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VETERINÊR-MEDIESE

VERENIGING

Editorial

GUEST EDITORIAL

MAN — AND THE PARASITES OF ANIMALS

(Contributed by Dr. R. Elsdon-Dew.)

Over the aeons, man, by domesticating animals to his own use has built up a new ecology in which the parasites were quick to play their part. Man is almost alone in being able to modify the environment and, in so doing, he may have unleashed forces of which he knew but little.

It must be recalled that host and parasite have evolved together, and that, by natural selection, those host-parasite relationships which are in balance are most likely to have survived. Thus it is that, under natural circumstances, the pathology due to parasites is at a minimum, and there are few conditions where the parasite is detrimental to his host, the exceptions being where the larval phase may make the intermediate host a more likely victim of the predator definitive host.

For example, a sheep with "gid" is more likely to be caught and eaten by the canine host of the adult *Multiceps*. Here, the pathology in the sheep facilitates transmission of the parasite, and, provided there were enough sheep to make them expendable, natural selection would favour such a mechanism.

Such a manifestation is, however, exceptional. As a rule, it does a parasitic species no good to harm its host. In fact the healthier and more prolific the host the better it is for the parasite and the more likely is the combination to survice. It must be emphasised that the parasite is the dependent species, for, unlike the host, it cannot survive without its partner.

This is true under natural circumstances, but man, by modifying the environment, may well upset the host-parasite balance.

It must be remembered that for most parasites, the passage from host to host is precarious, and to counter this, many and varied mechanisms have been adopted, all aimed at increasing the probability that some at least of the new generation will find suitable accommodation — that the majority fail is of little consequence as long as few succeed. If, however, circumstances change, the proportion succeeding may well be beyond the host economy. A good example is to be found in the human hookworms. In cave-man days, the probability that a man collected more than a few hookworms was slight, but when man took to agriculture, the odds against a successful hookworm shortened drastically, and the load acquired by man might be such as to deplete his iron reserve.

So, too, with his domestic animals, by confining his sheep to narrow ranges, the probability of infection by parasites increased beyond the nature level, and the veterinarians were in business.

Thus man may easily upset the host-parasite balance, and examples are many. Here, in the Lowveld, by the introduction of irrigation he is in the process of upsetting the balance in Bilharzia, with consequences which may well bring our people to the level of the fellahin in Egypt.

In other ways too, man may pay the penalty for his disturbance of nature. The domestication of animals has facilitated the passage not

only of "normal" human parasites, but also of parasites of which man has no genetic experience and for which he may have no protective mechanism.

Dealing first with the "normal" parasites, the best known example is the tapeworm. Under "wild" conditions, the probability of a bovine eating human faeces and getting measles would be slight — but, when the herd-boy harbours a tapeworm — well. Luckily for man, adult tapeworms seem to have a "lebensraum" rule, and infections with more than a few adults are rare or our intestines would be as clogged as are our lives by that other worm *Taenia rubra.*

Measles in pigs is a similar but different tale. Apart from the anomalies which form the basis of another story, man may suffer for his carelessness in this respect. While the adult worm causes little, if any, disturbance man can — and does — harbour the cysticercus phase.

Though a large number of humans have these "measles", specific pathology has not been established, though the proportion of epileptics carrying cysticerci is far higher than that of the normal population.

We can hardly consider Trichinosis as a normal parasitism of man, for the life cycle of *Trichinella* has but little hope of completion, but the disease toll, even in as highly organised a civilisation as that of the United States, is considerable. Luckily for us the parasite has not, as yet, been introduced to South Africa.

It is perhaps the dog which has been most generous in sharing his parasites with man. The list is formidable, and frightening.

Luckily what can happen but seldom does happen, or we would have to do without these delightful companions. By keeping our canines parasite-free, we are not only helping them, but are also protecting ourselves.

Starting with the protozoa — the most important infection is probably cutaneous Leishmaniasis, luckily unknown in South Africa but a real scourge in the Mediterranean and Near East. We do not see Delhi sore, Aleppo boil, — or the like, but if we did we would have to look to our dogs as the source of infection.

Out of sequence, the cestodes are probably the best-known parasites of the dog which may affect man. We all know that hydatid disease in man is by no means uncommon in sheep-farming areas particularly where sheep dogs are used.

The very close association of the shepherd and his dog in the Scottish Highlands where they sleep together makes for ready transmission of a condition for which the only cure is surgical, and dangerous. Prevention by disposal of carcasses and treatment of the dogs is the only way out.

Though not as common as hydatid, *Multiceps* larvae occur in man, and with this parasite's predilection for the brain, the results are usually disastrous.

Following on the mobility of what is the commonest dog-parasite to affect man, the flea, infections with *Dipylidium* are not unusual in man. The worm is unable to establish itself in adults but in babies the passage of numerous proglottids has often given rise to the mistaken diagnosis of intestinal myiasis. Luckily a dose of salts will dislodge the intruder.

When we come to the nematodes, we are in different country, for here the association may well be unrecognised. It is only of recent years that some strange clinical syndromes in man have been found to be due to dog nematodes. Possibly the best known is the "sandworm", an extremely irritating and resistant infection, common in the warmer areas of our country. For a long time this was considered to be due to a mite, possibly due to the similarity to scabies, but it has been established that the "worm" is the larval phase of *Ancylostoma brasiliense*. This larva whilst it is able to traverse the skin of the dog and completes its life-cycle, is unable to get through the hide of man, and in its attempts — sets up the tracks so commonly seen on the fingers of gardeners and the backsides of babies.

The larva is surprisingly long-lived — six months and more. Its propensity for lying dormant has given rise to a multiplicity of "cures", the very multiplicity being indicative of their inaffectiveness. The moral here is obvious — keep Fido out of the sand-pit. Treat Fido. If these are impossible, load the sand-pit heavily with salt — to the discomfort of the rhabditiform larvae.

Our experience with larvae migrating in the skin led to a suspicion that others might migrate elsewhere — and lo — it was true. There are other larvae, strange to man, which by their inability to reach their normal habitat are condemned to wander till they die. Here too, the dog is an offender as host.

The eggs of *Toxacara canis* if ingested by a human, will hatch, penetrate the intestine and head for the lungs via the liver. But they don't get past the liver and they wander, lost among the liver lobules leaving eosinophilic granulomata in their tracks. If a child known to indulge in pica, has a tender hepatomegaly and an eosinophilia, suspect viscercal *larva migrans* — but the only proof lies in liver biopsy — of a sufficiently large chunk to find the larva. Only when we had studied sections of these larvae, did we realise that we had missed thousands in the past. What the end result of such infections is — who can say? But it may well be one of the causes of cirrhosis.

So much for the dog — what of other animals?

Of the flukes *Fasciola* occasionally gets into man, but the interesting group are the *Schistosoma*. Man has its own schistosomes, *S. haematobium*, *S. mansoni*, and *S. japonicum*. While the first two are practically hostspecific this is not true of *japonicum*, which affects other animals — notably the pig. One wonders whether the severe manifestations of this parasite in man do not follow on this being a parasite "new" to the human, one of which he has insufficient genetic experience. An interesting feature of this parasite is that there are strains having differing pathogenic potential, and one has been found, which, causing little or no damage in monkeys, yet confers a strong protective immunity against the more pathogenic strains.

Here, in South Africa, Pitchford has shown that in some areas humans are heavily infected with the cattle schistosome *S. mattheei*, and that there may be a hybridisation between *mattheei* and *haematobium*. Finally in this group one may mention the condition of "swimmer's

itch" following an invasion of the skin by the cercariae of the duck schistosome *Ornithobilharzia.*

Enough has been said to illustrate yet another reason why medicine and veterinary science should get together. We have much to learn one from the other, but in my view the medicals can learn more from the vets. than *vice versa.* After all, we doctors, cannot deliberately infect our subjects and slaughter them as we wish, and we need someone to *vet* our *doctored* ideas

THE 1962 CONGRESS

If reports from bystanders are to be believed, the 1962 Congress must be classed among the many successful scientific meetings which the Association has held.

This is most encouraging, especially as it was opened by the Honorable Mr. P. M. K. le Roux, Minister of Agricultural Technical Services (whose Department has recently undergone considerable re-organization) and attended by His Worship the Mayor, who graciously consented to welcome the guests and delegates.

The Association and its members make considerable contributions each year to the welfare of South Africa, and well-meant and well-deserved publicity can only stimulate us to greater endeavours.

There is no doubt that the Symposium on Rabies in Animals was well presented and well received by both medical and veterinary authorities whose uneviable task and responsibility it is to give major spot decisions at times when the lives of men and animals are in serious jeopardy.

The contributions to Bluetongue and Specific Oculovascular Myiasis (Uitpeuloog) disclosed in the papers, are true examples of how research can be undertaken with and without the existence of elaborate facilities.

The technique of Bluetongue investigation as practised at Onderstepoort is probably as good as can be found with virus research anywhere in the world. The facilities with which Dr. Basson had to investigate Uitpeuloog under field conditions, would have failed to attract the average investigator.

The true investigator will obtain results, not necessarily in proportion to the facilities available.

The contributions to Congress on the Skin lesions of Domestic Animals, on Geeldikkop and Enzootic Icterus, on Heartwater Immunization, were of a very high order and the authors of the papers on Foot and Mouth Disease in game, Besnoitiosis and the Health of the Weanling Pig must be congratulated on the information they imparted to Congress.

A member whose opinions are always respected, was overheard to say about the demonstration by the Reproduction Group — "I've never seen a better demonstration".

The Association extends its sincere appreciation to all members who contributed to the scientific meeting and who therefore were largely responsible for the success of Congress.

The Association has many members who perform useful veterinary services every day of their lives. To them an invitation is extended to participate in the propagation and distribution of knowledge to others.

Next year is "Animal Health Year" throughout the Veterinary World.

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SCIENTIFIC CONGRESS

OPENING CEREMONY

THE PRESIDENT, in introducing His Worship the Mayor of Pretoria to an audience of over two hundred and twenty persons, who had gattered to enjoy the opening ceremony of the Fifty-Seventh Annual General Meeting and Scientific Congress of the South African Veterinary Medical Assiciation, reminded them that Mr. Smith was well known and needed little introduction.

HIS WORSHIP THE MAYOR — MR. E. SMIT

Meneer Die President, Sy Edele, Dames en Here,

Namens die Stad Pretoria is dit vir my werklik 'n plesier en 'n eer om u hier welkom te heet. Hierdie deel waarop ons staan is natuurlik nie deel van Pretoria nie. Ons staan in die buite wêreld bekend as 'n voorstad van Onderstepoort, en ek moet vir u sê dat ons daarop trots is. Ek verwelkom u. Die President het vir my gesê — „Mnr. Smit, asseblief tog net twee woorde, nie meer as dit nie".

U het 'n baie lang program en ek gaan u nie lank hou nie.

U is baie welkom in Pretoria.

Ladies and Gentlemen,

You are in a city. You are going to see a city that is probably developing faster than any other city in South Africa.

It is a friendly city, it is a beautiful city and we say to you "Welcome".

Its development is indicative of the courage of its people and of their faith in the future of our Republic. I say to you, while you are here, enjoy yourselves, mingle with our people and find out what a very fine type of person you've got in the Northern Transvaal.

Thank you very much.

Die President van die Vereniging, Dr. H. P. Steyn, versoek toe sy Edele mnr. P. M. K. le Roux, Minister van Landbou-Tegniese Dienste om die Kongres te open.

„Sy Edele is 'n welbekende en hoogsgerespekteerde vriend van die Veeartsenykundige beroep" het dr. Steyn gesê. „Hy het feitlik geen voorstelling nodig nie".

TOESPRAAK DEUR SY EDELE MNR. P. M. K. LE ROUX

Sy Edele mnr. P. M. K. le Roux, Minister van Landbou-Tegniese Dienste spreek die vergadering as volg toe:—

Mnr. die President,

Ek wil u graag, in die eerste plek, bedank vir die vriendelike wyse waarop u my hier verwelkom het en u terselfdertyd verseker dat dit vir my baie aangenaam is om by hierdie geleentheid nader kennis te kan maak met u Vereniging en sy lede.

Ek stel ook u Vereniging se vriendelike uitnodiging aan my, om die openingsrede by hierdie geleentheid te voer, baie hoog op prys. Omdat die veeartsenykunde so 'n hoogs belangrike deel uitmaak van die wetenskappe waarop die landboubedryf, en derhalwe ook die land se ekonomiese welvaart as geheel berus, verwelkom ek die geleentheid om 'n paar gedagtes in u midde te kan lê.

Nou, mnr. die President, ek wil graag begin deur u en al u Vereniging se lede geluk te wens met die volgehoue vordering wat u organisasie oor die jare gehandhaaf het. Dit is interessant om te dink dat die ou Transvaalse Veterinêr-mediese Vereniging wat sy eerste vergadering in 1904 met 'n ledetal van sowat 20, in die ou Museum hier in Boomstraat in Pretoria gehou het, gegroei het tot die invloedryke organisasie wat dit vandag is, met 'n ledetal van 460. Dit is 'n bewys dat u organisasie tred gehou het met die algemene ontwikkeling.

Wat vir my veral opvallend en verblydend is, is dat, soos uit u agenda blyk, u Vereniging hom nie slegs beywer om die belange van die lede van u professie te beskerm en te bevorder nie maar dat hy hom dit ten doel stel om daadwerklik diens aan die veebedryf van die land te lewer deur dit sy taak te maak om sy lede op hoogte te stel en te hou met die jongste navorsingsresultate en aktuele probleme op die gebied van dieresiektes.

Die Rol van die Veebedryf in ons Volkshuishouding

Die waarde van die bydrae wat u sodoende lewer, kan alleen besef word as dit gemeet word aan die belangrikheid van die veeteeltnywerheid in ons landbou en volkshuishouding. Die bruto-inkomste uit veeteelt het in 1960/61 bv. R368,203 miljoen beloop — d.w.s. 45 persent van die totale bruto-inkomste van die landbou — met wol, wat 'n dierlike produk is, as ons belangrikste uitvoerlandbouproduk.

Dit is dus duidelik dat die veeteeltbedryf reeds 'n baie belangrike bydrae tot ons volksinkome maak. As ons egter 'n blik in die toekoms werp is daar alle tekens dat die veebedryf nog 'n relatief belangriker rol in ons lands-ekonomie gaan speel. Met die styging van die lewensstandaard van die bevolking as gevolg van die snelle nywerheidsontwikkeling, kan verwag word dat die verbruik per kapita van veeteeltprodukte soos vleis, melk, kaas, eiers en so meer, steeds sal styg.

Selfs in ons akkerboustreke sal veeteelt in die toekoms ook in groter mate in die saaiboerdery geïntegreer moet word ten einde beter gebalanseerde boerderystelsels wat op groter bestendigheid en die behoud van

grondvrugbaarheid gemik is, te bewerkstellig. In hierdie rigting staan die veebedryf dus ook voor groot toekomstige ontwikkeling, wat sonder die nodige veeartsenykundige hulp nie ekonomies moontlik sal wees nie.

Doeltreffendheid van Produksie

Vir die instandhouding van ons veebedryf en vir die noodsaaklike verdere ontwikkeling daarvan, sal doeltreffender produksietegnieke egter steeds meer en meer 'n volstrekte vereiste word. Weens die stygende koste van produksiemiddels en die dalende neiging van pryse vir landbouprodukte, ondervind boere oor die hele wêreld vandag dat die winsgewendheid van hul boerderye krimp. Nou tref dit so dat, net soos met enige ander nywerheid, die inkomste uit die boerderyonderneming alleen op ekonomiese wyse gehandhaaf of verhoog kan word as dit so doeltreffend as moontlik georganiseer en bestuur word. *Op die lange duur is daar nou eenmaal net nie 'n plaasvervanger vir doeltreffendheid nie.*

Om dié rede is 'n gesonde en welvarende veebedryf in ons land dan ook slegs moontlik as alles in die werk gestel word om faktore wat ondoeltreffende en lae produksie in die hand werk, uit te skakel.

Van hierdie faktore is die lae peil van produksie en reproduksie per dier en die groot verliese weens siektes en droogtes, sekerlik die belangrikste — dit is ongetwyfeld die swakste skakels in ons veeboerdery.

