Medicine, University of Cape Town.

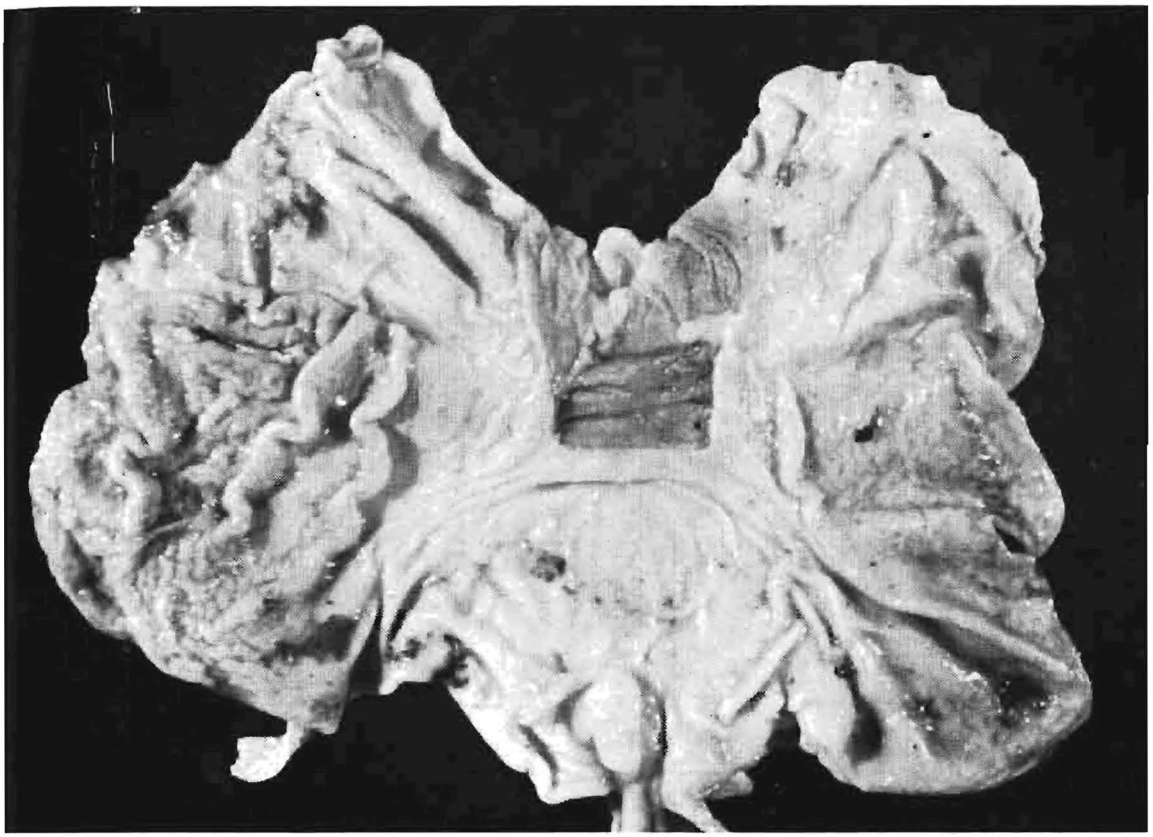

FIG. 1. — A large gastric ulcer occurring in the pars oesophagea of the pig stomach.

by the bad biliary anastomosis (viz. gall bladder to duodenum).

An attempt was thus made to try and eliminate gastric ulceration after our transplant experiments. Analysis of pre- and post-transplant acid output from pig's stomachs demonstrated a significant increase in acid output after liver transplantation. Ulceration and haemorrhage have subsequently been prevented by performing a gastro-enterostomy as well as the bile duct to bile duct biliary drainage during these operations.

This study, although designed to reduce the serious complication of gastric ulceration in our liver transplanted pigs, may well throw light on the incidence of naturally occurring gastric ulcers in pigs. Although gastric ulcers do not appear to be an economic problem in South Africa as yet, there is evidence from other countries that it is becoming of increasing importance and it is possible that pig breeds in South Africa may have to face this in the future.

MALIGNANT HYPERPYREXIA

An interesting sideline has arisen from the liver transplant programme. A quarter of the Landrace pigs subjected to halothane anaesthesia developed a syndrome of malignant hyperpyrexia. This does not develop when a barbiturate anaesthetic is administered to these pigs. Although halothane has been the commonest agent that induces this condition (as it is the anaesthetic agent most used in our laboratory) chloroform and suxamethonium have also been shown to produce the syndrome, in some of the Landrace pigs. Of 85 Landrace pigs tested with halothane 21 developed hyperpyrexia, while only 2 of 59 Landrace/Large White cross pigs and none of the 16 pure Large White pigs tested, developed this syndrome[16].

This condition is interesting as the

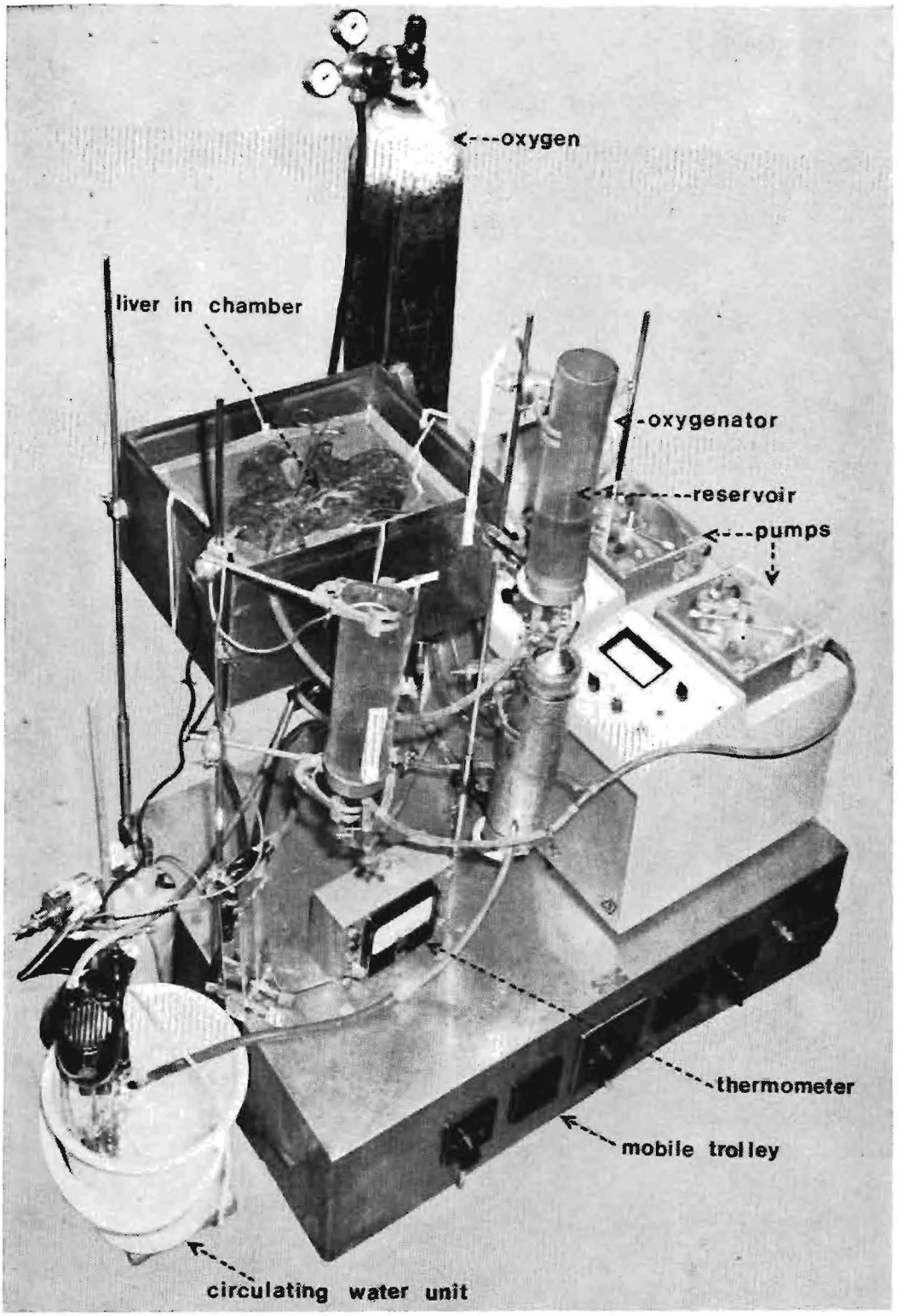

FIG. 2. — The circuit for isolated perfusion of the pig liver.

anaesthetic agent appears to trigger the metabolic chaos that ensues. Once commenced, the process accelerates until the death of the animal, unless the anaesthetic is discontinued immediately upon recognition. The condition is characterised by a progressive rise in body temperature to between 42° and 45° centigrade, generalised muscle hypertonia with the legs becoming stiff and extended, tachypnoea, poor peripheral circulation and tachycardia with blotchy cyanosed skin. Astrup determinations demonstrated progressive metabolic acidosis with pH's often as low as 6.5 despite attempts at correction with THAM or sodium bicarbonate[16, 17, 18].

The importance of the recognition of this syndrome in pigs is that experimental models to study the condition have not been readily available in the past. One other group has recognised the syndrome in the pig[19]. On the other hand, malignant hyperpyrexia is being reported increasingly in the medical and anaesthetic literature as a rare but very real and lethal problem in human anaesthetics [20,21,22]. In humans too, there appears to be a genetic factor which makes a particular person liable to this syndrome when exposed to certain anaesthetic agents. The tragedy is that in man, as in the pig, it is almost invariably fatal. Detailed studies are underway in the laboratory in an attempt to elucidate the nature of the condition [23].