Die veeartsenykundige versorging van ons kuddes en die toepassing van siektewerende maatreëls is dus basiese vereistes om doeltreffendheid van produksie by ons veebedryf te bewerkstellig en sodoende die produksie te verhoog en die betaalbaarheid van die veeboerdery te verseker. Hier rus daar dus 'n groot verantwoordelikheid op beide die veeartse (sowel die Staats- as die privaatveearts) en die boer — 'n verantwoordelikheid wat in die toekoms steeds groter sal word na gelang die veeboerdery groter afmetings en meer intensiewe vorm aanneem.

Bydrae wat Veeartsenydienste reeds gelewer het

Mnr. die President, waar ek hier praat van die verantwoordelikheid wat op die veearts rus, verbly dit my dat ek kan verwys — en wel met 'n groot mate van trots — na die reusebydrae wat die veeartsenydienste reeds gelewer het om 'n gevestigde veebedryf in Suid-Afrika moontlik te maak. Dit verskaf nie alleen rede vir trots nie, maar boesem ook vertroue in dat, soos in die verlede, daar ook in die toekoms staat gemaak sal kan word op ons veeartse om hul deel tot die uitbouing van 'n florerende veebedryf by te dra.

Hoewel ek nie hier 'n volledige beeld daarvan wil probeer skilder nie, wil ek tog met waardering verwys na enkele van die opvallendste prestasies.

In 'n mens se leeftyd is daarin geslaag om die mees verwoestende dieresiektes onder beheer te bring. Gevreesde siektes soos nagana, ooskuskoors, longsiekte, droes (om maar 'n paar te noem) is bykans totaal uitgeroei, terwyl daar teen die meeste siektes soos bv. bloutong, perdesiekte, rooiwater, bloednier, knoppiesvelsiekte, hondsdolheid en andere, doeltreffende entstowwe ontwikkel is. Die feit dat daar verlede jaar nie minder as 62 miljoen dosisse entstof deur Onderstepoort aan

boere verskaf is, dien as 'n aanduiding van die omvang en waarde van hierdie bydrae. Terselfdertyd word die navorsingswerk in verband met die bekamping en voorkoming van siektes onverpoos voortgesit.

Bek-en-Klouseer

Ook wat die gevreesde Bek-en-Klouseer betref, wat op die sowat 2,000 myl landsgrense vir ons 'n gedurige bedreiging is, het ons veeartsenydiens baanbrekerswerk verrig. Die siekte is nog altyd dermate beheer dat die besmettings wat die land binnegedring het meestal tot die grense beperk kon word sodat die binneland, en daarmee die Republiek se algemene uitvoerhandel, behoue kon bly.

Ek kan hier net meld dat om die Veldveeartsenydiens in staat te stel om hierdie groot en belangrike taak in die toekoms selfs beter te kan uitvoer is dit besluit om op groot skaal wild- en veewerende heinings op te rig. Sowat 700 myl grensheinings is reeds voltooi en die doelwit is om binne enkele jare meer as 2,000 myl heinings langs alle grense opgerig te hê.

Daar word ook nie net langs en binne ons grense teen die indringing van hierdie en ander siektes gewaak nie maar veiligheidshalwe selfs daarbuite. Hier kan ek verwys eerstens na die hulp wat aan Suidwes-Afrika verleen word om die uitgebreide uitbreking van bek-en-klouseer te bekamp, om sover moontlik te verhoed dat dit verder versprei en moontlik die Republiek binnedring; en tweedens na die aktiewe stappe wat deur ons, in medewerking met die owerhede van ons Noordelike buurstate, geneem word om die Suidwaartse verspreiding oor ons grense van die tsetsevlieg aan bande te probeer lê.

Daarbenewens is binnelandse beheer algemeen verskerp om te waak teen die moontlike invoer van besmetlike siektes en parasiete vanaf oorsese lande en buurstate.

Bydrae tot Volksgesondheid

Die veeartsenydienste bedien ook nie alleen die boeregemeenskap nie, maar lewer ook 'n belangrike bydrae tot die volksgesondheid as geheel. Ek dink hier veral aan die rol van ons veeartse in die beskerming van die bevolking se gesondheid deur die bekamping van dieresiektes wat ook die mens aantas soos bv. beestering, masels in beeste en varke, hondsdolheid en so meer. Vanuit hierdie oogpunt is die noue skakeling wat daar reeds tussen die veeartseny- en mediese dienste bestaan van die grootste belang.

Doeltreffende Aanwending van Dienste van Wetenskaplikes

Hierdie prestasies van ons veeartsenykundiges is des te indrukwekkender as mens in gedagte hou dat die getal veeartse in Suid-Afrika in verhouding tot ons veebevolking aansienlik kleiner is as in ander Westerse lande. Weens ons klein Blanke bevolking en die hoë eise wat aan ons beskikbare wetenskaplike mannekrag gestel word, sou dit ook onrealisties wees om te verwag dat Suid-Afrika ooit dieselfde verhouding van veeartse tot veebevolking sal kan bereik of handhaaf as wat dit die geval in sekere

digbevolkte Europese lande is. Die doeltreffende aanwending van ons beskikbare wetenskaplikes is dus, veral in ons land, van die allergrootste belang. Dit was dan ook een van die beweegredes waarom ek die Rautenbach-komitee benoem het om aanbevelings te maak oor hoe om die funksionering van die tegniese dienste van my Departement doeltreffender en meer vaartbelyn te maak.

Herorganisasie van Dienste

Met die implementering van die aanbevelings van die Komitee is dan ook alreeds goeie vordering gemaak.

Die besonderhede van die veranderde diensstruktuur is by wyse van persverklarings reeds aan u bekend en ek beoog nie om hier daaroor uit te wy nie. Van aktuele belang, egter, vir sover dit die lede van u Vereniging betref, is die feit dat in die nuwe bedeling die vroeëre geamalgameerde Afdeling Veeartsenydiens van 1926 weer geskei is en onder twee Hoofde funksioneer, nl. die Hoof van die Afdeling Velddienste en die Hoof van die Navorsingsinstituut vir Veeartsenykunde.

Die status van die Onderafdeling Velddienste is nou verhoog tot dié van 'n volwaardige Afdeling met sy eie Hoof wat verantwoordelik is vir die koördinering en beplanning van alle veeartsenykundige velddienste, die administrasie van die Wet op Dieresiektes en -parasiete en die handhawing van algemene dieregesondheid waarby voorligtings- en diagnostiese dienste in die veld ingesluit is; en wat die navorsingsy betref, beteken dit dat daar nou 'n afsonderlike Navorsingsinstituut vir Veeartsenykunde by Onderstepoort geskep is onder leiding van sy eie Hoof wat weer verantwoordelik is vir die beplanning en uitvoering van gespesialiseerde navorsing oor alle aspekte van veesiektes, die bereiding van entstowwe en doseermiddels en die biologiese analise van vee-middels en dipstowwe en tegniese advies in die verband.

Alhoewel daar oënskynlik 'n skeiding teweeggebring is, kan ek u die versekering gee dat, vanweë die aard van hulle werksaamhede en doelstellings, daar altyd die nouste skakeling en samewerking tussen die nuwe Afdeling en die Navorsingsinstituut gehandhaaf sal word. By die Instituut op Onderstepoort is ook die veeartseny fakulteit van die Universiteit van Pretoria ingeskakel.

Die Afdeling Velddienste sal ook voortaan nouer inskakel by die verskillende ander vertakkings van my Departement want die bestryding van veesiektes en veesiektenavorsing vorm, saam met vertakkinge soos veeteelt en veeverbetering, die suiwelbedryf, voeding en weiding, grondbewaring, plaasbeplanning, ensomeer, onafskeidbare fasette van die geheel-prent van doeltreffende landbou- en boerdery-ontwikkeling en -vooruitgang. Onderlinge spanwerk tussen alle Streke, Institute en Afdelings is dus 'n noodsaaklike vereiste, en sal onder die nuwe bedeling, op doeltreffende wyse kan geskied.

Onder hierdie nuwe bedeling is daar ook 'n aantal hoër poste geskep en die salarisse van alle range van veeartse is verhoog. Hierdie skepping van beter loopbane en beter vooruitsigte, voel ek oortuig sal 'n sterker en doeltreffender diens tot gevolg hê sodat die beoogde uitbreiding van die veeartsenydienste verwesenlik sal kan word.

TEGNICI

'n Ander, uiters belangrike stap wat deur die Departement geneem is en waarna ek kortliks wil verwys is die skepping van poste van tegnici ook vir die veeartsenykundige velddienste. Hierdie beamptes ontvang 'n intensiewe teoretiese en praktiese opleiding wat oor 4 jaar strek. Daar is reeds magtiging ontvang vir die skepping van 57 sulke poste, terwyl 'n aantal Assistent-Veeinspekteurs ook reeds dieselfde opleiding ontvang.

Hierdie beamptes sal, deur werk van 'n roetine en 'n laer tegniese aard te verrig, aansienlik daartoe bydra om die werkspeil van die gekwalifiseerde veldveeartse te verhoog tot die vakkundige vlak waarvoor hulle opgelei is. Dit sal ook die Afdeling Velddienste in staat stel om dié vir hul taak uiters nodige, en in sommige gevalle reeds beplande opnames van dieresiektes, van stapel te stuur.

TRAINING OF VETERINARIANS

As an additional measure to meet the need for a strengthened veterinary service, steps have also been taken to make possible the training of a larger number of veterinarians. Here the Department was faced with the choice between the establishment of another faculty of veterinary science or the expansion of the facilities at the existing faculty. Having regard to the high cost which a new faculty would involve and the undue claims which such a faculty would make on capable and experienced staff, I decided that in the interests of the country, it would be preferable to enlarge the faculty at Onderstepoort so that 45 instead of 30 students could be enrolled annually. Due to financial and staff considerations, it will not be possible, therefore, to consider a second faculty in the near future. It has also been decided by the Pretoria University to establish a post degree course at Onderstepoort. This will contribute greatly to the further intensification of research work at Onderstepoort while at the same time it will serve to raise the standard of training of veterinarians to even higher levels. The number of lecturers at the faculty has been increased over the past few years and a further increase of personnel is contemplated. Veterinary research and training will therefore reach an important new phase and I think you will agree with me that it can thus never be said that the State is not meeting its obligations in this respect.

BUILDING FOR VACCINE PRODUCTION AND DISPENSING UNITS

In addition to these developments provision has also been made at Onderstepoort for an extension of the facilities for vaccine production: R900,000 has been made available for the erection of a building for housing the vaccine production and dispensing units. It is anticipated that this building will be completed within the next two years, and that it will solve the accommodation problem for research workers.

SCHEMES FOR THE DISTRIBUTION OF VACCINES

In this connection, I may remark in passing that the demand for Onderstepoort vaccines is increasing almost daily and as I mentioned previously, a total of some 62 million doses of all vaccines have been

issued by the Institute during the past financial year as against the 57,000,000 doses during the previous year. The scheme of distributing vaccines through trade channels has recently been revised and in terms of the new agreement a list of 13 vaccines will now be available to wholesale firms for distribution through their subsidiaries. Although issues to the public will still be undertaken at Onderstepoort and at State Veterinary Offices, it is anticipated that by the extension of the trade distribution scheme, vaccines will be more readily and widely procurable by both stock owners and private practitioners.

Basic Research

To return to the contemplated expansion of research, I would also like to mention that arrangements have been made for more basic research in regard to infectious diseases in game to which domestic animals are susceptible. Especially also basic research on Foot and Mouth disease so that diagnosis, typing, vaccine production and so forth can be put into effect with the minimum of delay in our own laboratories.

To make this possible, the establishment of a Foot and Mouth Research Unit has already been approved and the planning of this unit is now receiving attention together with the suitable training of Viroligists who will be in charge of this branch of the work.

Establishment of Diagnostic Centres

Important expansion and planning of the Veterinary Field Services is also intended. In the struggle against stock diseases, the need, to date, has been in the main to concentrate on the more destructive epizoötic stock diseases. With the large measure of success which, as I previously mentioned, has been attained on this front, the need for a general animal health service has become relatively greater.

The time has therefore arrived for the Veterinary Field Services to be expanded so that in addition to the administration of the Animal Diseases and Parasites Act, it will also be able to meet the growing need for an Animal Health Service.

It has therefore been decided to extend this branch of the Department's services so that an organised veterinary extension service will be available to stock farmers and more positive attention can be directed to the insidious erosion diseases and factors which adversely affect production and reproduction.

The successful carrying out of this aspect of Veterinary Field Services will call for a planned survey on a nation wide front in order to establish the nature and extent of the problems in the different regions and also the institution of strategically placed diagnostic centres which will efficiently serve both the European and Bantu areas. The necessary provision has also been made for this.

State Veterinarians in charge of such centres will receive special training at Onderstepoort and will be provided with properly trained technicians to assist them in their laboratories and in the field.

A start with the establishment of such diagnostic centres has, in fact, been made and a few such centres, including Allerton, which has now been transferred to the Division of Field Services, are already functioning.

While diagnostic procedure which calls for special equipment or specialised knowledge will, as in the past, still be carried out at the Central Research Institute, research workers at Onderstepoort will to a large extent be relieved of routine diagnostic work which can be carried out in the field and will, in consequence, be able to devote more time and attention to research.

In addition to the benefit which the stock owner will derive from this scheme, I believe that private practitioners will also be better served, in that routine diagnostic services will be more readily available to them. I am also convinced that this greater emphasis on general animal health will serve to make stock owners more conscious of the importance of healthy animals for maintaining and increasing production and that this will induce them to make use of the services of veterinarians to an increasing extent. In this, the private practitioner will naturally also be actively concerned.

Scheme for the Eradication of Tuberculosis in Animals

While on the subject of the services of the private practitioner, I might add that the Division of Veterinary Field Services is presently exploring avenues for the development of a scheme whereby the eradication of tuberculosis in animals can be tackled on a national basis. The number of qualified personnel in the service of the Division is, however, inadequate for a task of this magnitude, and I sincerely hope that private practitioners will find it possible to make their services available part-time, to assist the Department in this drive against tuberculosis in animals. The Department is busy formulating a scheme which will enable it to engage private practitioners on a part-time basis for the just mentioned and possibly other future campaigns.

Verantwoordelikheid van die Boer

Mnr. die President, ek vertrou dat na wat ek gesê het dit duidelik sal wees dat die Staat sy verantwoordelikheid teenoor die veeteeltbedryf, ook wat die uitvoering van sy veeartsenydienste betref, ten volle besef en dat die Staat van sy kant 'n daadwerklike bydrae maak om, deur die beste gebruik te maak van die dienste van sy wetenskaplikes, nie alleen siektes te bestry en die land teen die binnekoms van siektes te beskerm nie, maar ook om die gesondheid van ons veestapel oor die algemeen te bevorder. Hierdie stappe kan nie anders as om tot hoër produktiwiteit en doeltreffendheid in die veeteeltbedryf te lei nie.

Waar die Staat so 'n groot bydrae tot die bevordering van die veenywerheid lewer, rus daar egter ook 'n groot verantwoordelikheid op die boer. Ons boere is soms geneig om die oplossing van hul boerderyprobleme slegs in 'n prysverhoging van hul plaasprodukte te sien. Deur die bemarkingswet word daar, weliswaar, veel gedoen om ordelike bemarking te bewerkstellig en om groot skommelinge in pryse uit te skakel. Die boer self kan egter ontsaglik veel doen om sy produksie te verhoog en sy inkomste uit sy veeboerdery te vergroot deur verliese weens veesiektes te verminder, die gesondheidspeil van die plaasvee te verhoog deur beter weiding, versorging en bestuur en deur die kalf- en lampersentasie te

verhoog. Dit kan nie van die Staat verwag word om verantwoordelikheid vir die gesondheid van die vee op elke plaas op hom te neem nie, want daardeur sal die boer sy selfstandigheid en vryheid noodgedwonge moet prysgee. Die veeartsenydienste wat die Staat lewer, moet dus deur die boer self toegepas word. Dit is derhalwe noodsaaklik dat daar die nouste samewerking tussen die boer en die veeartsenydienste sal bestaan.

SLOT

Mnr. die President, ten slotte wil ek u graag verseker van die hoë agting wat ek en my Departement vir u Vereniging koester en dat ek altyd bereid sal wees om simpatieke oorweging aan vertoë van u Vereniging te skenk. Ek vertrou dat dit u President se ondervinding was toe ons laasjaar tydens 'n onderhoud die probleme van u Vereniging op vriendelike en openhartige wyse bespreek het. Ek het my dan ook bereid verklaar om volgende jaar 'n wetsontwerp oor die wysiging van u Veeartswet by die parlement in te dien.