ISOLATED PIG LIVER PERFUSION

The pig liver more closely resembles that of man than does the liver of the favourite surgical laboratory animal, the dog. When one attempts to study liver physiology by using the dog's liver in an isolated perfusion circuit, many problems arise. The dog's liver withstands handling poorly and reacts by constriction of the hepatic vein sphincters which leads to outflow block, liver congestion and failure of the experiment[24]. Fortunately outflow block is uncommon in the pig liver, and we have established an experimental model using the isolated pig liver attached to a heart-lung machine in an extensive study of over 50 pig livers [25]. (Fig. 2.)

The value of studying liver physiology in the isolated perfusion circuit is that this complicated organ is isolated from its various interactions with the rest of the body. This enables one to determine the role of the liver itself under a given set or circumstances.

The isolated liver perfusion circuit is also being used as a method of storing livers prior to liver transplantation. This storage has to be performed outside the body so that when a suitable human liver donor becomes available and the patient dies, the liver can be rapidly removed and subsequently stored to preserve viability. This is necessary to enable one to perform tissue typing to determine which of a panel of potential human liver recipients is the most suitable for the particular donor liver that has become available. It is also necessary to keep the liver alive while the recipient is having his own liver removed. At the present time we are establishing a method of storing livers for between 3 and 6 hours at normal temperatures and also commencing a study whereby the perfusion circuit is cooled in a hope that this will improve the viability of the stored liver and possibly enable us to store them for longer periods.

A further very valuable use for the isolated perfused pig liver is as a hepatic assist. The pig liver can be temporarily attached to patients with severe liver failure to clear their blood and to act as a liver support while their own livers are recovering. To date we have performed two such hepatic assists in patients with liver failure.

CONCLUSIONS

It is hoped that the work reported in this study will be of benefit not only to medical, but also to veterinary science. Certain of the problems that have arisen during our study of the pig as an experimental model for liver transplantation, such as gastric ulceration and malignant hyperpyrexia, might well be problems that veterinarians have already encountered, or will meet in the future of their practice.

ACKNOWLEDGEMENT

It is a pleasure to acknowledge the support and interest of Professor J. H. Louw, Head of the Department of Surgery, University of Cape Town.

Financial support was gratefully received from the Council for Scientific and Industrial Research of South Africa, the Cape Provincial Administration, the Round Table Medical Research Fund and the Barn

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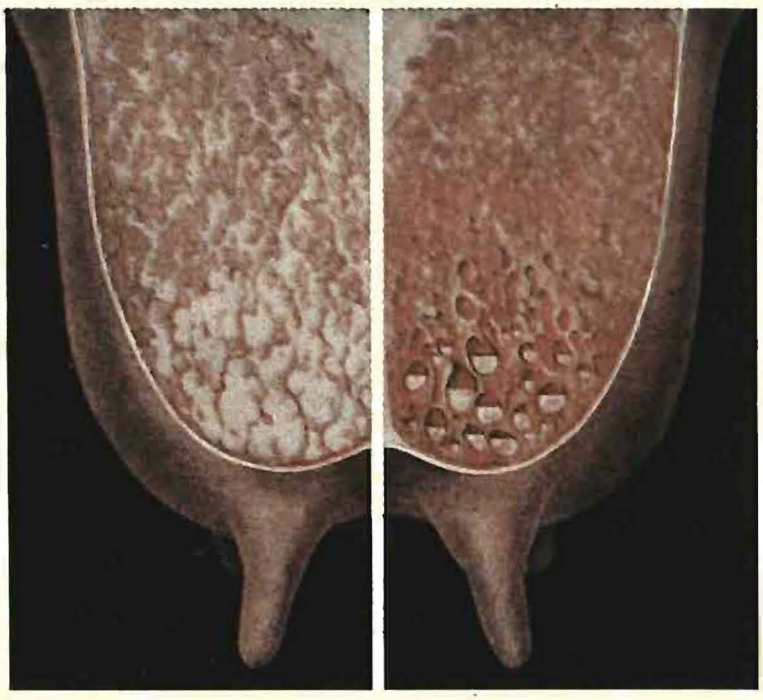

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Theatre Fund Raising Committee, and the C. L. Herman Bequest to the University of Cape Town.

This work would not have been possible without assistance from members of the Western Province Pig Development Association and the Municipal Abbatoir, Cape Town.

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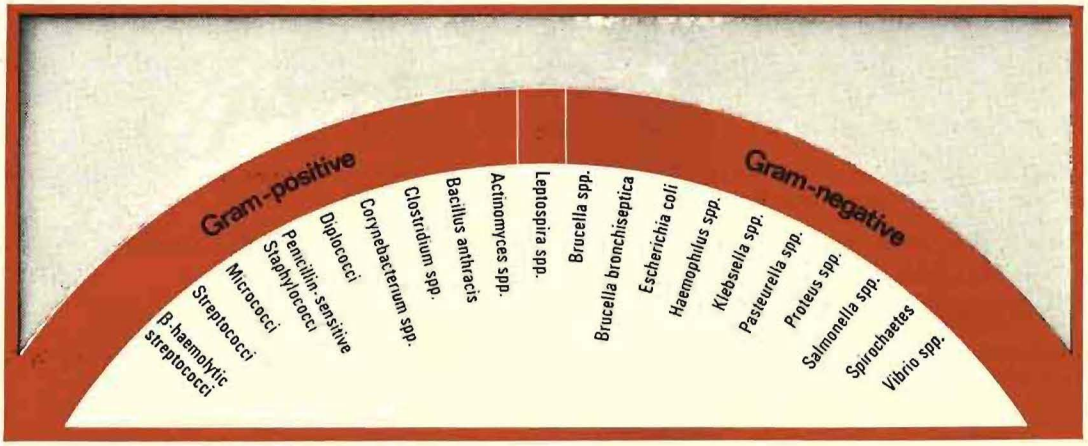

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THE USE OF DOMESTIC PIGS IN MEDICAL RESEARCH IN SOUTH AFRICA 2. Physiological Data

R. HICKMAN*, S. J. SAUNDERS*, J. TERBLANCHE

SUMMARY

This paper describes the biochemical values obtained in 50 anaesthetised pigs during the course of experimental surgery. These results are compared with a series provided by the Faculty of Veterinary Science, Onderstepoort, and with a series of normal human values. A comparison of relative organ weights is also provided.

INTRODUCTION

A survey of literature concerning pig physiology revealed a certain amount of data published from countries other than South Africa[1], but little from research centres in this country. Hence it was thought advisable to confirm these findings in South African pigs, and in the course of experimental surgery, the accompanying results were collected.

RESULTS

The animals were bred in the Durbanville/Somerset West area of the Western Cape and were of pure Landrace or crossed Landrace/Large White stock. Their ages ranged between two and four months, and their weights were from twenty to forty kilograms. They were housed in cement enclosures with roofs of corrugated asbestos insulated with glass fibre. They were fed ad lib. on Creep meal (Vereeniging Consolidated Mills).

Pre-operatively, the animals were starved for twenty-four hours with free access to glucose water. Anaesthesia was induced by one of two methods. One utilised Halothane, nitrous oxide and oxygen administered through a nose cone, and the other, intravenous injection of Sodium Pentothal (5%). In both cases, the animals were then intubated by direct endoscopy, and anaesthesia was maintained using a closed Magill-type circuit. The selection of the induction regime depended upon the suspicion that the animal might develop malignant hyperpyrexia as described in the previous paper[2].

The first operative procedure was the insertion of a catheter into the jugular vein. Hence samples for the present data were taken before dilution occurred with the administration of inter-operative fluid. The organs to be weighed were taken from animals donating livers for transplantation or perfusion. A standard arbitrary period of fifteen minutes was allowed before removal of the organs from the dead animal to ensure drainage of blood out of the organs. In the transplantation experiments, livers removed from recipients were allowed to drain for fifteen minutes before weighing.

The chemical methods used for biochemical analysis have been described elsewhere[3].

The results are presented in Tables I and II, in comparison with pig and human normals from standard texts.

The difference in organ weights between this series and that used for comparison is almost certainly due to the different body weights of the animals concerned — those used in the comparative study weighed up to 100 kg — almost double those investigated in the present series.

The establishment of a series of baseline values proved invaluable in the assessment of abnormal values obtained during the recovery phase of animals receiving organ transplants, and of organ weights at autopsy. In the course of liver perfusion, an alteration in the weight of the liver provides

* Departments of Surgery and Medicine and the Liver Research Group, University of Cape Town.