Daar is reeds baie op die gebied van veeartsenykunde in ons land bereik en die lede van u Vereniging het gedurende die jare van u Vereniging se bestaan 'n trotse rekord daargestel. Die rekord is sonder twyfel die vrug van spanwerk en waar ek u graag alle sukses ook vir die toekoms toewens, wil ek die noodsaaklikheid vir die volgehoue samewerking en die ontwikkeling van 'n spangees tussen al die verskillende seksies waaruit u Vereniging bestaan, beklemtoon. En omdat, soos ek vroeër gesê het, die veeartsenykundige bydrae 'n integrerende deel van die geheel-beeld van die land se ontwikkeling en welvaart uitmaak, is dit ewe noodsaaklik, as u u volle aandeel ook in die toekoms wil lewer (wat ek glo u wil en sal doen), om ten nouste te skakel met alle instansies wat op die een of ander wyse in verband met u beroep staan soos bv. alle vertakkinge van my Departement, die Departement Gesondheid, die Mediese Navorsingsinstituut, die Provinsiale Administrasies en Plaaslike Owerhede en die W.N.N.R.

Mnr. die President, met die paar gedagtes wil ek dan volstaan. Ek hoop dat u 'n geslaagde kongres sal hê en dat u beraadslagings vrugbaar sal wees tot die verdere uitbouing van u Vereniging en die bevordering van die gesondheid van ons land se veestapel.

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DR. B. C. JANSEN BEDANK DIE MINISTER VIR SY OPENINGSREDE

DR. B. C. JANSEN het Sy Edele mnr. P. M. K. le Roux vir sy openingsrede, baie hartelik bedank.

Hy het in besonder die waardering van die veeartsenykundige professie aan die Minister oorgedra, vir die positiewe stappe wat deur sy Departement onlangs geneem is. Hy het Sy Edele mnr. le Roux verseker dat die Veeartse as 'n geheel hom nie sou teleurstel nie. „Veeartsenykundige navorsing in Suid-Afrika, sal hom by wêreldstandaarde aanpas", het dr. Jansen gesê. „Ons staan nou voor kruispaaie, maar hier op Onderstepoort sal altyd gepoog word om navorsing op voorbehoedmiddels hoog te hou. Ons sal voortgaan om die tradisies van die verlede voort te sit".

PRESIDENTSREDE

SY EDELE, DIE MINISTER VAN LANDBOU-TEGNIESE DIENSTE, SY EDELAGBARE, DIE BURGEMEESTER VAN PRETORIA, DAMES EN HERE

Dit is 'n besondere voorreg om u hier teenwoordig te hê by hierdie 57ste Jaarkongres van ons Suid-Afrikaanse Veterinêr-Mediese Vereniging.

Ek verwelkom ook alle lede en besoekers van binne en buite die Republiek wat vandag hier byeengekom het om te luister en deel te neem aan ons verrigtings.

Ons waardeer veral Sy Edele mnr. le Roux se teenwoordigheid omdat hy en sy Departement 'n besondere intieme verhouding met ons het. Ek bedoel nie van die amptelike verhouding wat bestaan tussen Staats Veeartsenydienste en die Departement nie; ek verwys eintlik na die verhouding tussen die Minister en Veeartsenykunde as geheel; en dit is vir my aangenaam om van die Minister se openingsrede te hoor dat hy ten volle op hoogte is met al die vertakkinge van veeartsenykunde.

Daar bestaan nog 'n algemene neiging om slegs te dink aan die Staatsafdeling van Veeartsenydienste wanneer van veeartsenykunde gepraat word, en om te vergeet van die oorgrootte meerderheid van veeartse en hul werk wat nie onder Staats-beheer groepeer is nie. In werklikheid het die Veeartsvereniging, waaraan feitlik alle veeartse behoort, die toonaangewende liggaam van die Professie geword.

Hierdie verandering het geleidelik plaasgevind en is die natuurlike gevolg van die verandering in verhouding tussen die getalle wat onder die verskillende groepe binne die Professie sorteer.

Mnr. le Roux, as Minister van Landbou-tegniese Dienste, is verantwoordelik vir die administrasie van die Veeartswet. Hy is die man by wie ons met alle probleme wat ons nie self kan behartig nie, moet aanklop vir hulp en ondersteuning.

Ons waardeer dus die belangstelling wat u, mnr. le Roux, toon, om vandag hier teenwoordig te wees. Ons hoop dat u deur hierdie persoonlike aanraking met die Veeartsvereniging tot 'n mate die gevoel sal kry dat u 'n deel van ons is.

As ek nadink oor die veranderinge en verbeterings wat oor die afgelope twee of drie jaar reeds in die Staats-veeartsenydienste aangebring is, dan het ek rede om te glo dat ons in u 'n baie goeie vriend van ons Professie gevind het: dit is ook duidelik dat u 'n man is wat daaraan glo om sonder versuim agterstallige verpligtinge afgehandel te kry.

Ons besef terdeë dat enige belangrikheid wat aan ons Professie geheg mag word, daaruit voortvloei dat ons diens moet lewer. Ons vernaamste plig is ongetwyfeld teenoor die veenywerheid van die land. Daarna, in noue samehang met die vorige, is ons plig teenoor die algemene gesondheid van die bevolking. Ons moet daarvoor sorg dat mense nie onnodig blootgestel word aan siektes wat van diere of diereprodukte oordraagbaar op mense is nie. In die verband is daar natuurlik die grootste moontlike samewerking met die openbare Gesondheidsowerhede.

Ons deurleef op die oomblik 'n ernstige episoötie van hondsdolheid waarin albei voorafgenoemde funksies van veeartsenydienste vervul word. Ook om die rede verskyn daar op ons program vir hierdie kongres 'n lywige symposium waaraan veeartse en medici deel neem.

'n Ander belangrike diens wat die Professie lewer is die versorging van huis en weeldediere. Die diens dra wel meer by tot die geluk van mense as tot hul voorspoed, maar aangesien elkeen van u hier teenwoordig seker 'n dier besit waaraan u besonder geheg is sal u saamstem hoe belangrik die rol van die veearts in die huislike lewe is.

Aangesien die Staat verreweg die grootste enkele werkgewer aan veeartse is, speel hy natuurlik 'n toonaangewende rol tot die standaard wat die professie kan bereik. Om die rede verwelkom ons enige erkenning wat van Staatsweë toegeken word en die verbeterings wat reeds aangebring is, is ongetwyfeld 'n erkenning van die waarde en belangrikheid van die veeartsenydienste aan die land.

Die stigting van diagnostiese laboratoria gaan beslis 'n verbetering aan veeartsenydienste ter plaatse aanbring en ek hoop dit gaan aanleiding gee tot die stigting van 'n paar streeks-laboratoria. Allerhande besware teen navorsingslaboratoria weg van Onderstepoort word geopper. Ons wonder of al die besware goed gegrond is? Daar bestaan die moontlikheid van oorsentrilisasie. 'n Bietjie mededinging is soms 'n baie gesonde stimuleermiddel.

Daar word dikwels die klagte gehoor dat daar 'n tekort aan veeartse is, die klagte is geregverdig, maar die tekort word beklemtoon deur 'n mate van wandistribusie van die beskikbare mannekrag.

Om die tekort in die reine te stel word nou baie meer studente jaarliks op Onderstepoort opgeneem as ooit tevore.

'n Ander moontlike hulpmiddel tot die uitwissing van die tekort sou wees om veeartse tot 'n mate weg te lok van die digbewoonde gebiede. Die wandistribusie wat bestaan word alleen deur ekonomiese druk veroorsaak. Op die oomblik kan veeartse meestal slegs hulself vestig waar daar 'n voldoende huisdierepraktyk is, om die plaasvee praktyk te subsideer. Ons vra dus of dit nie moontlik so wees om deur middel van deeltydse staats en munisipalebetrekkings meer veeartse op die platteland aan te moedig nie?

Die groot vermeerdering aan die getal studente wat jaarliks na Onderstepoort toegelaat word is 'n ernstige poging om die tekort aan

veeartse aan te vul. Ek glo egter dat die groot meerderheid van veeartse daarvan oortuig is dat die huidige Fakulteit baie gou oorlaai gaan word. Ons voel dat die toelating van vyf-en-veertig studente per jaar na die een Fakulteit, ernstige afbreek gaan doen aan die gehalte van die praktiese opleiding wat die studente kan bekom. Dit bly dus nog ons mening dat aandag geskenk moet word aan die moontlikheid van 'n tweede Fakulteit.

Daar word jaarliks groot bedrae geld deur die Staat belê om veeartse op te lei, en persone spandeer baie geld om die opleiding te bekom. Die hele doel van die opleiding is hoofsaaklik om voldoende goed opgeleide veeartse beskikbaar te hê om te sorg vir die gesondheid van ons veeteelt bedryf nl. om die belange van die veeboer te beskerm. Hier kan gesê word dat daarin geslaag is om een van die beste veeartsenykursusse in die westerse wêreld hier op Onderstepoort te verskaf, en daar word pogings aangewend om, indien nodig, verdere verbeterings aan te bring.

Ten spyte hiervan is dit die ondervinding dat ons veeartse oor die algemeen nie op die platteland 'n bestaan kan maak nie.

Na voltooiing van sy studie moet die jong veearts konkureer met allerhande instansies en organisasies en selfs persone wat hulleself alleen ten doel stel om munt te slaan uit die veeboer en diere-eienaar. Die middels wat oor die lengte en breedte van die land verkoop word, vergesel van vrye advies en raad van die verkopers, vind maar al te vryelik byval by die boer, want dan hoef hy mos nie daardie hoë fooie aan 'n veearts te betaal nie. (Dit het nou mode geword om te kla oor die fooi wat 'n veearts vra, afgesien van wat die fooi mag wees). As dit moontlik sou wees om die skade wat aan die veeboerdery jaarliks berokken word deur die vrye advies wat deur kwaksalwers verskaf word, om van hulle middels ontslae te raak, te beraam sou dit 'n ontsaglike som beloop.

Baie van die middels is gevaarlik, ander het indirekte gevolge wat vir die oningeligte persoon onverstaanbaar is.

Ons mediese kollegas is net so bekommerd as onsself oor die geweldige verkoopsorganisasies wat middels van enige soort aan mense, ja en aan die dokters self, verkoop. Daar is blykbaar geen perke aan die vindingrykheid van die verkoopers om middels van die hand te sit nie. Dit word oor die algemeen aanvaar dat nie veel meer gedaan kan word om die onbeperkte verkwansel van middels te beheer nie. As dit egter sou gebeur, soos wel die geval met 'n sekere middel oorsee was, dat 'n skadelike middel aan die publiek verkoop word sou hulle baie gou vra waarom hulle dan nie meer beskerm is teen wanpraktyke nie.

Aan hierdie misbruik van die vee-eienaar se liggelowigheid is daar nie enige regstreekse optrede wat ons kan of wil aanbeveel nie. As mense die reg het om hulself dood te dokter het die veeboer seker die reg om te maak wat hy wil met sy diere. Ons kan egter deur middel van 'n sekere mate van beskerming, en die verskaffing van veeartsenydienste teen redelike koste, stadig die wanpraktyke wat bestaan die hoof bied.

Die amendamente aan die Veeartswet wat mnr. le Roux hopelik volgende jaar voor die Volksraad gaan lê sal tot 'n mate daartoe bydra om onwettige praktyke onder beheer te bring.

Die daarstelling van meer uitgebreide Staatsveeartsenydienste, wat nou vinnig plaasvind, gaan ook baie daartoe bydra om wanpraktyk te ontmoedig. Inderdaad, dit was seker juis die gebrek aan voldoende

veeartsenydienste van enige aard wat die geleentheid geskep het vir die geweldige uitbreiding van ongewenste verwikkelinge in die verlede.

Ons het verlede jaar vir die eerste keer 'n kongres weg van Onderstepoort gehou. Dit was 'n volslae sukses. Dit was 'n proef waaruit geblyk het dat groot voordele moontlik sal voortvloei. Ons is in die verlede tot 'n groot mate gestrem in ons ontwikkeling deur 'n te nougesette, 'n te enge, toenadering aan probleme wat wel veeartsenykunde raak maar nie juis 'n deel daarvan uitmaak nie.

Die neiging om die besondere enge uitkyk op die lewe te ontwikkel begin al in ons studente jare. Ons kom hier na Onderstepoort en verkeer tot 'n groot mate in afsondering van alle belange behalwe veeartsenykunde. Ons word byna geïndoktrineer met 'n rein veeartsenykundige filosofie.

Die hou van Jaar Vergaderings op verskillende plekke oor die land gaan bydra om veeartsenykundige aangeleenthede meer pertinent in die openbaar te stel, en ons as 'n groep 'n breër uitsig te gee.

Navorsing is 'n onmisbare deel van enige wetenskap, maar die toepassing van die resultate van navorsing in die vorm van voorligting ens. is net so belangrik, as die beste voordeel daarvan verkry moet word. Dit is ons oortuiging dat die hou van kongresse op verskillende plekke 'n materiële bydrae tot die verspreiding van kennis kan lewer, en ons vertrou dus dat die proef van verlede jaar binnekort herhaal sal word, en wel met die ondersteuning van die Departement Landbou-tegniese Dienste.

Hierdie oorweging is dan ook een van die redes waarom so baie van ons voel dat 'n tweede Fakulteit meer voordele as nadele sal inhou.

Ek het vroeër gesê dat ons daarvan oortuig is dat die huidige veeartsenykursus hier op Onderstepoort goed is. Ons het rede om te glo dat dit baie goed is. Daar is egter een groot leemte wat veroorsaak word deur geografiese ligging, dit is dat ons studente in isolasie verkeer. Hulle aanraking met studentelewe is te beperk. Hulle mis dus een van die grootste voordele van 'n akademiese opleiding d.w.s. voldoende aanraking met ander sienswyses. Die normale omgang tussen grootgetalle studente is iets wat nie vervang kan word deur enige kunsmatige hulpmiddels nie.

Terwille van die welsyn van die Professie as geheel sou ek graag hier 'n verbetering wou sien.

THE SOCIAL FUNCTIONS AND ENTERTAINMENTS

Accommodation at the Hotel Boulevard

Because delegates, members and guests had been pleased with the idea of being accommodated at the same Hotel in Durban last year, it was suggested that a similar endeavour should be made to repeat the experiment at Pretoria. Many people did arrange accommodation at the Hotel Boulevard.

Attendance at the Opening Ceremony

A large number of guests attended the opening ceremony. Among them can be mentioned the Rector of the University of Pretoria, Prof. Rautenbach, the Secretary for Health, Dr. B. M. Clark and a number of Senior Officers in his Department. A number of Senior Medical Officers of Health attached to Municipal Health Authorities were present, among them Dr. M. L. Freedman (Johannesburg), Dr. Erasmus (Germiston), Dr. Bernstein (Vereeniging). Senior Officers of the Department of Agricultural Technical Services were present. Mr. Knobel and Mr. Labuschagne of the National Parks Board, Mr. Hirzel of the Livestock and Meat Industries Control Board, Mr. Letty, General Manager of the S.A. Poultry Association and many other prominent and interested persons attended the opening ceremony. The wives of members, delegates and guests were also in attendance at the opening of the Congress.

Entertainment of the Ladies

A number of ladies visited the works of the Transvaal Pearl Plastics, in Mitchell Street, where artificial flowers are manufactured. The Proprietor, Mr. Max Burger, kindly provided tea and displayed his very artistic "blooms" to the ladies. The Association is grateful to Mr. Burger for his co-operation and attention to its needs.

The Social Functions

A very homely and extremely pleasant evening was spent attending the Braaivleis, so generously sponsored by the General Manager and Staff of the Livestock and Meat Industries Control Board. Nearly two hundred persons attended this truly South African social function.

The Buffet-Supper was also very well attended and appeared to be enjoyed by all.

The popular presentation by the President, assisted by Mrs. Steyn, of the trophies won at tennis, golf and bowls, was enjoyed by everyone.

THE SPORTING EVENTS

The sports afternoon was graced by excellent weather and the sportsmen gave a good account of themselves.