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Table I: A COMPARISON OF BIOCHEMICAL AND HAEMATOLOGICAL RESULTS OBTAINED IN THE PRESENT SERIES AND RESULTS FROM STANDARD TEXTS

Biochemistry: No.:	Pigs—This series 50 animals* †	Pigs—Loveday[4] 4 animals 36 estimations*	Human varying numbers
Total Protein g%	5.4 (3.9 — 7.4)	5.3 (4.7 — 7.0)	7.9 — 10.3
Albumen g%	2.1 (0.8 — 3.9)	1.4 (0.9 — 1.9)	2.1 — 4.6
Globulin g%	3.4 (1.4 — 5.1)	4.3 (1.8 — 5.9)	3.9 — 5.6
Alkaline Phosphatase (Shinowara-Jones-Reinhart units)	5.4 (1.2 — 12.1)	—	2.0 — 4.5 Bodansky units
Aspartate Transaminase	42.3 (15 — 140) Karmen units	54.6 (32 — 92) King units	10 — 40 Karmen units
Cholesterol mg%	89.4 (64 — 144)	—	150 — 280
		Pigs—Spector[5] varying numbers	
Sodium mEq/l	136 (115 — 145)	140 — 160	136 — 145
Potassium mEq/l	3.5 (2.6 — 5.8)	4.9 — 7.1	3.5 — 5.0
Chloride mEq/l	109 (78 — 110)	100 — 106	100 — 105
Haematology: No.:	Pigs—This series 46 animals*	Pigs—Blecher[6] varying numbers*	Human varying numbers
Haematocrit %	31.3 (20 — 50)	33.7 (28 — 42)	42 — 47
Platelets × 1000mm^3	360 (144 — 530)	407 (220 — 665)	200 — 500
Leucocytes × 1000mm^3	17 (6 — 30)	19 (11 — 33)	9 (4 — 11)

*Values are presented as a mean with the range in parentheses.

†These results are included with permission from the Editor, S.A. Medical Journal.

useful confirmation of dehydration or oedema resulting from modifications in technique.

The comparison of these figures with those routinely accepted for normal human and porcine physiology is similar in these respects.

It is hoped that the above presentation may prove of value to other workers in these and other fields of research with the pig.

Table II: A COMPARISON OF ORGAN WEIGHTS OBTAINED IN THE PRESENT SERIES AND RESULTS FROM STANDARD TEXTS. THE WEIGHTS ARE EXPRESSED AS GRAMS PER 100g BODY WEIGHT.

Organ No.:	Pigs— This series 50 animals	Pigs— Spector[5] varying numbers	Human 20kg varying numbers	Human 40kg varying numbers
Liver	3.64	1.51	2.96	2.47
Heart	0.50	0.32	0.49	0.46
R. Lung	0.55		1.31	1.15
L. Lung	0.46			
Kidney	0.30	0.26	0.54	0.46
Spleen	0.43	0.13	0.28	0.21

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BOOK REVIEW

KRANKHEITEN DES RINDES

G. ROSENBERGER

in collaboration with G. Dirksen, H.D. Gründer and M. Stöber: Verlag Paul Parey, Berlin and Hamburg. 1970. Pp. xviii + 1390 Figs. 747 + 28 in colour DM 350.

The author and his collaborators were all, at the time of preparing this monumental work, members of the Bovine Clinic, Veterinary School of Hannover, Germany. It is generally known that this School employs the species approach in teaching and research in contrast to the Faculty of Veterinary Science, University of Pretoria where the discipline approach is favoured.

It follows that between the covers of this book the whole field of bovine disease is dealt with except obstetrics, gynaecology and andrology.

There is ample evidence of the tremendous labour that went into its preparation e.g. the large number of clear illustrations, the great variety of pathological conditions described, including some which are rare, and the extensive bibliography.

The medical and surgical conditions of all the organs and systems (with the exceptions mentioned) occupy nearly 700 pages. Many excellent articles on the surgical diseases of the bovine digestive system have emanated from this clinic. This information is collected in the book and form a valuable section, as does that on orthopaedic surgery. These two sections are not singled out because other parts of the book are not valued highly — on the contrary — but because the practicing veterinarian often encounters the conditions described.

The part covering infectious diseases (mycotic, bacterial and viral) covers about 200 pages and, as can be expected, is mainly concerned with diseases occuring in Europe, some well known South African diseases being omitted. Anaplasmosis and eperythrozoonosis are included under the general heading of Rickettsiosis.

The next group of diseases is headed "parasitic diseases" and here babesiosis, theileriosis etc. are included and followed by a description of helminth infestations. The listed conditions are again, as with the infectious diseases, those of importance to Europe.

Metabolic and deficiency diseases are presently receiving a great deal of attention in this country. The nearly 150 pages in the book on these diseases will command great interest.

The penultimate section is headed "toxicology". After disposing with inorganic poisoning, organic poisons come under review. These include poisoning by therapeutic substances as well as by agricultural pesticides, the latter particularly forming an increasing threat to the life of domestic animals. Some of the plant poisons listed are of interest in this country. This section is concluded by a short reference to animal poisons.

The last 30 pages of this weighty tome are given to a therapeutic index.

Taken as a whole this book makes available a tremendous amount of well documented information lucidly represented. As reference work it is highly recommended.

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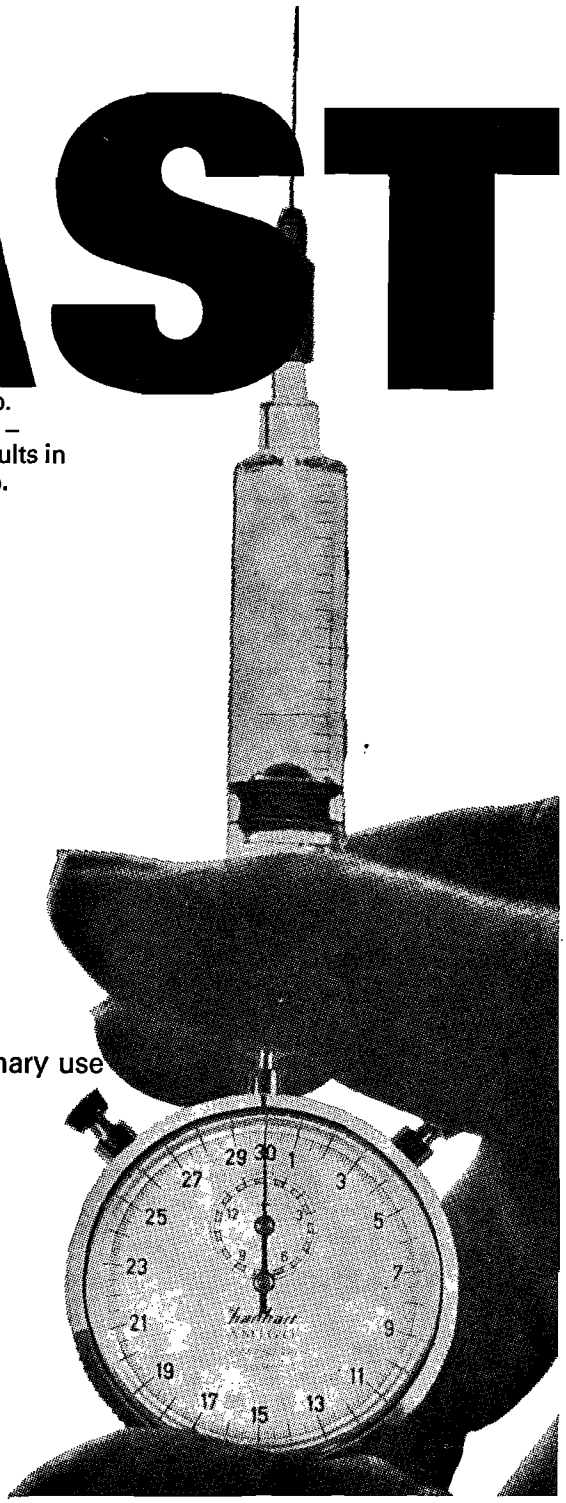

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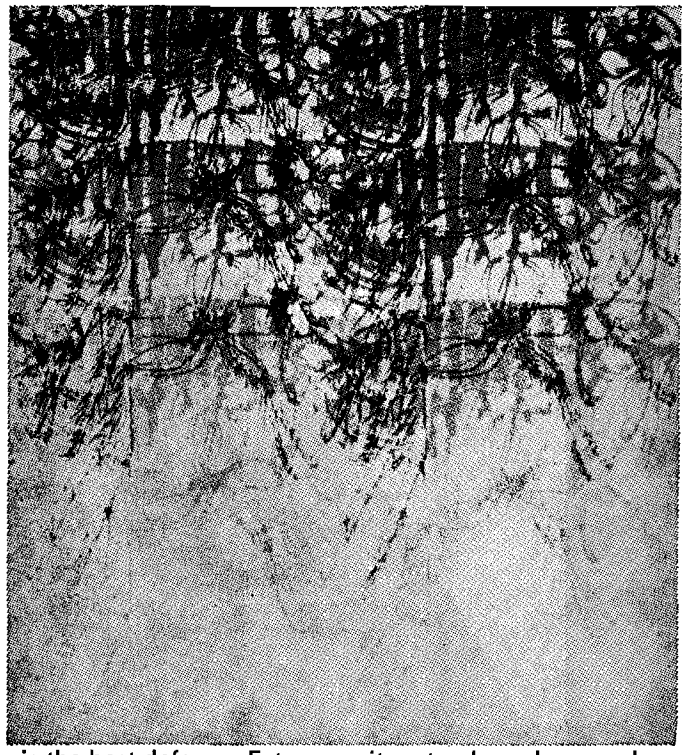