The Tennis Trophy was won by Mrs. R. du Toit and Dr. P. J. J. Fourie; the Golf Trophy by Dr. Terblanche and the Bowls Trophy by Drs. A. M. Diesel, S. W. J. van Rensburg, G. F. van der Merwe and G. D. Sutton.

PRESENTATION OF SCROLLS TO HONORARY ASSOCIATE MEMBERS

A very pleasant function was fulfilled on Friday 28th September, 1962, when the President presented scrolls of Honorary Associate membership to the following distinguished persons:

Dr. Harry Nelson (Hon. Ass. Mem., 1948).
Dr. J. W. Groenewald (Hon. Ass. Mem., 1951).
Dr. J. G. Louw (Hon. Ass. Mem., 1951).
*Dr. R. J. Ortlepp (Hon. Ass. Mem., 1951).
*Dr. G. Theiler (Hon. Ass. Mem., 1951).
Dr. J. J. Morris (Hon. Ass. Mem., 1956).
Mr. P. M. Bekker (Hon. Ass. Mem., 1959).
Dr. B. M. Clark (Hon. Ass. Mem., 1962).
*Dr. B. A. Dormer (Hon. Ass. Mem., 1962).
*Dr. A. Kipps (Hon. Ass. Mem., 1962).
*Dr. K. F. Meyer (Hon. Ass. Mem., 1962).

*Presented in absentia.

The late Dr. van den Ende was the only other distinguished person on whom the title of Honorary Associate Member of the Association had been conferred.

DISCUSSION ON PAPERS PRESENTED AT THE ANNUAL CONGRESS HELD AT ONDERSTEPOORT ON 25th-28th SEPTEMBER, 1962

SYMPOSIUM ON RABIES IN ANIMALS IN SOUTH AFRICA

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RABIES: A REVIEW OF THE TYPES OF VACCINES IN GENERAL USE AND THEIR METHODS OF PREPARATION

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At the outset it is necessary to make it clear that in this paper there is not even a suggestion that any results of original research are being presented. At Onderstepoort no basic research whatever on the production of immunity against rabies is being carried out. The reason for this apparent deficiency is that the available staff in the Virology Department are so overloaded with work on a mass of problems connected with a wide variety of other diseases into which little or no research is being done outside the boundaries of the Republic, that they rely entirely on the Expert Panel on Rabies of the World Health Organization for information on rabies. This body of experts have available to them the results of research work conducted throughout the world. In addition, from the very nature of their organization, they are in a position to organize research on the basis of international collaboration between recognized institutes on a scale that we could not hope to emulate. Therefore, the considered opinions and advice of the Expert Panel are accepted and at Onderstepoort modifications of techniques are introduced only to meet the requirements of the laboratory organization.

TYPES OF VACCINE AND THEIR PREPARATION

No consideration of anti-rabies immunisation would be complete without reference to the classical work of Louis Pasteur, since a derivative of his virus fixé is the basis of several vaccines in use today.

This strain of virus was isolated on the 19th November, 1882, and has been maintained at the Institute Pasteur, Paris, solely in rabbits from that date. Originally the strain of virus was maintained by serial rabbit passage, i.e. when an infected rabbit was sacrificed in extremis, almost invariably on the 6th day, the brain was removed with aseptic precautions, an emulsion prepared in 0.85 per cent saline and immediately subinoculated intracerebrally into other rabbits. This procedure was fol-

lowed until April, 1952, when it was decided to passage the virus only once a month, the infective brain material being stored in pure glycerol at about 5°C in the interim. The harvested brains are tested for bacterial sterility. examined histologically for the typical lesions produced by the fixed virus and the virus content determined by serial dilution in rabbits. A 1:15,000 dilution of brain must kill 6 out of 7 rabbits, a 1:16,000 dilution 5 out of 10 rabbits, a 1:17,000 dilution only an occasional rabbit and a 1:18,000 dilution is not infective. It will be seen, therefore, that the characteristics of this virus are constant. By June, 1953, the strain had undergone 1,908 rabbit passages since its isolation so that today it has been passed well over 2,000 times.

This virus was used for the first time for the immunisation of man in July, 1885, when in its 90th passage. The method consisted of drying the spinal cords of rabbits, which had succumbed to intracerebral infection, over potassium hydroxide for periods of from 1 to 14 days. Rabbits that received emulsion of cord dried for periods longer than 6 days did not die, while those that received similar emulsion of cords dried for less than 6 days died after periods of incubation progressively increasing from 7 to 14 days. This was taken to indicate a further progressive attenuation of the virus fixé by drying. A course of 13 daily injections starting with cord material dried for 14 days was adopted and the results were considered to be satisfactory.

In this way the therapeutic treatment of man by immunisation as soon as possible after being bitten by a rabid canine had its inception and the imprint of the method, involving a prolonged series of daily injections is apparent even today. It is obvious that to maintain supplies of the required material to treat large numbers of patients presenting themselves at irregular intervals would require a vast and uneconomical organisation. For that, if for no other reason, the method is today merely of historical interest, having been replaced by other more practical and probably more effective methods, but it should be remembered that the original Pasteur virus fixé is the basis of many of these methods.

A.—INACTIVATED VACCINES

It is not the intention to describe in detail the method of preparation of any of the different vaccines inactivated either by chemical or physical means but rather will the general principles be outlined so that veterinarians will be conversant with the nature of the products which are being handled.

1. Inactivated by Phenol (Semple Type)

This is the type of vaccine produced at the Institute Pasteur, Paris, using the Pasteur strain of fixed virus propagated in the brains of sheep. The final product which contains no living virus consists of a 5 per cent brain emulsion in 1 per cent phenolised saline.

Young healthy sheep weighing about 42 kilos are selected and kept under observation for a period of not less than 3 weeks as a safeguard against possible intercurrent infection. Then, with full aseptic precau-

tions the skull is trephined so that 0.5 ml. of a 10 per cent emulsion of fixed virus may be injected into the lateral lobe of the brain as a single injection. The first symptoms of rabies appear usually on the 7th day and the sheep is sacrificed on the 9th day when it must be down but still alive. The brain is removed with aseptic precautions and placed in a sterile air-tight glass container for storage at −20°C until used. This period of storage, which must not exceed 30 days, is necessary to enable the requisite aerobic and anaerobic sterility tests to be carried out and for an accurate determination of the virus concentration by titration intracerebrally in rabbits. On completion of these tests the brains, still in the sterile containers, are rapidly thawed in a water bath at 37°C prior to homogenisation in a mechanical grinder such as a Waring blendor. Sufficient 0.85 per cent saline containing 1 per cent phenol is then added to produce a 5 per cent brain emulsion which is again homogenised before incubation at 22°C for 24 hours. After taking the samples required for bacterial sterility tests, virus inactivation test and potency test, the vaccine is dispensed into 5 ml. ampoules. During the process of ampoulling the vaccine must be continuously homogenised by a mechanical stirrer to ensure that the contents of all ampoules are absolutely identical.

The final vaccine may be stored before use for a period not exceeding 5 months at a temperature between 2 and 5°C. Under no circumstances must it be frozen since the antigenic potency is seriously impaired.

A normal course of treatment consists of 20 daily injections. In the case of severe bites about the head and neck it is recommended that 30 injections be given.

2. Inactivated vaccine recommended to meet the requirements of the United States National Institutes of Health (N.I.H.)

The strain of virus used is the Pitman-More strain of fixed virus which is usually propagated in the brains of rabbits but horses, sheep and goats may be used to replace rabbits.

The vaccine comprises 20 per cent brain tissue in which the virus is present in a titre of not less than 10^{-6} Ld50, suspended in buffered phosphate saline, inactivated by 0.25 per cent phenol and containing 1:10,000 merthiolate as preservative. It is stipulated that each dose of vaccine administered must contain an amount of brain tissue equivalent to that contained in 2.0 ml of a 5 per cent suspension, thus the dose may be varied with the concentration of tissue. Essentially this vaccine closely resembles the Institute Pasteur product and the most stringent requirements as regards sterility, virus inactivation and potency testing are laid down.

3. Inactivation by Physical Means

In the past heat in addition to slow desiccation, has been used as the inactivating physical agent. The underlying principle was to expose virus emulsions for a given period of time to different degrees of heat up to 80°C. This resulted in progressive inactivation of the virus and the course of injections commenced with material completely inactivated at the highest temperature. Heat as the inactivator has been supplanted by the use of exposure to ultra-violet light as the virucidal agent.

Ultra-violet energy is unable to penetrate biological substances therefore, for effective exposure, the material to be irradiated must be presented in the form of a thin film not exceeding 1.0 mm in depth. The biological effect of ultra-violet light, for all practical purposes, is instantaneous and therefore the time of exposure should be short because, with prolonged exposure, the degree of chemical changes in the material increases. To meet these requirements there have been developed certain types of apparatus, available commercially, by means of which a suitably clarified infective brain emulsion may be exposed to ultra-violet light for the desired length of time in a continuous flow for large scale vaccine production.

This method of production has one great advantage in that the final product may be stored frozen as an aid to the maintenance of bacterial sterility without loss of antigenic potency. During the process of freeze-drying there is some loss of potency but thereafter the potency is remarkably stable for long periods of time.

The vaccine prepared in the Pathological Laboratories of the Department of Health in Cape Town is an ultra-violet light inactivated vaccine using the Pitman-Moore fixed virus propagated in rabbit brain. It conforms to the standards laid down by W.H.O. and in addition is checked for potency by comparison with a standard product obtained from time to time from W.H.O.

4. Propiolactone Inactivated Vaccine

Peck and his co-workers adapted the fixed virus strain obtained from the American National Institute of Health to propagation in duck embryos. Emulsions of duck embryo tissue containing virus in high titre was found to be inactivated completely by β propiolactone in a concentration of 1:6,000 but not by lower concentrations. Therefore, for routine vaccine production β propiolactone in a concentration of 1:3,000 was used for inactivation and the resulting product was found to be fully antigenic.

The great advantage of this type of vaccine is that it contains no mammalian brain tissue and therefore the absence of myelin is regarded as a safe-guard against the production of post-vaccinal neuroparalytic accidents.

It is necessary to point out that, following the initial report of the use of fertile duck eggs for the propagation of rabies virus and the production of high titre virus emulsions, the antigenicity of the virus was investigated in a limited series of experiments on laboratory animals and human volunteers in the form of a live attenuated virus vaccine. In subsequent reports on more extensive trials Peck merely mentions that "it seemed prudent to inactivate the virus" and selected β propiolactone for the purpose.

B.—LIVE ATTENUATED VIRUS VACCINES

1. Chick Embryo Vaccine (Flury Vaccine)

On 29th March, 1939, a girl named Flury died after an illness of 4 days duration following exposure to the licks of a dog which died of confirmed rabies 5 days before she became ill. Harold Johnson of the Rockefeller Foundation carried out the autopsy, and confirmed the clinical diagnosis of rabies by inoculation of suitable material intracerebrally into mice, in which street virus was demonstrated. At the same time Johnson injected the human brain tissue suspension intracerebrally into day-old chicks. In the first passage it took 30 days before the chicks showed signs of paralysis but on serial passage the period of incubation decreased to 6 days. After 136 day-old chick passages the strain of virus was acquired by Hilary Koprowski of Lederle Laboratories, New York, who passed it twice more in day-old chicks and then adapted it to multiplication in this chick embryo, in which cell system he carried it for a further 40 passages. At this passage level the virus, now known as Flury virus low egg passage level (LEP) was shown to be virulent by the intracerebral route for mice, cotton rats, hamsters and guinea-pigs but relatively avirulent for rabbits. Mice, cotton rats and hamsters succumb to extraneural injection but guinea-pigs are relatively resistant. Rabbits and dogs do not react specifically to the virus on intramuscular injection but a small percentage of cattle and cats may react and die. It is the LEF Flury virus that is used for the mass immunisation of dogs by the intramuscular injection of a single dose of concentrated chick embryo emulsion containing live LEP Flury virus at the 40-50th egg passage level.

As a matter of general interest it should be mentioned that Koprowski continued the serial passage in chick embryos of this strain of virus which, it will be noted, had had no contact with mammalian brain or nervous tissue since the time of its isolation. At the 180th passage a sudden change in the pathogenicity of the virus was detected in that 3 out of 6 mice, 28-35 days old, failed to succumb to the usual intracerebral injection of embryo suspension. In the next egg passage none of the mice died. At the time it was feared that for some unaccountable reason the virus had failed to multiply in the injected chick embryos and that the strain had been lost. To recontinue the series, material of the 170th passage that had been stored frozen for about 4 months was used, this material being shown to be fully virulent for adult mice. Again at the 174th passage the test mice failed to react. The procedure was repeated in two further series of experiments and on each occasion between the 172nd and 174th passage the chick embryo suspensions became non-pathogenic for young adult mice. Meanwhile it was found that guineapigs which had received chick embryo suspensions avirulent for adult mice were resistant to challenge by fully virulent virus. This led to a detailed investigation of the apparently non-pathogenic virus between the 180th and 205th egg passage level. The results of a long series of critical experiments may be summarised by stating that the virus on intracerebral injection is non-pathogenic for adult mice over the age of 14 days, dogs and rabbits but that baby mice younger than 8 days of age and monkeys are fully susceptible.

Hamsters and guinea-pigs are resistant to concentrated embryo suspensions but susceptible to diluted suspensions lethal to baby mice. At this passage level, known as Flury virus high egg passage level (HEP) the strain has been used for the immunisation of man, in addition to dogs and probably will be used for the immunisation of cats and cattle.

METHOD OF VACCINE PREPARATION

The exact details of vaccine preparation is of interest only to laboratory workers actively engaged upon research on rabies. To summarize the position briefly it will suffice to state that fertile eggs after 9 days of preincubation are used. These eggs are infected via the yolk sac with 0.25 ml of a 20 per cent suspension of seed material. These eggs are incubated for a further 8 days at 36.5°C when all the live embryos are harvested with full aseptic precautions, and immediately chilled but not frozen. By any suitable mechanical means, such as a Waring blendor, the embryos are finely minced and sufficient sterile distilled water containing 500 units of penicillin and 1 mgm of streptomycin are added to produce a 66 per cent emulsion which is again fragmented in the cold. This emulsion is squeezed through a double layer of sterile gauze and an equal volume of buffered phosphate-lactose-peptone added to produce a 33 per cent emulsion containing 1 per cent lactose and 5 per cent peptone. After further homogenisation the emulsion is distributed in 3 ml amounts in 5 cc ampoules for desiccation from the frozen state in an Edwards freeze-drier. The final product which must have a moisture content of less than 1.0 per cent is sealed in an atmosphere of purified dry nitrogen. Before issue each batch of vaccine must conform to the prescribed standards of sterility, safety and potency. Multiple packs are prepared either by keeping the volume of material to be freeze-dried constant and doubling the percentage concentration of tissue, or by increasing both the volume and the concentration bearing in mind that after reconstitution with sterile distilled water each dose of vaccine must be 3 ml of a 33 per cent tissue suspension administered intramuscularly.

2. Chick Embryo Vaccine (Kelev Strain)

Komarov working in Israel isolated a number of virus strains which he adapted to propagation in the developing chick embryo. Of these, one, which he designated the Kelev strain, rapidly lost pathogenicity for animals on serial passage while retaining antigenic potency so that by the 60th to 70th passage level it produced no signs of infection on extraneural injection into hamsters, guineapigs, rabbits and dogs. It retained virulence for suckling mice on intracerebral injection.

Vaccine prepared by methods exactly similar to those used for the production of Flury vaccine was used for the mass immunisation of dogs and for the protection of cattle, apparently with excellent results. Sufficient data from the use of this vaccine have not been accumulated to warrant a comparison with Flury vaccine as to the value of the strain as an immunising agent for the protection of domestic animals or man but the results are most encouraging.

C. PASSIVE IMMUNISATION WITH HYPERIMMUNE SERUM

Although the value of hyperimmune serum for the post-exposure treatment of both animals and man has been known for many years, little use has been made of it in general practice, until the advent of the live attenuated vaccine. Since then its place in routine prophylaxis has been established but for economic reasons, except in the case of very valuable animals, it is doubtful whether it has a place in veterinary medicine.

Again no good purpose would be served in dealing in any detail with the method of production since this varies from laboratory to laboratory though the basic principles remain the same.

Hyperimmune serum is produced in horses by the stimulation of the antibody producing system by the administration of increasing doses of virus usually starting with inactivated virus and ending with massive doses of fully virulent virus. Thereafter the animal is rested prior to the administration of a massive booster dose of antigen after which the serum is collected.

Apart entirely from the method of hyperimmunisation it is obligatory that the final product before the addition of any preservative must be tested for antibody content by neutralisation of virulent virus according to the technique laid down by the World Health Organization. The results of these tests must show that the potency of the raw serum is at least 2.5 times that of a standard comparative serum. Thereafter it may be preserved and purified the recommended dose being fixed by the manufacturer in accordance with the standards laid down.

So much for the types of vaccines that are available and the basic principles underlying the methods of production. The next point which merits attention is the efficacy of these products under field conditions.

Although the needs for potency tests has been recognised since the days of Pasteur, their absolute necessity was not appreciated until an investigation of the vaccines produced in all good faith, with meticulous care, by various commercial laboratories in America showed that many were of very low if not negligible immunogenicity. This led to a concerted effort to develop standard potency tests which would ensure the distribution only of highly potent vaccines, the maintenance of that standard of antigenicity, and a means of comparing the relative merits of the same or different vaccines produced by different laboratories. This proved to be no simple matter.

In the case of many bacterial and virus vaccines a potency test on the final product is comparatively simple. All that is necessary is to apply the vaccine to a suitable experimental animal, if not the actual species to be immunised, and thereafter, after a suitable interval, to challenge the immunity produced by the injection of a predetermined known number of virulent or infective doses of the particular bacterium, virus or toxin and noting the outcome as compared with the simultaneous injection of a number of untreated control animals. But in the case of rabies the state of affairs is entirely different.

In the first place these vaccines were developed for the post-exposure treatment of fully susceptible individuals. Therefore, the ideal test should

simulate conditions of natural exposure to infection followed by the recommended prophylactic treatment. This would necessitate the introduction of the virus through a wound, approximating that produced by a dog bite, followed by a course of treatment, after which the tester must sit back and wait for something to happen or not to happen amongst the treated animals and the controls. It is well known that the susceptibility of different species of animals to a given strain of virulent street virus varies within wide limits and even today we have no accurate knowledge as to the relative susceptibility of any ethnic group of humans and say a particular strain of guinea-pig. It is well known that lacerated bites on the face and neck are far more dangerous than say simple bites through clothing on the thigh and as the incubation period following extraneural infection may be longer than 6 months it is obvious that it is impracticable to apply the ideal potency test as a routine to any given rabies vaccine. The result is that a compromise has been reached whereby antigenicity is determined by the immunity produced in a test animal to the intracerebral injection of an agreed number of infecting doses of virus. Such a test is the Habel Test for Potency.

1. The Habel Test

For this test a minimum of 100 White Swiss mice 4–6 weeks of age and uniform in weight, of either sex, are required.

On Monday, Wednesday and Friday of two successive weeks each of 60 mice receive intraperitoneally 0.25 ml of the vaccine so diluted as to comprise a 0.5 per cent emulsion of the original wet brain used for the preparation of the vaccine. Each mouse, therefore, receives 6 doses. On the 14th day after the first dose the intracerebral challenge is carried out. For this challenge, a standard virulent street virus is distributed on request to manufacturing laboratories with instructions down to the minutest detail as to how it is to be propagated, stored and prepared. The immunised and control mice are divided at random into groups of ten, each of which receives intracerebrally 0.03 ml of a serial ten-fold dilution of virus. All mice are observed for 14 days and only deaths occurring after the 5th day are considered as rabies death. Mice surviving the 14 days but showing symptoms of progressive paresis are recorded as rabies deaths. The 50 per cent end points are calculated by the method of Reed and Muench. In this way there is calculated the dilution of test virus which kills exactly half of the vaccinated and control mice. The potency is expressed numerically as the difference between the logarithm of the reciprocal of these two dilutions and must be not less than 3, that is 1,000 minimal lethal doses.

To check technique, methods and materials and also to enable a comparison to be made of vaccines prepared in different institutes it is recommended that a similar potency test should be carried out from time to time on a standard vaccine issued with full instructions for that purpose.

Bearing in mind that it is obligatory to carry out a potency test on every batch of vaccine produced it is obvious that exceedingly large numbers of mice are required for this purpose alone. To meet this objection there has been developed the Modified Habel Potency test.

2. The Modified Habel Potency Test

In checking the results of large numbers of potency tests of vaccines of high, low, and intermediate antigenicity, it was found that if approximately 500 M.L.D.'s is used as the challenge dose then more than 50 per cent of the immunised mice will survive if the potency of the vaccine is acceptable. Therefore, it is permissible to immunise only 20 mice with vaccine diluted as for the full test and to challenge each on the 14th day with a dilution of virus containing 500 lethal doses per 0.03 ml. If less than 10 die or become paralysed during the following 14 days then it will be found that the given vaccine will conform to the minimum requirements of the full test.

3 The Potency Test requirements of the United States National Institutes of Health (N.I.H.)

In 1953 the N.I.H. issued its revised minimum requirements for all rabies vaccines distributed under United States licence. This is an antigen extinction type of test based upon the immunisation of groups of mice by the intraperitoneal injection of 2 doses of 0.5 ml of serial 5-fold dilutions of vaccine at an interval of 7 days followed by an intracerebral challenge of standard virus diluted to contain between 5 and 50 M.L.D.'s of virus 7 days later. The potency is expressed as the amount of brain tissue in milligrams required to protect half the mice. Again this is compared with the potency of a standard vaccine.

4. The Rabbit Potency Test.

This test has been devised for use with the Louis Pasteur strain of fixed virus which is used for intracerebral challenge of rabbits immunised by repeated injections of vaccine. Since the properties of the fixed virus are so constant and are known so accurately no difficulty is experienced in determaining potency of a vaccine if the procedure laid down in great detail is followed with meticulous care.

The above tests have been devised primarily for testing the antigenic potency of inactivated virus vaccines. An entirely different test has been laid down for chick embryo vaccines containing attenuated live virus. Because our entire campaign for the control of rabies is based upon the use of LEP Flury vaccine for the prophylactic immunisation of dogs it is of interest to outline the test applied in the laboratory to every batch of vaccine prior to issue.

5. Potency Test for LEP Flury Vaccine

W.H.O. distributes to recognised laboratories the test virus currently advocated by the United States N.I.H. Previously the strain of virus used was the New York City (N.Y.C.) strain of street virus but from about the beginning of 1962 this was changed to a strain known as the C.V.S. fixed virus. The N.Y.C. virus is issued in freeze-dried form and after reconstitution, according to directions, in sterile distilled water is injected in 0.1 ml amounts bilaterally into the masseter muscle of adult dogs.

At Onderstepoort we use about 20 dogs i.e. the full capacity of our specially designed rabies isolation kennels. Dogs which go down are sacrificed when moribund for aseptic removal of the submaxillary salivary glands. A small portion of each gland is removed for deterimination of the virus titre by serial ten-fold dilution intracerebrally in young adult mice, the balance being stored at a temperature not higher than −50°C. All glands with a virus titre less than log 5.5 are discarded. The selected glands are thawed rapidly and macerated to form a 10 per cent emulsion in 10 per cent normal rabbit saline, which, after clarification is dispensed in 1.0 ml amounts in glass ampoules for sealing and storage in the dry ice cabinet. A random sample is now taken for virus titration in guinea-pigs. This is carried out by setting up serial two-fold dilutions of the virus for injection in 0.25 ml amounts into the gastrocnemius muscle of guinea-pigs. All deaths are recorded for a period of 21 days (paralysis is regarded as a death) when the highest dilution which kills 100 per cent of the guinea-pigs is noted. If all the guinea-pigs which receive the 1/80 dilution die and 40 per cent of those receiving the 1/160 dilution survive then 1/80 is regarded as the critical end point and for the potency test proper twice that dose i.e. the 1/40 dilution is used for challenge.

For the test, groups of 10 guinea-pigs each weighing not less than 400 grams are given 0.25 ml of a 1 in 7 dilution of a reconstituted dog dose of vaccine intramuscularly into the right leg. After an interval of 21 days together with a group of 10 control guinea-pigs, they receive 0.25 ml of the test virus in the other leg. The vaccine is considered satisfactory if not less than 70 per cent, but not less than 7, of the challenged vaccinated guinea-pigs survive without showing any signs of paralysis, and not less than 80 per cent of the controls die.

Slight Modifications of Procedure apply to the C.V.S. Strain

So much for the types of rabies vaccines which are available, and the basic principles underlying the methods of production. It merely remains to emphasise that W.H.O., through its Expert Panel on Rabies has performed an invaluable service by standardising methods of product on and laying down obligatory potency tests. What the result of the use of any of those vaccines may be is an entirely different story which is dealt with elsewhere in this symposium.

THE THERAPEUTIC AND PROPHYLACTIC VALUE OF ANTI-RABIES VACCINES

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To bring this symposium to a conclusion I feel it is necessary to follow the example of K. F. Meyer and pose the question "Can man and animals be protected against rabies?" Without hesitation it is possible to answer that question in the affirmative, both from direct experimental evidence, such as that illustrated in the application of vaccine potency tests, and from less spectaculour field observations. Having agreed upon that point there immediately spring to mind two further questions:—

1. How successful are our efforts to protect man and animals against rabies?
2. Of the many types of vaccines available which is the one of choice?

Even today some 78 years after Pasteurs classical pioneering effort there appears to be realy only one answer "We do not know "

In attempting to answer these two questions it is necessary to consider the problem from two entirely different angles—

(*a*) post-exposure therapeutic treatment;
(*b*) prophylactic pre-exposure immunisation possibly combined with post-exposure therapy.

A.—POST-EXPOSURE THERAPY

I feel it is necessary to discount a considerable portion of the data accumulated prior to 1953, because of the lack of adequate potency testing of the therapeutic agents used. For this reason reliable data are limited.

We may consider it axiomatic that once an animal or man shows clinically recognizable signs and symptoms of rabies the outcome will be fatal, in spite of the belief that on rare occasions infected animals may develop an abortive form of the disease followed by recovery and immunity. On the other hand there is abundant evidence to show that not every animal that receives an extraneural injection of many infective doses of a known virulent virus, or every individual that is bitten by an infective rabid dog, will develop rabies.

Scrutiny of the Onderstepoort records shows that 100 per cent of dogs that received an injection of virulent New York City virus into the masseter muscles died though the virus content of the salivary glands varied within wide limits. When these figures were presented to the Expert Panel on Rabies of W.H.O. they occasioned considerable surprise since the mortality rate was not expected to exceed 80 per cent. Moreover in the potency test for Flury vaccine a mortality rate of 80 per cent among the control guineapigs is acceptable.

In the case of man it is not easy to obtain accurate figures on the infectivity rates in humans bitten by rabid dogs but data supplied by Veerareghaven (1954) in India are illuminating. He showed that of 44 persons bitten by animals proved to be infective since one or more of the individuals or animals bitten by them died of rabies, only 19 (43.2 per cent) died. If there are included in the total a further 9 fatal cases who died during the course of therapeutic treatment then the known infectivity rate was 28 out of 53 (52.8 per cent). From this it is deduced that persons butten by infective rabid animals have just about a 50-50 chance of escaping infection.

The same author collected additional data on persons bitten by dogs proved to have been *infected*, but not *infective*, by laboratory diagnosis or presumed to be infected by virtue of clinical symptoms but with the diagnosis not confirmed by subsequent laboratory diagnosis. A total of 106 were not treated and 9 died before the completion of treatment. Of these 115, 28 (24.4 per cent) died. This means that after being bitten by a rabid but not proved infective animal there was roughly 3 chances in 4 of escaping infection.

These figures indicate the extreme care that must be taken in evaluating the beneficial results of post-exposure treatment but at the same time emphasize the great importance of determining the infectivity of the salivary glands of any suspected rabid animal with a history of human contact.

Using a potent Semple type 5 per cent sheep brain vaccine produced with the Pasteur fixed virus it was found that out of a total of 1,461 persons observed 1,329 presented themselves for a full course of treatment. Of these only 10 (0.75 per cent) died but do not forget that of the untreated group only 24.4 per cent died. On the other hand 17 individuals failed to present for the full course and of these 3 (17.65 per cent) died.

It is apparent, therefore, that therapeutic post-exposure treatment of fully susceptible persons is of great value but is by no means infallible. The result of treatment will depend on many factors which will include the species and infectivity of the rabid animal, the nature and location of the bite, the strain of virus involved, the interval between the time of bite and the initiation of treatment, and the type of treatment applied. Clearly there is need for considerable improvement in the efficacy of anti-rabies therapeutic agents particularly in regard to the rapidity of the induction of protection. In this connection a great stimulus to further research has been the comparatively recent development of proved attenuated live viruses such as the Flury virus both L.E.P. and H.E.P. the Kelev virus and the duck embryo virus, which in turn has focussed attention upon the possible value of hyperimmune serum. The result has been that hyperimmune serum has been found to be of great value in post-exposure therapy as indicated in a previous paper. The factor of importance is that the value of the early production of passive immunity far outweighs the confirmed interference with the subsequent production of active immunity resulting from the use of a vaccine. Therefore, the W.H.O. Expert Committee advises the use of serum under specified circumstances.

But what of the type of vaccine to be used in conjunction with serum. All experimental evidence points to the fact that a full course of not less than 12 daily doses of any of the present vaccines is necessary for maximum antibody response. Therefore, any deviation from the present course of post-exposure treatment of fully susceptible persons cannot be advocated. There is considerable evidence that the antigenicity of inactivated vaccines prepared from mammalian tissue is not superior to that of either live or inactivated attenuated virus vaccines prepared from tissue other than mammalian brain. Since there is considerable evidence that the myelin content of mammalian brain is the factor responsible for post-vaccinal neuroparalytic accidents, it is felt that there is no justification for the continued use of vaccines known to contain myelin. The percentage of neuroparalytic accidents is stated by the Expert Panel to be approximately 1 in 600 though on occasion it may be higher. This percentage may seem small but in human practice it is important and there is no consolation in the knowledge that the severity of the accident can be minimised by discontinuing treatment on the appearance of the first signs of paresis, since it is proved that the mortality rate amongst persons whose full course of treatment has been interrupted is significantly, if not alarmingly, increased. It is felt that the time has arrived when a bold decission to substitute H.E.P. Flury vaccine or inactivated duck egg vaccine for mammalian tissue vaccine could be defended before any tribunal on humanitarian, ethical and technical grounds.

B.—PRE-EXPOSURE PROPHYLACTIC IMMUNISATION

1. Man

This is a field of preventive medicine which has received considerable attention during the last decade, even though the percentage of persons who would benefit, due to the hazard of occupational risk, is very small.

The difficulty in maintaining continued mass immunisation against small-pox, diphtheria and recently poliomyelitis, indicates that to use a full course of therapeutic treatment for pre-exposure prophylaxis is out of the question. Therefore, research has been aimed at the reduction of the number of injections compatable with the production of adequate durable protection. This has involved a comparative study of different types of vaccines inactivated and live, the method of administration, the dose and interval between injections, and the safety with and without serum, the efficacy being judged by a quantitative estimation of antibody production. It is obvious that it would be necessary to treat large numbers of individuals for the results to satisfy critical statistical analysis in the full knowledge that any final conclusions might be at fault since serum antibody content is not an accurate index of protection, but is at present the only available yard stick. To review the work that has been done would require another full scale symposium but the results may be summarised briefly as follows:—

(1) H.E.P. Flury vaccine administered subcutaneously or intradermally to man is safe. Probably the L.E.P. virus is equally innocuous

when one considers the number of persons who have handled it throughout the world without accident.

(2) Local reactions of an allergic or anaphylactoid nature may be produced but, though somewhat unpleasant they are of no consequence.

(3) The efficacy of inactivated duck egg vaccine is of the same order as H.E.P. Flury vaccine.

(4) Antigenicity is dependent as much upon total mass of vaccine injected as upon number of doses and interval between doses.

(5) A reasonable, convenient, and effective immunisation schedule is 3 or 4 doses of 0.2 ml administered intradermally followed by a booster after an interval of 6 weeks.

(6) The reduced schedule of injections cannot be expected to produce an antibody response in 100 per cent of recipients though, with the above schedule, the positives should not be less than 80 per cent. The negatives should receive additional boosters until positive.