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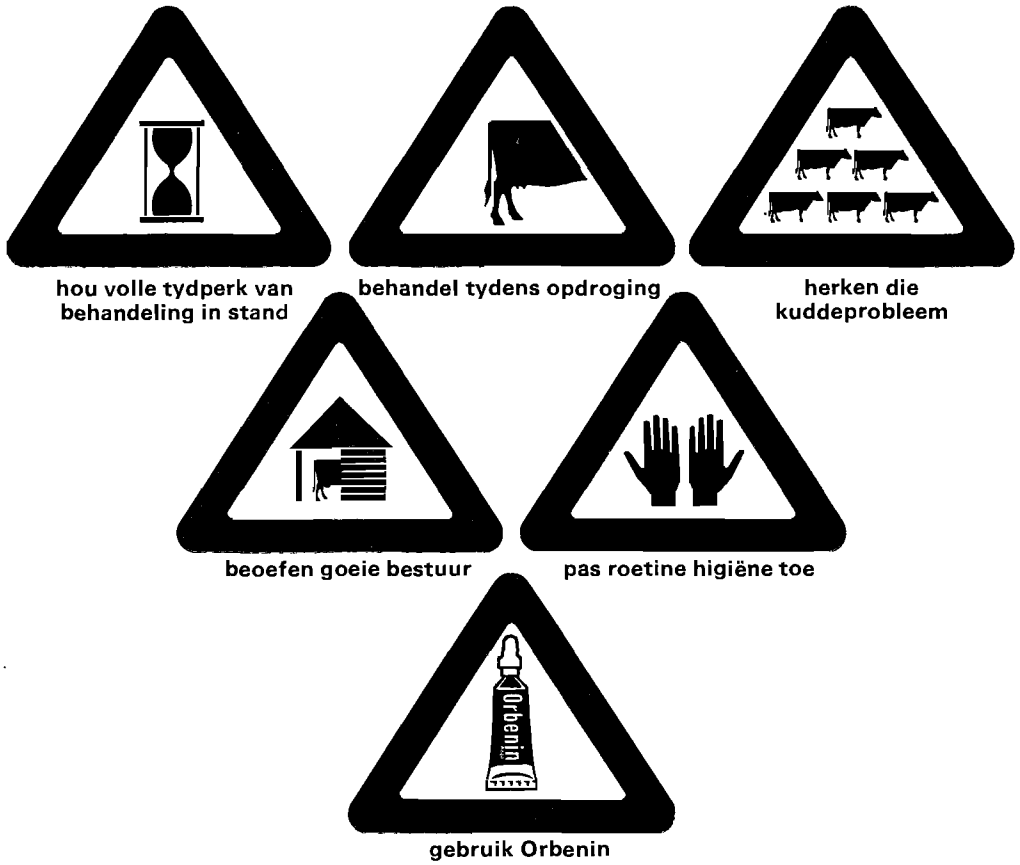

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Jl S. Afr. vet. med. Ass. 41 (2): 113-115 1970

CASE REPORT

A CASE OF MALIGNANT LYMPHOMA IN A 41 DAY-OLD AFRICANDER - SOUTH DEVON CROSSBRED CALF

HISTORY

The calf was presented for examination alive and showing marked swellings on either side of the head below the ears. Further examination revealed gross enlargement of all the superficial lymph nodes. The parotid, mandibular, prescapular, subiliac and popliteal were easily palpable, not adherent to the skin and freely movable. No other external abnormalities were obvious.

POST-MORTEM EXAMINATION

The most striking findings observed after sacrificing the calf included the following changes: There was marked generalised lymphadenopathy (See Fig.). The hepatic lymph node measured approximately 11 × 6 × 6 cm, while the liver showed the presence of focal whitish areas, disseminated over the parietal surface and extending a few millimetres into the liver substance. The thymus was markedly enlarged. Focal whitish streaks were seen to be disseminated in the kidney cortices. The renal lymph nodes measured approximately 6 × 3½ × 3½ cm, while the internal iliac and ischiadic nodes were somewhat larger. Marked enlargement of the pulmonary, mesenteric, spinal, prescapular, subiliac, parotid and mandibular lymp nodes was evident. The latter two were as big as the hepatic node mentioned earlier.

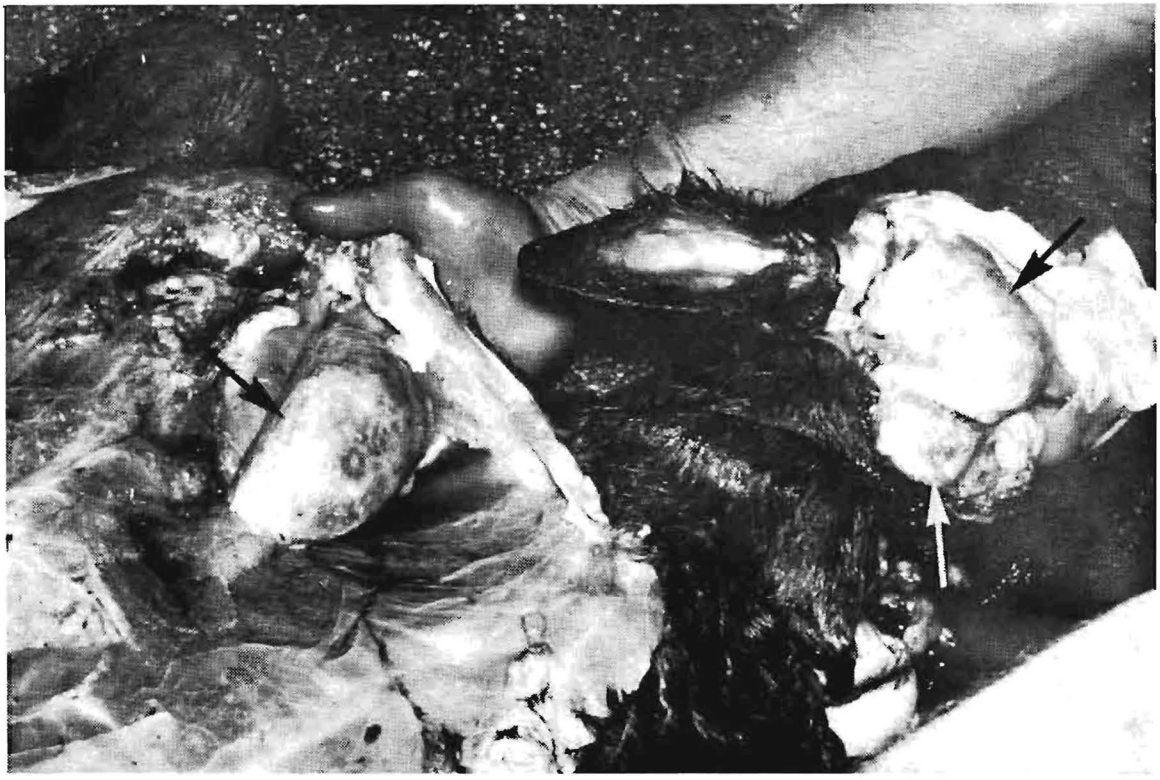

FIG. Enlargement of prescapular, parotid and mandibular lymph nodes (arrowed).

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Splenomegaly was observed but no other lesions were evident. The intestinal lymphoid patches and bone marrow appeared normal.

MICROSCOPIC EXAMINATION OF SPECIMENS —performed by Major E. E. McConnell:

Sections of the affected organs all showed the presence of a diffuse infiltration of immature lymphocytes. The invading cells were all very uniform in their morphology, being immature and probably "blast" forms. Mitotic figures were numerous in all areas examined.

FURTHER INVESTIGATIONS

The diagnosis of malignant lymphoma of the lymphoblastic type was established by the autopsy mentioned above. The parents and one half-sister of the calf were then examined for signs of the disease. Blood specimens for white cell counts were taken on two occasions at short intervals from the sire and half-sister. The dam could unfortunately only be bled once. The total leucocyte and differential counts found are shown in the table:

	Total count $\times 10^3/mm^3$	Monocytes %	Lymphocytes %	Neutrophiles %	Eosinophiles %	Basophiles %
DAM	9.9	4	52	39	5	0
SIRE	8.6	2	45	42	11	0
	6.3	0	46	47	7	0
HALF-SISTER	11.7	1	83	15	1	0
	10.6	1	72	23	3	1

The half-sister thus showed on two occasions a lymphocyte differential count markedly higher than normal, and higher than those of the other two animals. She has been singled out for further special scrutiny. The herd involved has also been placed under close surveillance in case the condition should prove to be infectious.

D. G. CATTON,

Department of Reproductive Physiology,
VETERINARY RESEARCH INSTITUTE,
ONDERSTEPOORT.

BOOK REVIEW

MANUAL OF LABORATORY ANIMAL PRACTICE AND TECHNIQUES.

INSTITUTE OF ANIMAL TECHNICIANS

Edit.: D. J. SHORT AND D. P. WOODNOTT

Publ. Crosby Lockwood & Sons Ltd., London, 1969, pp. 462; 55s (± R5.50)

This book represents the combined effort of over twenty authors who have revised and brought up to date, twenty-seven separate chapters. These deal with relevant British law, housing, equipment, methods of handling, identification, sterilisation and disinfection, transport, common diseases and pests, humane killing, various other techniques, genetics, reproduction, physiology, nutrition and specific pathogen-free animals. Attention is given to a wide range of species, small and large as well as hot and cold-blooded.

The overall standard is very high and the numerous practical comments by authors are considered to be of particular value, as these are not always to be found in text books. The book is well printed and contains numerous excellent illustrations.

Several publications in the field of laboratory animals have appeared, and this one is classed with the best. It provides valuable advice, data and insight into the use and management of laboratory animals. Although obviously primarily intended for the laboratory animal technician, on whose shelf it deserves a place, it will undoubtedly also prove to be of great interest and value to the professional man dealing with this increasingly important matter. P.A.B.

Jl S. Afr. vet. med. Ass. 41 (2): 117-130 1970

ALBIZIA POISONING: REPORT OF THE FIRST OUTBREAK AND SOME EXPERIMENTAL WORK IN SOUTH AFRICA

P. A. BASSON*, T. F. ADELAAR**, T. W. NAUDE*** AND J. A. MINNE**

SUMMARY

The first outbreak of *Albizia* poisoning in the Republic of South Africa is recorded. Eight cattle in a herd of 160 died and about 50 showed symptoms. Feeding experiments on sheep, using the dry pods of *A. tanganyicensis* Bak. f. confirmed the toxicity of this plant. Symptoms very similar to those of chlorinated hydrocarbon poisoning occurred within 3 hours after dosing. Hyperthermia, hypersensitivity, tetanic convulsions and dyspnoea were prominent clinical features. At autopsy, petechial haemorrhages were found subepicardially, in the subcutis, diaphragm and in some of the skeletal muscles. The lungs were severely congested and often prominently oedematous. Moderate, but significant degenerative changes were present in the myocardium, some of the skeletal muscles, liver and kidneys. All these lesions were confirmed histopathologically. The brain was only congested except in 3 cases where areas of microcavitation and chromatolysis were also encountered. Multiple eosinophilic, intracytoplasmic globules occurred in some of the neurones of 3 sheep. The toxic principle evidently effects the central nervous system and the degenerative lesions in the various organs and tissues are probably caused by the marked hyperthermia.

INTRODUCTION

Both ripe and unripe pods of *Albizia versicolor* Welw., a tall deciduous tree of approximately 40 feet in height, proved to have caused severe mortalities in cattle in both Zambia (1961, 1967)[1,2] and the Republic of Rhodesia (1966)[3]. These mortalities occurred during spring and coincided with widespread gales which blew off many of the unusually large pods. Hypersensitivity, laboured breathing, a staggering gait and convulsions were the most characteristic symptoms. Death, which seemed to be due to cardiac failure, occurred about 3 to 14 hours after ingestion of the pods. The most significant lesions were generalised congestion, petechial haemorrhages on the heart, lungs, trachea and subcutis and pulmonary oedema.

The toxic principle, which is still unknown, is present in both pods and seeds, but seems to be more concentrated in unripe pods. It is neither prussic acid nor an alkaloid and is insoluble in water[3]. Watt and Breyer-Brandwijk (1962) mentioned its possible use as an arrow poison in East Africa[4].

The pods of *Albizia tanganyicensis* Bak. f., commonly known as the "red paper bark tree", were also found to be poisonous and caused identical symptoms and lesions[5].

HISTORY AND CASE REPORT

During early September 1969, eight cattle from a herd of 160 suddenly died on a farm in the Thabazimbi area. Convulsions and symptoms very similar to those of chlorinated hydrocarbon (DDT, Dieldrin, BHC, etc.) poisoning were described by the owner. Approximately 30 per cent of the animals revealed various degrees of hyperaesthesia and convulsions. The main lesions of one case, an Afrikander heifer, which was presented for autopsy, were general congestion and cyanosis, prominent hydropericardium, severe oedema of the lungs; petechial haemorrhages in the trachea, bronchi, epicardium and some of the skeletal muscles and suspected myocardial degeneration. Many pieces and remnants of large pods resembling those of *Albizia* sp. were recovered from the ruminal contents. Various specimens such as fat, liver, stomach contents, kidneys and muscle were tested and

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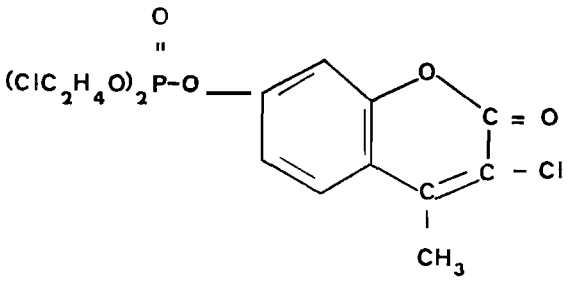
*** Section of Toxicology, Veterinary Research Institute, P.O. Onderstepoort.

HALOXON



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J. 4790

found negative for the presence of chlorinated hydrocarbons, arsenic, lead and prussic acid.

A subsequent examination of all the other carcases revealed the presence of identical pods in the ruminal contents of every animal. It also became evident that only animals from one mountainous camp had been affected and that strong winds prevailed at the time of the outbreak. Furthermore, all the remaining affected cattle recovered and the mortalities ceased soon after the animals were moved to another camp. Trees with pods similar to those recovered from the ruminal contents were found in the original camp only. They were identified as *A. tanganyicensis* (Fig. 1, 2 & 3).

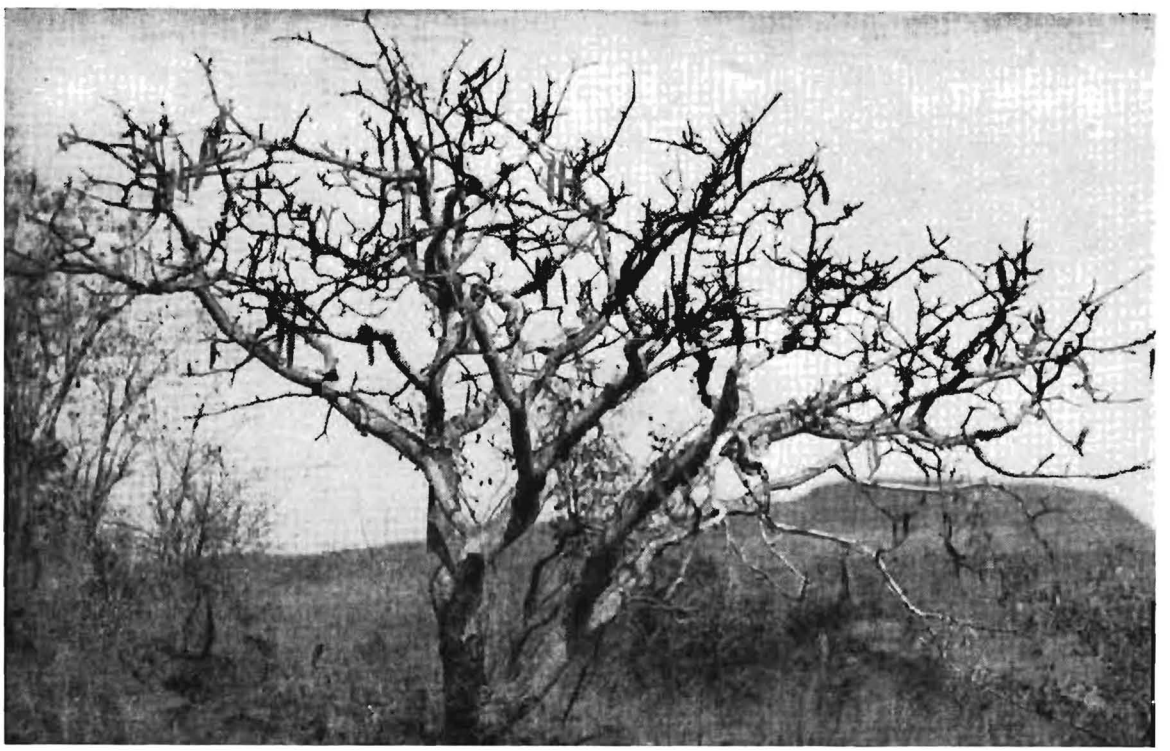

FIG. 1 **A. tanganyicensis.** Photography: I. B. Pole-Evans

Codd (1958)[6] gave the following description of *A. tanganyicensis:* Tree 3 to 8 m tall, sparingly branched; branches ascending; bark smooth, white to light brown, peeling in broad, papery strips; twigs sparingly pubescent, usually becoming glabrous or nearly so. Leaves 25 to 40 cm long and 20 to 30 cm broad, sparingly pubescent, especially when young; petiole 5 to 10 cm long; pinnae 2 to 5 pairs; leaflets 5 to 12 pairs, oblong, broadly elliptical to ovate-oblong, 2 to 4 cm long and 1 to 2.2 cm broad, oblique at the base, apex rounded to obtuse. Inflorescence of 20 to 25 flowers; peduncle 3 to 4 cm long; peduncle and buds rusty hispid; bracts and bracteoles small, linear, early deciduous. Flowers creamy white, subsessile. Calyx 4.5 to 5.5 mm long, 5-lobed, fulvous; lobes ovate-deltoid, 1.5 to 2 mm long. Corolla 7 to 9 mm long, 5-lobed; tube usually pubescent, 4 to 5 mm long; lobes ovate to ovate-lanceolate, 3 to 3.5 mm long, fulvo-tomentose, especially towards the apex. Stamens 2.5 to 3 cm long, united at the base for about 4 mm. Ovary glabrous, 3 mm long, shortly stipitate; style filiform, exceeding the stamens in length. Pod several seeded, flat, semi-woody, smooth, linear to linear-oblong,