(7) On exposure, depending on the severity, all that should be necessary is a further booster dose without serum.

2. Animals

It must be accepted that with exceptions, such as Canada with its large population of wild carnivores and in those parts of South Africa which are the natural habitat of the Viverridae, the domestic dog is by far the most important carrier and transmitter of rabies. If rabies is eliminated from the dog population then in due course infection will disappear.

This has been the experience in Central Europe following the tremendous increase in the incidence of the disease in all classes of animals and man after World Wars I and II. This very happy state of affairs was brought about by mass immunisation of domestic dogs as a supplement to the control of domestic pets and the ruthless destruction of ownerless dogs. In Europe a Semple type of inactivated mammalian brain virus vaccine was used as a single injection even though it was well known that a single injection of any vaccine cannot be relied upon to produce immunity in 100 per cent of treated dogs.

When Flury H.E.P. vaccine made its appearance, Malaya embarked upon its classical rabies control programme which was so eminently successful. The results of this campaign were confirmed by a critical field trial in Israel by a W.H.O. team who demonstrated conclusively that final control is dependent upon mass immunisation of dogs as a measure supplementary to, but not as a substitute for, so-called police control measures.

Coming nearer home we have available to us the experience in Southern Rhodesia. In spite of the fact that for the period 1951-57 there were 115 confirmed cases of rabies in slightly more than 700,000 dogs vaccinated, the incidence of rabies decreased from a peak of 149 cases in dogs and 24 in other animals in 1954 to 2 cases in dogs in 1961 and not a single confirmed case in other animals during the 2 years 1960 and 1961.

From the mass of data which it has been quite impossible to present or review in detail, there emerges one salient all important point. Rabies can be eliminated from a given region with the possible exception of Canada and a limited portion of South Africa by the regular continued immunisation of all dogs from the age of 3 months by a single injection of L.E.P. or preferably two injections at an interval of 6 months Flury vaccine as an ancilliary measure to the control and licensing of all dogs, the destruction of ownerless or stray dogs, and the control of the entry and exit of all dogs combined with the education of the people. These measures should be supplemented by an adequate diagnostic service and the maintenance of the necessary supplies of hyperimmune serum and vaccine prepared from non-mammalian tissue either as live H.E.P. Flury vaccine or inactivated duck egg vaccine for the prophylactic immunisation of individuals at occupational risk and the post-exposure treatment of all others. These facts stand out like a pylon in the desert. There remains only the provision of the necessary funds, should it be decided that the control of rabies with a view to its ultimate eradication, is to be undertaken. Given the green light and the funds both the medical and the veterinary professions know exactly how to set about the task.

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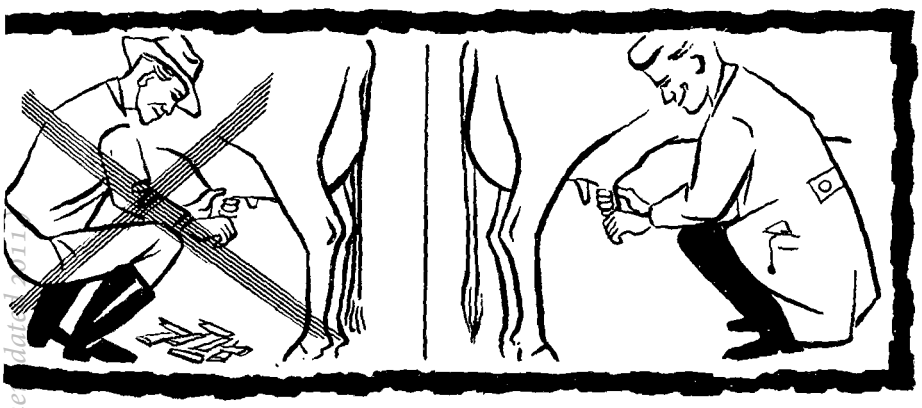

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RABIES SEMINAR

DISCUSSION

DR. SNYMAN said he wished to make a few remarks on the incidence of rabies in different animal species, and pointed to the two groups: on the one hand the small wild viverridae in the central plateau region of the Orange Free State and Karoo and on the other the high incidence amongst dogs in the remaining areas of the Republic. He considered the high incidence in cattle to be due to their inquisitive nature and described an incident in the Vryburg district where 9 out of 14 animals succumbed to the bites of a single meercat. Describing the transmission of rabies from cattle to man he gave an example where exposure occurred through drenching of a sick ox. The frequent occurrence of rabies amongst meercats characterized by a tame appearance, was illustrated by a case of a child contracting the disease after being bitten on the finger by such an animal.

Referring to the incidence amongst dogs Dr. Snyman traced the spread of the disease through Northern Zululand into Natal and expressed the opinion that the permit system was only .001 per cent effective through the lack of co-operation of the public in general, he considered that wholesale inoculation of all dogs in Natal was the only effective measure and stressed that vaccination should continue right throughout the year in order to immunize all young dogs.

PROFESSOR TURNER enquired as to the progress made with the flourescent antibody staining technique and wished to know if it really was as accurate as was claimed.

DR. WEISS stated that research was continuing but it would appear that the technique was not so practical as would at first appear.

DR. MEESER wished to know if Sellers stain had good keeping qualities and how long it could be effectively used. Dr. Meeser also enquired as to the ph of the Institutes' glycerine buffer in view of the recommendation by W.H.O. that a value of 6.8 was essential. The speaker said that Dr. Maré had shown a seasonal incidence of rabies, but he wished to draw attention to the present serious drought in the Northern Transvaal where the incidence of the disease was now very high and suggested that this climatic factor may be responsible for the variable seasonal incidence.

DR. TUSTIN replied that Sellers stain would retain its staining properties provided evaporation was prevented.

DR. WEISS indicated that the ph of the Institutes glycerine buffer was 7 and could be regarded as adequate.

DR. MUNDEL wished to know if biting animals should be killed or not, and what action was necessary when a human was bitten by an animal which 8 days after biting still appeared healthy?

DR. ALEXANDER replied that present evidence shows that if specimens are taken correctly it makes no difference if the animal is killed or not. Where possible animals should be sent to a laboratory whereupon the

correct specimens can be taken. It is important to include the salivary glands for biological tests.

PROFESSOR TURNER considered it essential that the animal should be kept alive so that it can be determined whether treatment should be continued or not.

DR. LEES MAY referred to the seasonal incidence of the disease and noted that a similar increase during drought periods had been experienced in Southern Rhodesia. In addition many outbreaks had been traced to the routes and movements of migrant labour.

DR. CANHAM wished to know what the effect of putrefaction was on the histological and biological tests.

DR. TUSTIN replied that severe putrefaction does make the histological examination very difficult.

DR. ALEXANDER considered it advisable to use antibiotics for the treatment of putrified samples but stressed that a positive diagnosis was conclusive, but a negative diagnosis had little significance.

DR. CANHAM asked if there was any danger in the administration of rabies and distemper vaccine simultaneously.

DR. WEISS stated that some commercial firms where producing such a combined product.

DR. BERNSTEIN enquired if any test was available to test for sensitivity to the brain tissue vaccines.

DR. NELSON was not aware of any such test.

PROFESSOR TURNER wished to coment on the previous papers. With regards to pre-exposure immunization he felt that it was undersirable to use nervous tissue vaccines, and advocated H.E.P. Flury or duck embryo vaccine. In cases of exposure the full course of 14 doses of inactivated vaccine was indicated. Neuroparalytic accidents were relatively uncommon. In California the accident rate was 1:700 to 1:600 of which 80 per cent recovered. In South Africa only 2 cases have been reported after 2,500 treatments. It appeared that the condition was overated. Professor Turner considered the early development and claims for brain tissue vaccines but stressed the importance of using vaccines of full potency and suggested that the newer vaccines may fall short in this property. The ultimate answer was considered to be in the field of tissue culture propogated vaccines.

DR. SCOTT MILLER expressed his appreciation on behalf of the medical health officers present for the invitation to participate in the congress and take part in the discussions.

STUDIES ON SPECIFIC OCULOVASCULAR MYIASIS OF DOMESTIC ANIMALS (UITPEULOOG)

P. A. BASSON — Senior State Veterinarian, Gobabis, South West Africa

Dr. Basson enlarged on the information detailed in the summaries of his previous article and published in the Pre-Congress number of the Journal of the S.A.V.M.A.

He supported his talk by a very interesting film which he had made.

Dr. Basson received hearty congratulations from many colleagues on the outstanding contribution he had made to research on "Uitpeuloog".

SKIN LESIONS IN SOUTH AFRICAN DOMESTIC ANIMALS WITH SPECIAL REFERENCE TO THE INCIDENCE AND PROGNOSIS OF VARIOUS SKIN TUMOURS

J. D. SMIT

Dr. Smit elaborated on his paper and gave some interesting details. This paper was very well received by members.

BLUETONGUE — RECENT ADVANCES IN RESEARCH

P. G. HOWELL — Section of Virology, Veterinary Research Institute, Onderstepoort

The following is a brief summary of the paper presented by Dr. Howell.

The virus of bluetongue presumably originated in the African continent and followed a similar evolutionary pattern to that postulated for the more well defined arbor viruses. Although bluetongue virus differs in many of its biological and physical properties it has in common an insect vector and a mechanism which ensures its continued survival from one season to another. In recent years the disease has made considerable advances and has been diagnosed on the continent of Europe and in Asia.

Early workers established the antigenic plurality of naturally occurring strains but no method was developed whereby naturally occurring strains could be identified and classified on the basis of similar antigenic structure. The adaptation, propagation and attenuation of strains of bluetongue virus on the fertile hens egg made it possible to prepare a polyvalent vaccine which has been used successfully for many years.

The most important advance in recent years has been the propagation of the virus in tissue culture. A typical cytopathic change was observed and the specific inhibition of cell destruction by homologous antibody, made it possible to develop a serum-virus neutralization test, which has been used to identify naturally occurring strains. To date 16 distinct immunological types have been identified.

The high yields of virus obtained from infected tissue cultures have made it possible to prepare a polyvalent vaccine containing representative strains of the established antigenic types. While an effective vaccine will control the incidence of the disease amongst susceptible species, the more effective control of the disease and the limitation of its further extention, will come primarily from an ecological approach. Considering the biological and physical factors which influence the transmission of the virus, together with the complex immunological properties it is apparent that a most fascinating biological problem awaits elucidation.

DISCUSSION

Both Dr. Howell and Dr. du Toit enlarged on the subject matter of their talks which were much appreciated by members.

BLUETONGUE — RECENT ADVANCES IN RESEARCH

THE ROLE PLAYED BY BOVINES IN THE TRANSMISSION OF BLUETONGUE IN SHEEP

PRELIMINARY COMMUNICATION

R. M. DU TOIT, Section of Parasotology — Veterinary Research Institute, Onderstepoort

Received for publication, October, 1962

During the course of the last few years an ever increasing amount of attention has been focussed upon the disease bluetongue, due to the fact that it has made its appearance and in fact established itself in a number of countries outside Africa, to which continent it was previously regarded as being confined.

Prior to the commencement of the present century the disease was described by Hutcheon[1], and Spreull[2] and Theiler[3] recognized it as a specific disease entity. To the latter author may be attributed the discovery of the virus origin of the disease but its actual mode of dissemination remained an enigma until the minute blood sucking midges of the genus *Culicoides* were shown to be responsible for its transmission by du Toit.[4]

In its enzootic areas the disease makes its appearance with absolutely regularity annually, generally occurring in epizootic form during the midsummer or late summer months. The extent of such epizootics varies from year to year depending presumably upon climatic factors. With dramatic suddeness the epizootic ends with the onset of winter when temperatures have dropped sufficiently to curtail insect activity, generally with the appearance of the first frost.

Up until the present no explanation has been forthcoming as to the method by which the virus manages to survive the winter and earlier portion of the ensuing summer only to make its reappearance again during the latter portion of summer.

During the course of the investigation of various diseases in South Africa which make their appearance within those regions where bluetongue is known to occur, the virus of this disease has been recovered on numerous occasions from the blood of cattle upon injection into bluetongue

susceptible sheep. Thus Bekker, de Kock and Quinlan[5], while investigating outbreaks of a form of ulcerative stomatitis in bovines during the course of an outbreak of Foot and Mouth disease in the highveld of the Transvaal, endeavoured to correlate the clinical manifestations observed with bluetongue, the virus of which they regarded as constituting the etiological agent. Mason and Neitz[6], while confirming the fact that cattle were capable of harbouring the virus of bluetongue, cast doubt upon the conclusions arrived at by these authors and stated that cattle after inoculation with the virus of bluetongue display a viraemia only with the development of a *maladie inapparente*.

While investigating tick-borne theileriasis in the Northern Transvaal in 1936 de Kock, du Toit and Neitz[7] recovered the virus of bluetongue from cattle exposed on the Tzaneen town lands and passaged the virus through several generations in sheep. Many other unpublished records of the recovery of bluetongue virus from cattle exist where, during the summer months, the occasion has arisen to inject the blood of cattle into bluetongue susceptible sheep.

The susceptibility of sheep to the virus of bluetongue, frequently with the development of severe clinical lesions and in a high percentage of cases with a fatal termination, has led to the general acceptance of the theory that bluetongue is primarily a disease of sheep and in fact the condition owes its name to the clinical cyanosis of the tongue observed in reacting sheep.

Neitz[8] has shown that the blesbuck (*Damaliscus albifrons*) is capable of harbouring the virus of bluetongue for a period of up to 17 days without showing any clinical symptoms and advanced the theory that bluetongue, like bovine malignant catarrhal fever or snotsiekte, occurs naturally in certain species of antelopes and may be fortuitously transmitted to sheep which happen to be highly susceptible and in a high proportion of cases succumb to it.

In an endeavour to ascertain the possible role played by bovines in the epizootiology of bluetongue the present investigation was undertaken.

The objects aimed at in this investigation were twofold. Firstly it was intended to establish the actual incidence of bluetongue virus in cattle exposed day and night to natural infection by the bites of the transmitting insects by injecting blood from such bovines at regular intervals into bluetongue susceptible sheep. Secondly, in the light of the discovery of the multiplicity of virus strains (Neitz)[9] and the existence of a serum-virus neutralisation technique whereby virus strains could be identified as to type (Howell)[10], an attempt was made to ascertain whether any particular virus type occurring in the blood of a bovine during the summer months could again be isolated from that animal during the ensuing summer. In other words it was intended to ascertain whether a virus type could be shown to have *survived* from one bluetongue season to the next.

Materials and Method

Commencing in August 1956 a group of 25 bovines selected at random from the laboratory herd which is maintained day and night at pasture, were bled in 10 per cent sodium citrate and the blood samples pooled in accordance with the method indicated below.

S	S	S*	S	S	
B	B	B	B	B	S
B	B	B	B	B	S
B	B	B^1	B	B	S^1
B	B	B*	B	B	S*
B	B	B	B	B	S

Method of pooling bovine blood in groups of 5.

B within the square indicates the blood sample from an individual bovine. The 5 samples appearing in the horizontal rows are pooled and 10.0 cc of the pooled blood injected intravenously into the sheep S opposite the row.

The same procedure is adopted for the vertical rows.

Should the two sheep indicated by asterisks react to the injection, the bovine marked with an asterisk would obviously have yielded the virus.

Should sheep e.g. marked with asterisks and that marked S^1 in the vertical row react and only one sheep on the horizontal row react then B^1 would have to be included together with the bovine marked with an asterisk as a virus donor.

The method obviously has many disadvantages should a number of sheep react simultaneously but it was adopted in order to limit the number of susceptible sheep necessary and yet obtain some indication of the incidence of viraemia in bovines under veld conditions.

The injections commenced in August 1956 i.e. just after the winter and with the onset of warm weather and were carried out initially at weekly intervals and after the end of October at fortnightly intervals.

The sheep which failed to react were tested for susceptibility by means of a modification of the complement-fixation test described by Shone, Haig and McKercher[11] after 5 to 6 weeks and, if shown to be susceptible. were used again.

Results

From the 22nd August 1956, when the injections were commenced, until the 15th November, the injected sheep remained negative.

The injections carried out on the 29th November yielded 8 reactions, some of which on clinical evidence and all from the application of the complement-fixation test on convalescent sera proved to be bluetongue. The injections of pooled bovine blood carried out on the 13th December

produced three positive cases of bluetongue. A week later, on the 20th December, nine further cases resulted and a fortnight later on the 3rd January, 1957, eight positive reactions in sheep were obtained. Thus from the latter series, according to the method of pooling of bovine blood samples used, 16 bovines out of the 25 used, could be incriminated as harbouring virus.