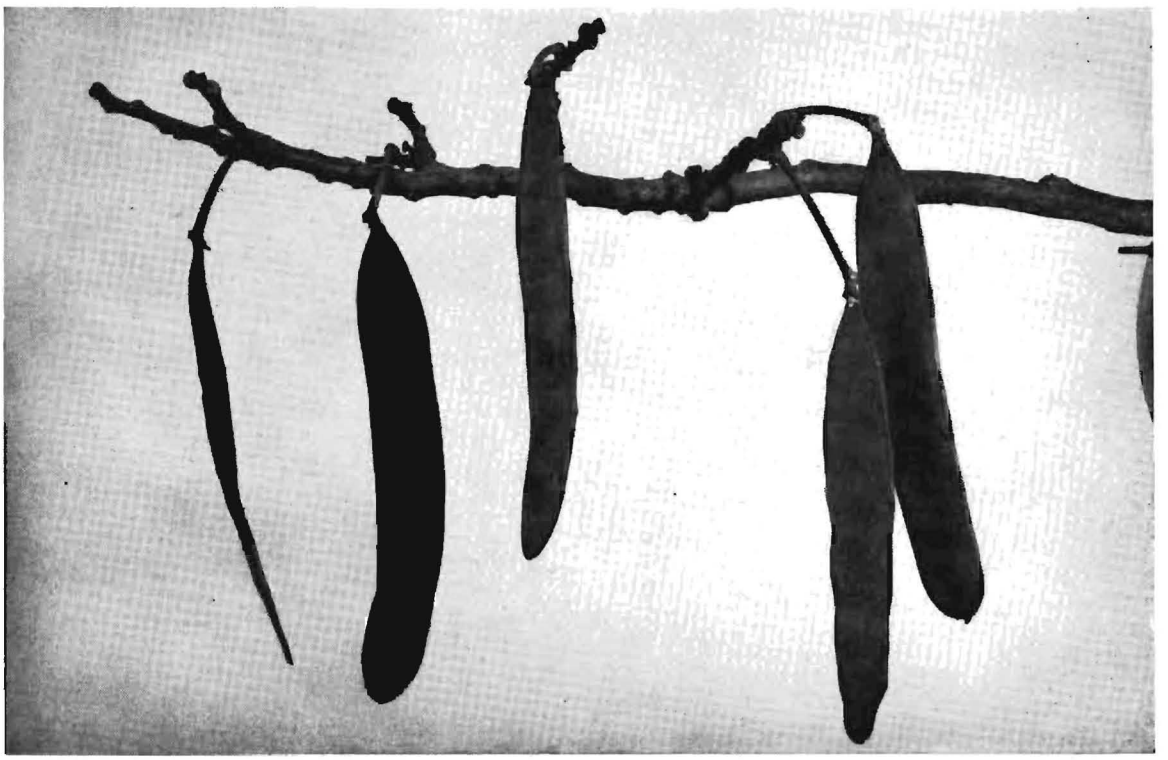

FIG. 2. **Pods of A. tanganyicensis.** Photography: J. Reyburn

15 to 25 cm long and 3 to 5 cm broad, light brown; margin scarcely thickened; position of seeds usually not visible through valves. The most striking feature of this small deciduous tree with its scare canopy, is the bark which is thin and light brown, peeling off in papery flakes, leaving a white smooth surface. It inhabits rock formations with an acid reaction such as granite and quartzite. The tree has been recorded from Tanganyika (Tanzania), Malawi, Rhodesia, Mocambique, Botswana and Transvaal (South Africa), where it has been found in the following areas: Soutpansberg: Kruger National Park (Punda Milia); Potgietersrus near the Magalakwin River; Waterberg: Vaalwater, Rooiberg, Leopard's Kloof, Hartebeeslaagte, Spruytskloof, Rietspruit and near Nylstroom and Warmbaths (Fig. 4).

The histopathological changes of the one case presented for examination were myocardial and muscular degeneration and haemorrhages, congestion and oedema of the lungs, congestion of the brain and the presence in the neurones of deeply eosinophilic intracytoplasmic globules and granules, mild degeneration and congestion of the kidneys and mild hepatic degeneration.

Some of the ripe pods were collected for the following experimental work.

MATERIALS AND METHODS

The dry, ripe pods of *A. tanganyicensis* were coarsely ground and fed as follows to four sheep.

Sheep 1 (S1): Six-tooth wether of 50 kg dosed per rumen fistula with 2.5 g/kg. This dosage was increased to 10 g/kg the following day.

Sheep 2 (S2): Six-tooth wether of 38.5 kg dosed with 5 g/kg.

Sheep 3 (S3): Two-tooth wether of 19 kg dosed with 5 g/kg.

Sheep 4 (S4): Because of a shortage, pod material recovered from the ruminal contents of S1 was stored in a refrigerator and used after 26 days to dose a four-tooth ewe of 40 kg. The dosage was therefore not calculated.

These animals were closely observed and

FIG. 3. **Flowers of A. tanganyicensis.** Photography: J. Reyburn

Fig. 4

DISTRIBUTION OF ALBIZIA

temperatured. After death autopsies were made and specimens collected in 10 per cent buffered formalin for histopathological studies. Sections were cut at 3 to 5 μ thickness and stained with haematoxylin and eosin (HE). Periodic acid Schiff (PAS), oil red O (30 minutes) (ORO) and Schmorl's method for lipofuscins (Schm.) were employed as special staining techniques.

RESULTS

Clinical Observations

After the initial dose of 2.5 g/kg, S1 revealed hypersensitivity only and subsequently recovered. However, after the second dose of 10 g/kg severe nervous symptoms developed within 3 hours. All the other sheep were also affected and the symptomatology, except for a few variations, was generally the same. Hypersensitivity, dyspnoea, foaming of the mouth and convulsions commenced approximately $2\frac{1}{2}$ to $3\frac{1}{2}$ hours after dosing. The convulsions were tetanic and intermittent, followed by short spells of recovery characterized by very mild spasms or quiescence and polypnoea. Either opisthotonus or orthotonus were exhibited, sometimes in association with nystagmus.

The respiratory distress was very severe and always accompanied by foaming of the mouth and cyanosis. S1 appeared to loose its hypersensitivity for a short period and exhibited galloping movements as in heartwater. However, a final tetanic spasm with respiratory arrest intervened prior to death. The animals invariably became prostrate with convulsions, but S3, during one of the short spells of recovery, rose and walked around normally. This same animal bleated almost mournfully while prostrate. All the sheep became hyperthermic and some developed temperatures up to 109°F (S1) and 111°F (S3). S1 died within 4 hours after dosing, S3 and S4 within 5½ and 20 hours respectively and S2 died overnight within an approximate 10 hours.

Macroscopic Findings

Post mortem changes were either mild (S2), very mild (S4) or almost absent (S1 and S3). The carcases of all 4 sheep were cyanotic and congested with mild to moderate subepicardial petechiae. Three out of 4 cases (S1, S2 and S4) contained the same degree of petechial haemorrhages in some of the muscles, lymph nodes and diaphragm. The same cases also revealed mild, localized, bilateral muscular degeneration, myocardial degeneration and nephrosis while the livers of all 4 animals were degenerated. Both the hearts and livers of these animals had a prominent parboiled appearance. Dull, light brown foci of suspected necrosis were also noticeable in the papillary muscles, septum and right ventricular wall of the heart in S4. The affected muscles included the triceps, infraspinatus, supraspinatus, subscapularis, extensor carpi radialis, longissimus dorsi, gluteal muscles, gastrocnemius, gracilis and muscles of the neck. Pulmonary oedema was marked in S2 and mild, very mild or absent in the other three cases. Pulmonary congestion, however, was a prominent and constant feature. Petechial haemorrhages were occasionally noticed in the lungs (S1); trachea, subcutis and thymus (S2); endocardium, abomasum and in the subserosa of both small and large intestines (S4). The pericardial cavity of S4 contained 15 ml of clear straw-coloured fluid.

Microscopic Findings

Brain and spinal cord

Mild to moderate congestion was present in all 4 sheep and chromatolysis of many neurones was seen in S1, S2 and S3. Slight microcavitation of both white and grey matter, but mainly of the former, occurred in the medulla oblongata, thalamus and corpus striatum of S2, in the optic tracts and medulla oblongata of S4 and in the optic tracts of S3. Multiple, deeply eosinophilic, circular granules or globules were noticed in the cytoplasm of some of the large multipolar neurones in both brain and spinal cord of S1, S3 and S4. These eosinophilic bodies were most conspicuous and numerous in the spinal cord, the roof nuclear area of the cerebellum and in the medulla oblongata, especially in the area of the dorsal vagal nucleus. Both the size of the largest ones and their colour in general resembled these specific features of erythrocytes very closely. Most of them, however, were small and approximately equaled the size of the eosinophilic granules of an equine eosinophil. They failed to stain with PAS, ORO and Schm. A very mild localized perivascular round cell reaction, probably unassociated with the disease, was present around a small number of vessels.

Myocardium

All the cases had prominent and fairly diffuse, focal disseminated, small to fairly large areas of degeneration which consisted of zonal foci of rarefaction, hydropic and lytic type changes as well as some Zenker's changes. No definite evidence of lipids within the degenerated areas were demonstrable with ORO.

Skeletal Muscles

Cloudy swelling, disappearance of cross striations, rarefaction, Zenker's changes, fragmentation and lysis were fairly diffusely distributed and constant lesions in all the sheep. These changes were also noticed in the diaphragm of the one case (S1) that was studied. Haemorrhages were present in S1, S2 and S4.

Liver

Cloudy swelling and hydropic changes of various degrees were constant lesions. Fatty degeneration was present in S4 and very mild to moderate megalocytosis was observed in S2, S3 and S4.

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Kidneys

The kidneys of three cases revealed prominent congestion and mild hydropic degeneration.

Lungs

Marked congestion was constantly present. Oedema, however, occurred only in S2 and S4.

Lymph nodes

Congestion, haemorrhages and mild oedema were noticed in two cases (S1 and S2).

Adrenal

Scattered, small multiple deeply eosinophilic granules were found in the zona glomerulosa and a small number of slightly purplish red globules in the medulla of the one adrenal of S3 that was studied.

DISCUSSION

A suspected outbreak of *Albizia* poisoning in cattle was experimentally confirmed by the feeding of dry pods of *A. tanganyicensis* to 4 sheep. The constant nervous symptoms of intermittent tetanic convulsions and hypersensitivity closely resemble those of chlorinated hydrocarbon poisoning and indicate that the toxic principle affects the central nervous system mainly. Hyperthermia is probably either caused by its effect on the heat regulating centres in the hypothalamus or by the severe convulsions or by both. This marked elevation of the temperature is suspected to be responsible for the degenerative changes in most of the organs and tissues. However, the tetanic convulsions evidently would have augmented the degenerative changes in the skeletal muscles and myocardium. The lesions in the brain are non-specific. The areas of microcavitation are probably related to changes in the glial cells and not to demyelination. Such changes may be compatible with acute swelling of oligodendroglia, vacuolation of the cell body and accumulation in it of unstainable fluid[7]. The significance of the multiple eosinophilic globules and granules is unknown and apparently also non-specific as they are more frequently encountered in the brains of ruminants. The presence of

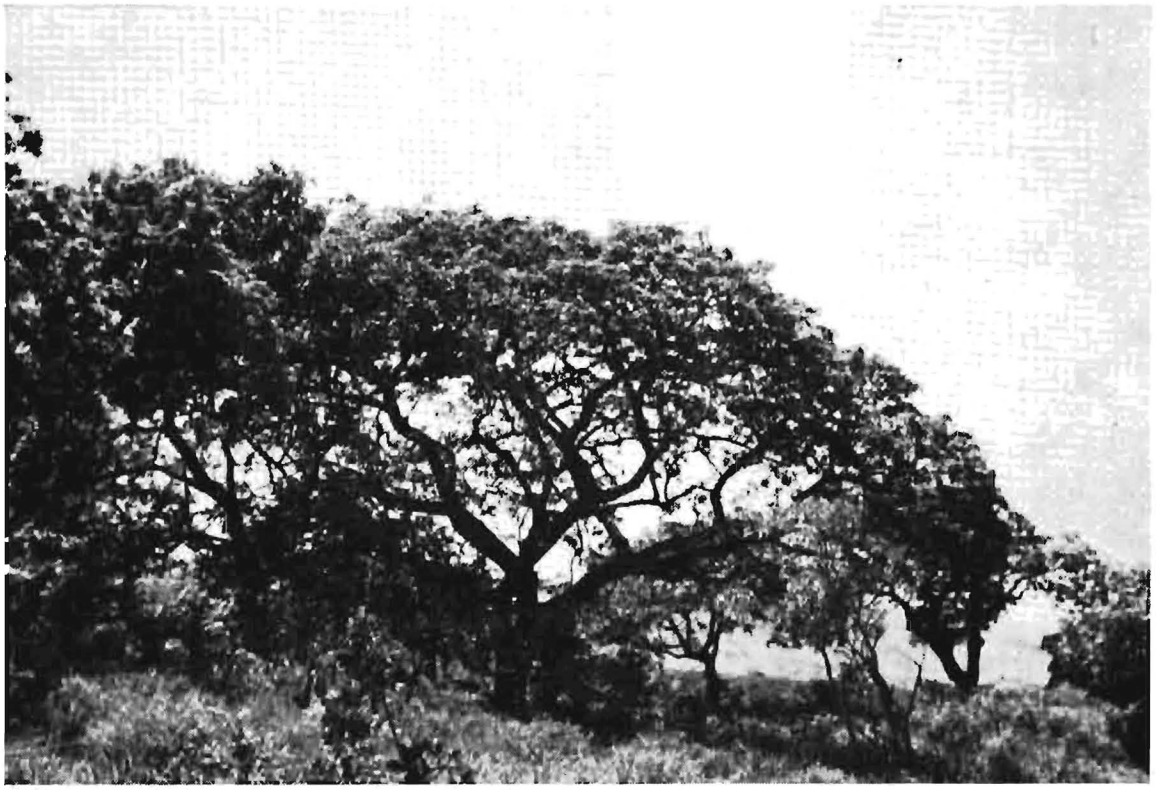

FIG. 5. A. versicolor. Photography: M. J. Wells

similar granules is regarded as an ageing phenomenon in ruminants and they are also thought to be precursors of an unidentified neuronal pigment, perhaps related to lipofuscin[8]. Such granules were also described in horses with grass sickness[8]. All the experimental animals in this study as well as the natural case (heifer), however, were young animals. It is therefore evident that ageing is not the only factor responsible for their production. Furthermore, neither lipids nor mucopolysaccharides could be demonstrated in them. The presence of eosinophilic globules in the adrenals, likewise, is a frequent phenomenon in other diseases which is still poorly understood.

The presence in South Africa of another toxic species, *A. versicolor*, needs emphasis. It is a taller tree than *A. tanganyicensis* and has a wider distribution in South Africa.

FIG. 6. Flower of A. versicolor.
Photography: B. de Winter

Codd[6] described it as follows (Fig. 5 and 6): Tree 6 to 18 m tall with a single main trunk and a large, round or spreading crown; bark grey; branchlets persistently tomentose. Leaves 18 to 30 cm long and 12 to 24 cm broad, rusty pubescent; petiole 3 to 6 cm long; pinnae 1 to 3 pairs; leaflets 3 to 5 pairs, oblong to obovate-oblong or broadly elliptical, 3 to 5.5 cm long and 1.5 to 3 cm broad, oblique at the base, apex rounded to truncate, often mucronulate. Inflorescence 18 to 25 flowered; peduncle 4 to 5.5 cm long, fulvo-tomentose. Flowers creamy white, sessile. Calyx 5.5 to 6.5 mm long, 5-toothed, fulvo-tomentose; teeth deltoid, 1.5 mm long. Corolla 7 to 8 mm long, 5-lobed, tomentose; tube 3.5 to 4 mm long; lobes ovate, 3.5 to 4 mm long. Stamens 2.8 to 3.5 cm long, united at the base for 3 mm. Ovary puberulous, 3 mm long, subsessile; style filiform, slightly exceeding the stamens in length. Pod several seeded, linear to linear-oblong, 8 to 22 cm long and 3 to 5.5 cm wide, flat, thin textured with some transverse striations; margin thickened, straight or slightly indented between seeds; position of seeds apparent as raised bumps on the valves. It has been recorded from Uganda southwards to Angola, South West Africa (Ovamboland, Okavango and Caprivi Strip), Transvaal (Soutpansberg Range, Messina, Sibasa, Kruger National Park (Punda Milia), Pietersburg, Lydenburg, Pilgrims Rest, Acorn Hoek, Bushbuckridge, Nelspruit, Barberton, Malelane, Queens River Valley, Sheba Valley), Swaziland and Natal (Zululand, Ubombo, Hlabisa, Hluhluwe Game Reserve, Lower Umfolosi, Umhlatuzi Valley, Entonjaneni, Eshowe and Mtunzini) (Fig. 4.).

The generic name of "albiziosis" is suggested for this poisoning, which should be considered in all the areas listed whenever cases with tetanic spasms and hypersensitivity are encountered during late spring and early summer especially when strong winds prevail.

ACKNOWLEDGEMENTS

The authors wish to thank the farmer, Mr. J. Peacock of Rhenosterkloof, Rooiberg for his co-operation; the Chief, Botanical Research Institute for the photographs and their co-operation and to the technical staff of the Sections of Pathology and Toxicology at Onderstepoort for their services.

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NUUS VAN DIE FAKULTEIT VEEARTSENYKUNDE, UNIVERSITEIT PRETORIA.

Aan die einde van die akademiese jaar, 1969 is die volgende beurse, pryse en medaljes aan nuwe B.V.Sc.-graduandi toegeken:

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C. Button.

(b) *Kliniese medalje:* (Tak-Witwatersrand, S.A. Veterinêr-mediese Vereniging)
Mej. J. Young.

(c) *Imperial Chemical (Pharmaceutical) Ltd.-prys:*

(i) *Ten opsigte van Chirurgie en Geslagkunde:*
Mej. C. M.E. Hay.

(ii) *Ten opsigte van Geneeskunde en Infeksiesiektes:*
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(d) *May-Baker Kliniese Prys:*
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(e) *Pfizer-prys:*
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(f) *Agricura-prys:*
C. Button.

(g) *Lilly Laboratories-prys:*

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C. Button en mej. C. L. V. Young.

(ii) *Varksiektes:*
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(h) *Reproduksiegroep (S.A.V.M.V.)-prys:*
C. Button.

Ons wens hulle almal van hart geluk.

BOOK REVIEW

CIBA FOUNDATION STUDY GROUP 34: PROGESTERONE.

Its regulatory effect on the myometrium.

Edited: G. E. WOLSTENHOLME AND JULIE KNIGHT

J. & A. Churchill, 104 Gloucester Place, London, 1969. pp. 193, figs 64 Price: 30 shillings.

The volume consisting of the proceedings of the 34th Ciba Foundation study group, is in memory of Brenda M. Schofield (1926-1968) who dedicated much of her work to the study of uterine physiology. A complete list of her publications is presented towards the end of the book, while her scientific activities are reviewed by E. C. Amoroso.

True to the Ciba Foundation motto — *Consocient Gentes* — eminent scientists within the field of reproductive physiology, have been brought together to produce a booklet which, although of small dimensions (5″×7½″), has considerable academic weight. The symposium was held on the 14th of May, 1969 under the chairmanship of A. Csapo. Apart from the chairman's introduction, the volume consists of eight separate contributions and includes the discussions held at at intervals during the proceedings. The book is finally completed by the inclusion of a useful subject index.