From the series of injections conducted on the 17th January, all 10 susceptible sheep reacted positively thus incriminating all of the 25 bovines.

This finding appeared to be so significant that it was decided to test individual bovines hereafter. Accordingly a 10.0 cc sample of blood from each of 10 head of cattle was injected into each of 10 susceptible sheep on the 31st January and 8 confirmed positive cases of bluetongue resulted.

A further 10 injections from individual bovines were carried out on the 14th February, again on the 27th February, 14th March and 28th March and each series yielded one positive reaction.

Table I indicates the results obtained.

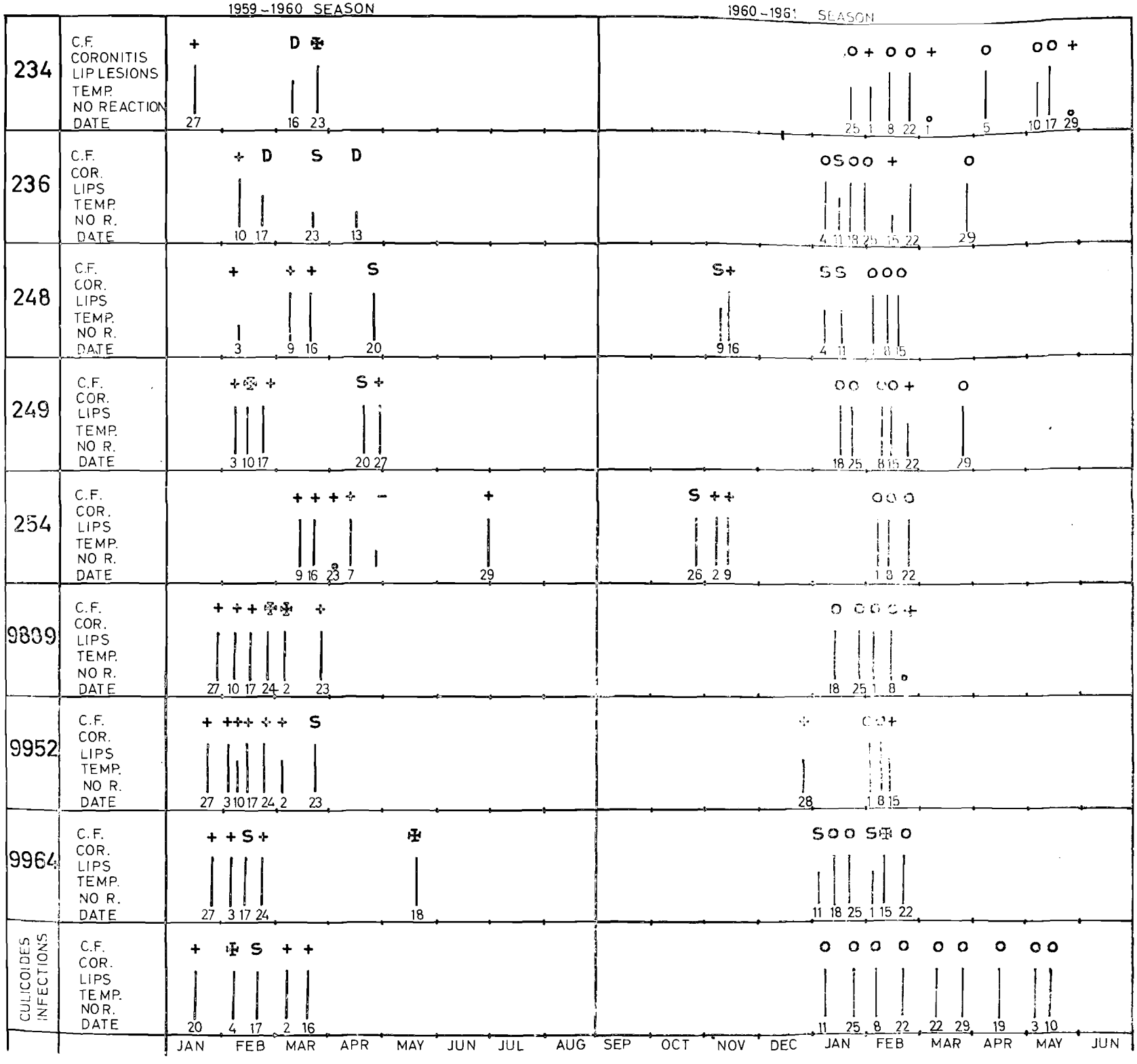
TABLE I

Recovery of Bluetongue Virus from Bovines
1956–1957 *Season*

Date of injections	No. of bovines used	No. of sheep used	Blood samples	No. of sheep showing *positive* reactions	Bovines	
					No. *possibly* yielding virus	Percentage reacting
22. 8.56	25	10	Pooled	Nil	Nil	Nil
29. 8.56	25	10	Pooled	Nil	Nil	Nil
6. 9.56	25	10	Pooled	Nil	Nil	Nil
12. 9.56	25	10	Pooled	Nil	Nil	Nil
19. 9.56	25	10	Pooled	Nil	Nil	Nil
26. 9.56	25	10	Pooled	Nil	Nil	Nil
4.10.56	25	10	Pooled	Nil	Nil	Nil
11.10.56	25	10	Pooled	Nil	Nil	Nil
18.10.56	25	10	Pooled	Nil	Nil	Nil
31.10.56	25	10	Pooled	Nil	Nil	Nil
15.10.56	25	10	Pooled	Nil	Nil	Nil
29.11.56	25	10	Pooled	8	16	64
13.12.56	25	10	Pooled	3	2	8
20.12.56	25	10	Pooled	9	20	80
3. 1.57	25	10	Pooled	8	16	64
17. 1.57	25	10	Pooled	10	25	100
31. 1.57	10	10	Not pooled	8	8	80
14. 2.57	10	10	Not pooled	1	1	10
27. 2.57	10	10	Not pooled	1	1	10
14. 3.57	10	10	Not pooled	1	1	10
28. 3.57	10	10	Not pooled	1	1	10

During the above reported series of injections of bovine blood into sheep, cattle had been selected at random amongst groups of different breeds running in groups on the Laboratory farm and totalling in all approximately 500 head.

BLUE-TONGUE IN CATTLE AS EVALUATED BY REACTIONS IN SHEEP



Conclusions

It had been established at this stage that—

(1) Bluetongue virus could be isolated from the peripheral circulation of cattle exposed to natural infection in the veld.

(2) According to the evidence obtained the virus first made its appearance in late November in a small percentage of bovines and the incidence of viraemia increased gradually to reach a peak during January when 100 per cent of the bovines exposed to natural infection harboured the virus in their blood.

(3) At no stage during the investigation was it possible to demonstrate the presence of any clinical manifestations of bluetongue in any of the cattle used and in fact the experimental cattle appeared to be in excellent health throughout.

In order to confirm whether the findings noted during the 1956/1957 season, namely, that cattle exposed to natural infection in the field could be shown to harbour the virus of bluetongue in their blood, constituted a regular feature in the epizootiological picture of the disease a further experiment was planned for the 1959/1960 season and beyond.

On this occasion an endeavour was made to have the virus strains isolated from bovine blood typed by means of the virus-antibody neutralisation reaction and by utilising identifiable cattle throughout the experiment, to determine whether typed virus strains persisted from one summer season to the next.

Eight head of cattle were used for this experiment. These were exposed day and night at Onderstepoort in small camps to the bites of *Culicoides* which occurred naturally in this locality as evidenced by catches in light traps situated in the vicinity.

The results are summarised in Table 2.

From this table which covers the period January 1959 to May 1961 it will be noted that virus may be recovered from cattle in November (1960) in a small percentage of cases, as was the experience in the 1956/1957 season, cited above, but this becomes a more regular feature from the end of December to reach a peak in incidence in January and February. Hereafter the incidence drops but odd occurrences may be encountered in May after the onset of cold wheather and even into June. The virus may persist in a bovine for a period of over 3 months e.g. in bovine 254 from 9th March to 29th June with, however, periods in between when no virus was demonstrable.

That a number of heterologous virus types are involved which may be regarded in some instances as reinfections by the transmitting insects to which the cattle were exposed continuously, there can be little doubt.

In collaboration with the department of virology at the Institute, which kindly undertook the identification of virus strains, a number of these virus isolates were typed and evidence was obtained of various previously isolated virus types being involved in individual bovines within a single season. At the same time evidence was obtained that an individual virus type might manifest itself in the peripheral circulation of a bovine at

irregular intervals over a considerable period as in bovine number 254, cited above.

The work involved in the identification of particular virus types or strains is, however, at this stage too incomplete to justify any positive conclusions being drawn and will form the subject matter of a later communication. So far as the typing of virus strains has progressed at this stage, it must suffice to state that no evidence of any one strain appearing in a single bovine in successive seasons has been noted.

The accumulation of more data on the types of virus strains occurring in successive seasons in individual bovines may throw more light on the survival of an identifiable type persisting in an individual bovine from one season to the next but the only evidence at present available merely justifies the conclusion that the viraemias recorded appear to be due to successive reinfections with different virus types.

Exposure of Sheep to Natural Infection

In order to note whether bluetongue susceptible sheep exposed in this locality would become infected by exposure to attack by *Culicoides* after it had been ascertained that bluetongue virus had been isolated from the experimental cattle, 5 Merino sheep were exposed to natural infection in a temporary fenced enclosure in close proximity to the cattle from early January until the end of May 1960 when good frosts had occurred.

Prior to exposure the 5 sheep were bled and by means of the complement fixation test proved to be fully susceptible to bluetongue.

Their blood was again tested on the 11th February, 25th March, 29th April and after removal on the 1st June, 1960.

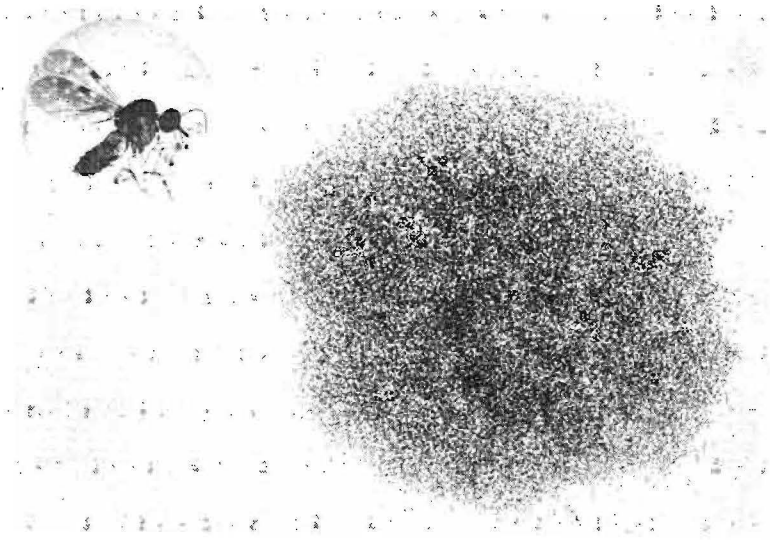
In each case the test proved to be negative thus demonstrating that the 5 sheep had remained fully susceptible throughout the period that bluetongue virus had been recovered on one or more occasions from the 8 experimental cattle kept in open camps within 50 yards of them.

It is difficult to account for the fact that the exposed sheep failed to contract bluetongue during the period of exposure but the following observations may be of interest:—

(1) That large numbers of *Culicoides* abound in the area is evidenced by the fact that a light trap situated within 200 yards of the camps in which the experimental cattle were exposed, consistently makes catches of many thousands of *Culicoides* on suitable warm, windless, dark nights.

Figure 1 illustrates photographically a good catch of these insects obtained on 4th March, 1960 which represented a suitable night but by no means an exceptional catch.

(2) Great difficulty is experienced in inducing *Culicoides* to feed upon sheep during experimental trials under stable or laboratory conditions. Various sites on the bodies including the ears of Merino sheep have been exposed to the bites of *Culicoides* held in cages after preparation of such sites by shaving, washing, etc., but in comparison with the ears of rabbits on which the insects feed readily, the results to date have been poor.



Conclusion

From the sheep exposure experiment described it seems justified to conclude that sheep are not very attractive to *Culicoides* for the purpose of blood feeding and that the insects appear to feed much more readily on cattle which, when run in close proximity to sheep, may serve to protect such sheep from natural infection by drawing the insects to themselves.

Discussion

The evidence presented indicates very clearly the extremely important role that cattle play in acting as reservoirs for the infection of *Culicoides* during an epizootic of bluetongue. Furthermore, the theory advanced by Neitz that game antelopes may act as reservoirs of the virus and that sheep appear to be incidental in the epizootiology of the disease finds support from the evidence presented, if consideration is given to the fact that game has virtually disappeared from many enzootic areas and have been replaced by cattle which appear to be just as capable of harbouring the virus.

As far as this work has progressed no conclusions can be drawn regarding the fate of the virus during the winter months. The identification of virus strains indicates that, of the types positively identified to date, the majority occur at Onderstepoort and may be recovered either from bovines or from *Culicoides* but no single strain has so far made its appearance in a bovine in two successive summer seasons. This seems to indicate that the varaemias encountered in bovines, which appear to

be of a transient nature, are due to successive reinfections with strains differing from those having caused viraemias in such animals previously.

It is significant that no basic immunity appears to be developed by bovines and that these animals can and do become infected year after year and may show the presence of circulating bluetongue virus for periods of as long as 16 weeks with, however, periods when virus is not recoverable from the peripheral circulation. Furthermore, several reinfections with heterologous strains may occur in individual bovines within a single season.

Finally it must be stated that from the experience gained of injecting emulsions of *Culicoides* caught in nature by means of light traps into bluetongue susceptible sheep the virus is generally not recoverable from those insects until December when only occasionally a sheep will react to such an injection. From about the middle of February, however, injections of emulsified *Culicoides* produce cases of bluetongue in susceptible sheep with absolute regularity until the first frosts in May when the insects disappear almost entirely.

With the techniques at our disposal, therefore, it is possible to demonstrate the presence of bluetongue virus in cattle some considerable time before it can be found in the transmitting insects.

ACKNOWLEDGEMENT

I would like to express my very sincere appreciation to Messrs. P. G. Howell and N. C. Owen, research officers of the Virological Section of Onderstepoort for undertaking the serological tests connected with this investigation and to Mr. S. T. Boshoff for the many hours spent on the routine work of carrying out the complement fixation tests. To Mr. D. W. du Plooy for the routine bleeding of the bovines, injections of sheep and collection of sera my sincere thanks are due. The permission to publish this preliminary article extended by Dr. B. C. Jansen, Chief of the Veterinary Research Institute, Onderstepoort, is acknowledged with thanks.

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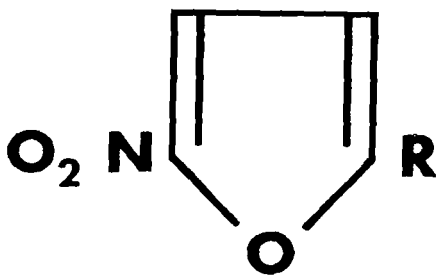

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ADVANCES IN "GEELDIKKOP" (*TRIBULOSIS OVIS*) RESEARCH

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5.: AETIOLOGICAL FACTORS IN GEELDIKKOP AND ENZOOTIC ICTERUS

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SUMMARY

Geeldikkop and enzootic icterus are reported as being two extreme syndromes of a single basic disease entity, which might be a low grade subclinical selenium intoxication. The two conditions are precipitated by severe non specific forms of stress which are discussed. Some aspects of the chemical pathology of these conditions and triterpene induced jaundice are reported and the author's present philosophy regarding the pathogenesis of the two syndromes is presented.

GEELDIKKOP AND ENZOOTIC ICTERUS

Attention has been drawn in some of the previous papers of this series[1], [2], [3] and in a more recent publication[4] to certain similarities between geeldikkop and enzootic icterus, and to certain interesting features which the two diseases have in common. On the basis of these and other facts it has been concluded that the two conditions represent extreme syndromes of a single basic disease entity. Many of the reasons for making this assertion will become obvious during the course of this paper, which is essentially a re-appraisal of our knowledge of the aetiology of these conditions in the light of recent findings. Although many of the views which will be advanced here are necessarily speculative at this stage there is sufficient evidence to suggest that most of the postulations made are possibly correct.