The individual contributions may be reviewed briefly as follows

A. Csapo discusses direct regulatory factors of myometrial function giving particular attention to so-called "progesterone withdrawal" from the plasma following intra-amniotic infusion of hypertonic saline. This aspect receives further attention in the contribution of M.O. Pulkkinen: *The significance of progesterone in myometrial regulation during mid-trimester human pregnancy.* He made simultaneous measurements of intra-uterine pressure and plasma progesterone in patients treated intra-amniotically with hypertonic saline and observed that progesterone withdrawal preceded the evolution of uterine activity. The discussion on this topic, however, leaves doubt about the functional significance of the drop in progesterone levels encountered.

W. G. Weist discusses work concerning the mode of action of progesterone. He followed the metabolism of (4-^{14}C) — progesterone and concluded that the catabolism proceeded at a slower rate when the target tisuue is most susceptible to the action of the hormone. Furthermore progesterone itself has most progestational activity as the products of catabolism had either less activity, or none at all. The mechanism apparently exists within the target organ to retain progestational activity, giving the desired effect.

The relationship of progesterone and the guinea-pig myometrium is discussed by D. G. Porter, while Jean M. Marschall described work concerning the effect of ovarian hormones on the uterine response to adrenergic stimulation.

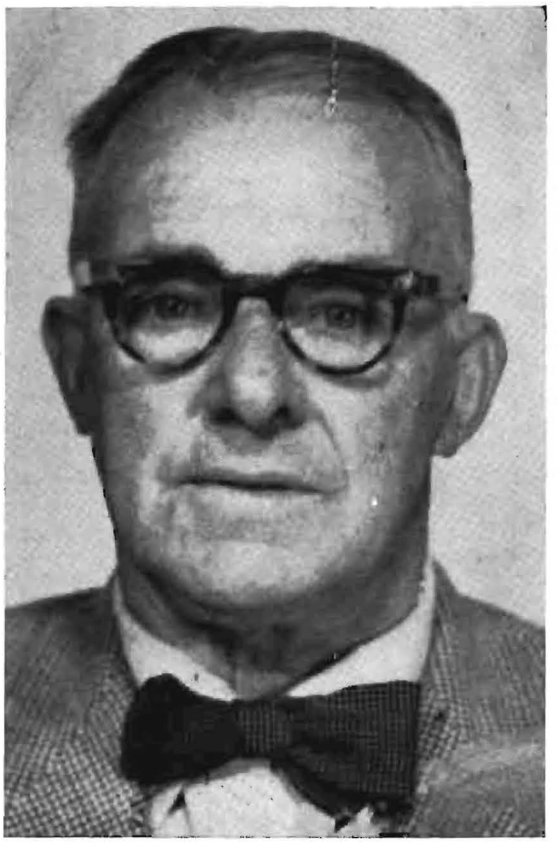
In their contribution, A. C. Turnbull and Anne B. M. Anderson *(The influence of the foetus on myometrial contractility)* draw attention to adrenal atrophy and delayed onset of labour.

This is followed by the work of T. D. Kerenyi *et al.* concerning the effect of exogenous progesterone on the early pregnant and non-pregnant uterus.

Finally, C. Wood discusses factors which might influence the contractility of the uterus during the latter half of pregnancy, including the possible role of the foetal — pituitary axis.

This book therefore contains recent work on progesterone and uterine function and is strongly recommenced to research workers and students in this field. Several recent references appear after each contribution. N.C.O.

OBITUARY



GILBERT THOMAS ("PADDY") HENDERSON, O.B.E., M.R.C.V.S.

At the time of his death he was South Africa's oldest veterinarian. Born in Ireland on March, 30, 1885, he studied in Edinburgh and Liverpool before becoming a Member of the Royal College of Veterinary Surgeons in 1907. In 1911 he came to South Africa to deal with East Coast fever in Pondoland and rode up to 600 miles per month on horseback doing so. In 1913 he was seconded to Nyasaland to deal with rinderpest and trypanosomiasis but returned to South Africa in 1914 and two years later became Government Veterinary Officer for the Elliot district. In 1924 he was once more posted to Kokstad to deal with E.C.F. and sheep scab, and his untiring energies and early appearance at dipping tanks earned for him the native name of "he who sleeps in his boots".

In 1934 he was appointed Principal Veterinary Officer to the then Basutoland Government. In due course he was awarded the O.B.E. for services rendered in this capacity.

In 1946 he retired to Kokstad where he took up private practice. He served on the Town Council for nine years, for five of which he was Mayor. He took a keen interest in sport, having played rugby, polo and golf, serving as President of the Polo Club, and judging horses at the Rand Show, Natal and Cape Town.

At 75 years of age failing eyesight forced him to discontinue his life's work, to which he was extraordinarily dedicated. On his death ,the "Kokstad Advertiser" proclaimed him to be East Griqualand's oldest and best known adopted son. He lived a full life, and his service to mankind is an example to all veterinarians. To his widow and family the Association extends it's sincere sympathy.

OBITUARY

SIDNEY GEORGE TURNER, B.V.SC.

Born 29.12.1911 at Port St. Johns, he was educated at Dale College and in 1931 proceeded to the University of Pretoria where he initially took Agriculture but later, after spending a year working for the Standard Bank, took and completed the course in Veterinary Science. At Varsity he took a keen and active part in athletics and captained the University and later the combined Universities team.

After qualifying he joined the State Service. Subsequently he saw private practice in Johannesburg, Pietermaritzburg and Howick before establishing his own practice in Port Shepstone.

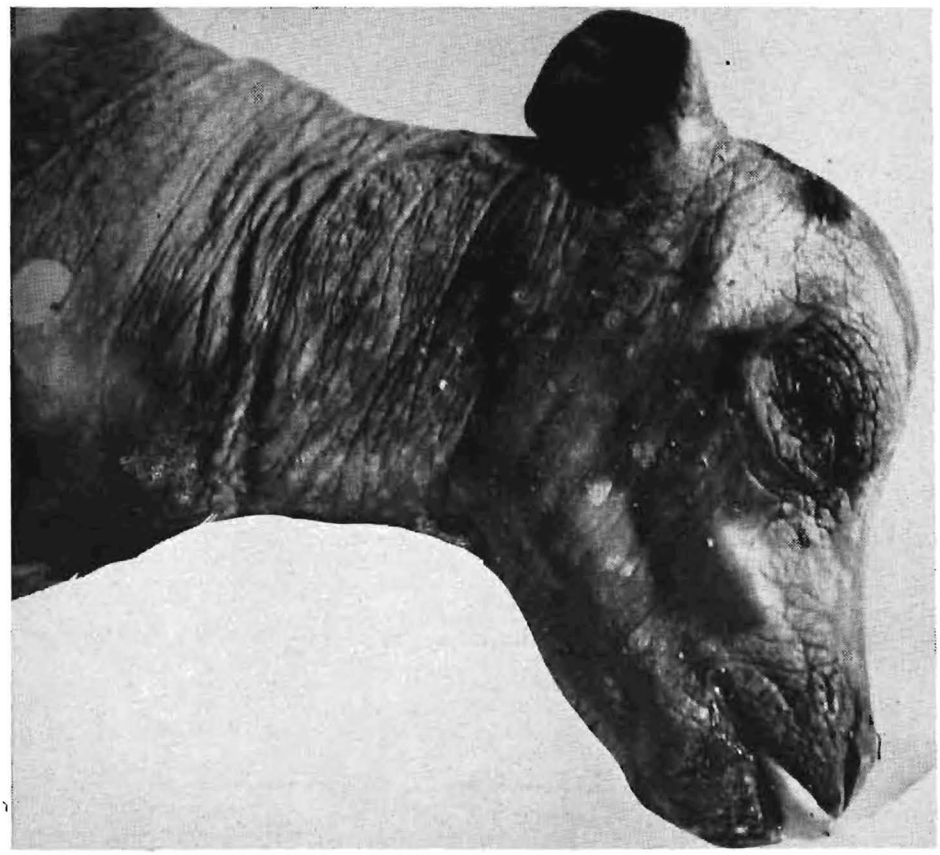
He was a keen Rotarian and past president of the Port Shepstone Club. His great love was fishing, instilled in him by the environment of the wild coast where he was born and lived as a youth. He represented Natal in numerous angling competitions.

He is survived by his widow, Natalie (née Moorhouse, of Pietermaritzburg) and his son Vincent, his wife, and a grandchild. Vincent joined his father's practice quite recently and will continue the good work at Port Shepstone. To them all we extend our deepest sympathy.

FEATURE PAGE

BOVINE ABORTION CAUSED BY **ASPERGILLUS** SP.

P. P. BOSMAN[1], E. E. McCONNEL[2] AND A. P. SCHUTTE[3]



The above photograph is of an aborted 190 day male foetus which was presented to the Artificial Insemination Section, Division of Veterinary Services, Onderstepoort for examination. The foetus came from a large dairy farm in the Standerton district, Transvaal. The dam (Friesian) was in her second pregnancy and had been bred by artificial insemination. She showed no signs of disease prior to the abortion. The placenta was not retained.

Examination of the foetus revealed a dermatitis characterized by patches of grey-white soft velvety skin. These were most prominent on the head, ears and neck, over bony prominences such as the elbow and hocks, and the scrotum. The placenta was brown, thickened and leathery in appearance. Microscopic examination of the placenta, skin and lungs revealed numerous branching septate hyphae compatible with **Aspergillus** sp. Subsequent cultures of infected material confirmed this observation.

Of the various causes of infectious abortion in cattle, fungi are not common. However, sporadic cases do occur and this agent should be considered together with bacteria, viruses, and toxic factors when investigating an abortion problem.

Although not observed in all cases of mycotic abortion, skin lesions in a foetus comparable with the above photograph should be considered as pathognomic.

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