Geeldikkop and enzootic icterus, although quite distinct clinically in their typical forms, represent thus two different manifestations of a single condition. Between these two extreme syndromes are to be found varying disease patterns typical of neither major syndromes, yet showing some distinct features of either or both. These intermediate forms of the disease present considerable difficulties in diagnosis to the clinician, and not infrequently the majority of cases in an outbreak of geeldikkop or enzootic icterus may be of this nature.

During the course of the more recent investigations into the aetiology of geeldikkop[1], [2], [3], [4] it was felt that although *Tribulus terrestris*, the plant usually cited as causing geeldikkop was undoubtedly concerned with the appearance of the condition, it was by no means the only factor involved.

The mass of evidence linking geeldikkop with enzootic icterus which has accumulated recently lends considerable support to the theory that the same unknown factors are probably operative in both instances. A critical study of the epizootiology of each condition showed that various

forms of severe but non specific stress, could precipitate the appearance of either condition in a flock[2], [3], [4]. This aspect will be discussed in more detail in a following section of this paper.

The nature of the basic disease condition is as yet not clear. Brown and de Wet[5] have recently incriminated a low grade subclinical selenium intoxication in the aetiology of geeldikkop and enzootic icterus and have drawn attention to the geology of the karoo system with regard to the occurrence of these diseases and some other conditions of which the pathogenesis is as yet quite unknown.

The results presented in Table 1 show beyond doubt the presence of dangerously high levels of selenium in the tissues of sheep from farms where enzootic icterus and geeldikkop are prevalent. It will be noticed that the selenium content of organs taken from enzootic icterus cases is in general much higher than in those from cases of geeldikkop. Moreover the presence of selenium is virtually a constant finding in enzootic icterus. Since this condition is the more violently acute and usually fatal syndrome, the results obtained are in excellent accord with the known facts.

The last two sheep shown in Table 1 and designated "Celeryfontein numbers 1 and 2" are of considerable interest. These sheep were apparently normal before being slaughtered for farm rations. The stock is owned by one of the leading sheep breeders in the Karoo and is situated in the midst of the worst enzootic icterus area in the country. The disease is seldom seen on this farm although the adjoining farms are severely affected every year. It is possible that the low incidence of the disease on the farm may be attributed to one or both of the following very important factors:—(*a*) the sheep on this farm receive *ad lib*, throughout the year the best protein supplements available, there being few farms in this area where the nutritional level of the sheep is so high; and (*b*) the management and grazing control of this farm leave very little to be desired. The results is that overstocking with all its attendant evils has been avoided and the animals are seldom if ever forced to eat inferior and possibly highly seleniferous plants. In spite of the appreciable amounts of selenium present in the livers of these sheep they appear to have suffered few ill effects.

The analytical results presented in Tables 2 and 3 are of interest since the sheep from which the tissues used were taken may be regarded as controls for this work. The animals represented by Table 2 were used for experimental field work on geeldikkop by the author at Victoria West and were maintained on a diet of fairly high protein content viz. green lucerne, hay and yellow maize and *ad lib*. It will be seen that the tissues of some of these cases contain fair amounts of selenium yet the animals appeared clinically normal.

Table 3 represents analysis performed on tissues from normal health Onderstepoort sheep which were slaughtered for staff rations. With the exception of three sheep none of the others appeared to have any selenium in their livers. The three exceptions were fairly recent introductions from the Karoo.

The worst outbreaks of enzootic icterus occur mainly in the summer months in and immediately around the Nuweveld, Roggeveld, Camdebo and Hantam mountain ranges, but are not necessarily confined to these

areas, outbreaks often being encountered simultaneously with geeldikkop on farms in the arid flats to the north and east of these mountain ranges. Geeldikkop in its typical form is almost invariably a disease of the plains, being found mainly on the silt flats along pans, rivers and dams, and on other "tramped out" areas and occurs generally during the latter half of summer.

Although *Tribulus terrestris* is usually cited as the direct cause of geeldikkop, in certain growth stages[1, 2], the author and his co-workers have encountered numerous outbreaks of the disease in which it was almost impossible to find any *Tribulus* plants growing on the farms involved. These farms were more often than not heavily overgrazed and much of the nutritious Karoo vegetation had been replaced by pioneer plants and other undesirable plants such as *Chrysocoma*, *Nestlera Rhigozum* or *hycium* species.

In the areas where enzootic icterus is prevalent grazing malpractices are rife and the grazing in these areas has deteriorated to an alarming extent. This aspect has been stressed by Skinner[6] in recent report and by Brown and de Boom in numerous earlier unpublished reports to the Director of Veterinary Services, Onderstepoort. Numerous farmers have in the past incriminated various species of *Chrysocoma* and *Nestlera* as playing a role in the aetiology of enzootic icterus and attention has been drawn to this fact by Skinner[6], de Boom and Brown[7]. On many farms in the affected areas these species as well as various *Eriocephalus* species form the dominant plants in the vegatation.

The results of numerous analyses done so far on the most important plants from both the geeldikkop and enzootic icterus areas are represented by the figures presented in Tables 4 and 5. The former table is illustrative of the plants presumably concerned in the aetiology of either syndrome while in Table 5 the analytical results from plants which are either generally regarded as excellent grazing or as inferior types but harmless to animals are presented for comparison.

Bearing in mind that it is generally held that plants which contain more than 5 parts per million (p.p.m.) of selenium are dangerous to stock, it will be readily appreciated that the figures presented in Table 4 represent alarmingly dangerous levels of this element.

A complete survey of the occurrence of selenium in the Karoo vegetation is at present being performed and the results will be published shortly in a forthcoming paper elsewhere.

It must be stressed at this stage that as yet we can only speculate as to the role of selenosis in the pathogenesis of these two syndromes. It is thought that it probably is the basic disease condition mentioned earlier, but whether it is the only other "conditioning or sensitizing" factor operative is not yet clear. Furthermore it must be remembered that considerable species differences exist as to tolerance for selenium and that in the sheep the effects of chronic low grade selenium intoxication may be quite different to those seen in other species. Sheep are in general more resistant to the toxic effects of selenium and apparently retain it longer in their tissues than do other species.[8] It must also be remembered that the clinical picture or pathology of any such lowgrade intoxications can be considerably modified or even masked by numerous nutritional manage-

ment or intercurrent disease factors. This is particularly true in the case of chronic selenium intoxication where the symptoms and pathological changes are much less severe on a diet of high protein content. This fact is clearly illustrated by the examples cited in Tables 1 and 3.

Selenium is a cumulative poison, the basis of it's toxic effects being its relation to sulphur; it readily displacing this element in some chemical combinations, the resulting products being biologically inactive. The fact that it is cumulative in it's action and more slowly eliminated by the sheep than other species, and the higher tolerance of sheep to it's harmful effects offers a possible explanation for some of the more bewildering aspects of the epizootiology of enzootic icterus. This disease, although generally confined to the areas mentioned and appearing during the summer months, has been encountered in many parts of South Africa other than the Karoo and at all times throughout the year. In such instances there is however always a history of affected animals being either fairly recent introductions from the enzootic areas or in exceptional cases were animals purchased from farmers in these areas at times of up to four years from the date of the appearance of the disease.

The syndrome is also more commonly encountered in adult or aged animals, in the enzootic areas, and is infrequently seen in lambs. When it does occur in this age group the mortality is extremely high.

In the case of geeldikkop the epizootiology is modified in some respects by certain important factors. On the whole, since it is essentially a disease of the plains, the grazing available is generally better than in the mountains of the enzootic icterus areas; management of flocks, although generally of the same standard, is much easier and it would appear from the preliminary survey work done on the vegetation in these areas that the selenium content of the apparently dangerous plants is in general lower than that of these plants in the areas where enzootic icterus occurs regularly. The generally lower values for selenium in the tissues of geeldikkop cases, certainly are an indication that in these areas far less selenium is available to the sheep than in the mountainous areas, referred to. Geeldikkop is encountered in sheep of all ages but when occurring in lambs seems to be milder than in the adult animals. The fact that it appears more frequently and is less severe in this age group than is enzootic icterus will be discussed at greater length further on in this paper.

Both major syndromes make their appearance extremely suddenly in a flock and outbreaks can generally be correlated with some severe but nonspecific form of stress. In the instance of geeldikkop the history is usually that the disease follows on the first good rains of the summer. In the areas where this syndrome is prevalent these usually take the form of heavy thunderstorms throughout the course of about a week or two, during which the greater part of the annual precipitation for a particular area may be registered. These rains if accompanied by hail may be followed by a period of intense cold accentuated by strong south-easterly winds or more generally they are followed by a period conducive to germination and rapid growth of annual plants such as *Tribulus terrestris*. Either climatic condition is generally soon succeeded by extremely hot and dry weather once more, during which scorchingly hot westerly winds are very prevalent. The intense cold is in itself generally a severe stressing

factor but wilting of the rapidly growing plants followed by severe digestive disturbances and rumenal atony is probably the most potent factor in this regard.

Enslin and Wells[9] have demonstrated that the saponins present in *Tribulus terrestris* exert a marked paralysing effect on the gastro-intestinal canal. It is highly probable that these compounds actually cause the extremely severe gastro-intestinal stasis which often immediately precedes the onset of clinical symptoms of geeldikkop.

Enzootic icterus appears under very much the same set of circumstances, but can however be readily produced by simply moving apparently normal sheep from the enzootic areas any long distance by road or rail. It is seen after dosing flocks with certain vermicides or often innoculation with bluetongue vaccine and appears after sudden changes of diet or sudden supplementation of concentrates during times of drought, and is a frequent complication of diseases like Wesselsbron disease. It is seen more frequently in fat sheep under the conditions described and in these animals is frequently an added complication to ketosis.

Before passing on to a closer consideration of some of the more important features seen in both syndromes, it is not out of place to consider the similarities and points of difference between the two diseases in tabular form. The symptoms listed below are those seen in the typical cases of either syndrome.

Geeldikkop	*Enzootic Icterus*
Low grade intravascular haemolysis	Explosive haemolytic crisis
Post haemolytic anaemia	Severe Post-haemolytic anaemia
Thrombocytopaenia (transient)	Methaemoglobincythaemia
Leukopaenia	Leukopaenia in some instances
Increased erythrocyte fragility	Markedly increased erythrocyte fargility
Nephrosis or nephritis	Very severe nephrosis or nephritis
Intrahepatic cholestasis	Severe retention icterus
Bromsulphalein retention	Bromsulphalein retention
Hyper cupraemia	Hypercupraemia
Very severe photosensitization	Almost unnoticeable photosensitization
Very severe stress reaction	Severe stress reaction

The nature of many of these lesions and ideas regarding their genesis are fully discussed elsewhere[3, 4] and for the purposes of this paper it is only necessary to touch upon the most important points in respect to each.

The Lesion in the Erythrocytes

Acute cases of enzootic icterus are characterised by a markedly increased red cellfragility, and explosive haemolytic crisis, methaemoglobincythaemia, methaemalbuminaemia and haemoglobinuria. It is believed that these symptoms possibly arise from a glucose-6-phosphate dehydrogenase (G-6-P-D) deficiency in the erythrocytes of affected cases, similar to the condition known in humans as "Primaquin sentivity"[4, 5]. This condition is an inherited in-born error of metabolism in humans,

affected individuals experiencing an acute haemolytic episode after the ingestion of certain drugs and plant goods such as fava beans. In individuals where the trait is fully expressed, the erythrocyte life span is shortened even in the absence of drug administration[10]. The condition as seen in typical cases of enzootic icterus is fully described in a recent paper by Brown[4], as is also the adaptation of the Methaemoglobin reduction test of Brewer et.al.[10] for detecting this lesion in the erythrocytes and its interpretation in sheep.

There is in animals showing full expression of this erythrocyte defect an extremely pronounced increase in red cell fragility, a large percentage of the erythrocytes from typical cases of enzootic icterus rupturing in 0.85 per cent saline solution and a marked inability on the part of these cells to reduce methaemoglobin (Met Hb.) It is certain that the erythrocyte lesion in the sheep studied is not of a hereditary nature as in humans, but is due to some toxic influence and possibly to the low grade selenium intoxication. The haemolytic crisis are however precipitated in much the same way as in human cases, i.e. by stressing influences.

Whether the distrubances in the Met Hb. reductase systems of the erythrocytes and their increased fragility are directly due to inactivation of G-6-P-D or not, is not yet at all certain. Normal sheep erythrocytes do not reduce Met Hb. as efficiently as do their human counterparts under the conditions of the Met Hb. reduction test of Brewer et. al[10] and it is possible that other enzymes may be involved in the ovine red cell defect as well. This point is under investigation at the moment and will be fully reported upon in a later paper in this series.

The same lesion has been observed in many of the advanced cases of geeldikkop and in this disease, appears suddenly. In the former condition the erythrocyte defect is more insidious in onset and culminates in massive intravascular haemolysis. Acute haemolytic crisis are not a feature of geeldikkop but low grade intravascular haemolysis is none the less present as evidenced by the moderate to severe anaemia, progressive and severe decline in the red cell volume and haemoglobin to values of 20 per cent and 6 gm per cent respectively, and fair to moderate haemosiderosis in organs like the liver, kidneys, lymphnodes and adrenals, seen in advanced cases of the disease[3, 4]. Severe bone marrow hypoplasia is very characteristic of both syndromes.

Kidney Lesions

Nephrosis varying from moderate to extremely severe is a prominent feature in both syndromes. The relevant chemical pathology and histopathology of this aspect of these conditions is described elsewhere[3, 4]. There are however some points of interest which deserve mention in a paper of this nature since they are relevant to the general pathogenesis of both syndromes. In the preclinical cases of geeldikkop[3] there is little or no evidence of any disturbance of kidney function. However as the symptoms appear so does nephrosis and it rapidly becomes most severe as judged from the chemical pathology. Very marked and rapid rises of blood urea nitrogen, creatinine, uric acid and inorganic phosphate indicate the onset of an uraemic condition. The appearance

of the kidneys and the histopathology of these organs is however not consistent at this stage with the extremely severe nitrogen retention. On autopsy only some enlargement of the kidneys and bile pigmentation is noticeable while histopathological examination shows mild to moderate nephrosis involving especially the proximal convoluted tubles, the cells of which contain small granules of bile pigment.

In the advanced cases of the disease the histopathology is more consistent with the severe uraemia and in these cases sharp rises of plasma inorganic phosphate and magnesium herald impending renal failure and a fatal termination. The tubular cells at this stage are swollen and packed with bilirubin granules. Varying degrees of fatty infiltration and hyaline droplet formation in the cells may be seen. The bile pigmentation tends to be confined to focal groups of tubules and bilirubin can be demonstrated in the cells of both the convoluted and straight parts of these structures, in which a fair amount of iron-containing pigment may also be present. There is a remarkable absence of bile pigment in the tubule spaces and in spite of the severe regurgitation icterus, bilirubinuria is seldom if ever seen at any stage of the disease. This is a most important point to bear in mind.

In the case of enzootic icterus both the gross and microscopic pathology of the kidneys is most dramatic. The kidneys of acute enzootic icterus cases are usually tremendously swollen, being often enlarged to twice or three times their normal size and their appearance being in most respects similar to that seen in chronic cases of copper poisoning. Histopathological examination reveals a severe diffuse nephrosis or in some instances acute glomerulonephritis. The bubule cells are intensely pigmented containing both bilirubin and an iron containing pigment, while many of the tubules are choked with haemoglobin casts or cellular detritus. On the whole the pathology is reminiscent of the "crush" syndrome in humans. Urea retention is usually severe in these cases, but retention of creatinine is by no means as severe as in the early or advanced cases of geeldikkop. Hyperphosphataemia and hypermagnesaemia have not yet been onserved in these cases, even in those terminating fatally. Albuminuria and haemoglobinuria are frequent, severe and characteristic of enzootic icterus, but bilirubinuria is never seen even in severe jaundice.

The apparent discrepancies between the renal chemical pathology and histopathology in both conditions are some of the most intriguing aspects of either syndrome. In the advanced cases of geeldikkop where the pathology is comparatively mild, the uraemic changes are most pronounced, yet in the acute forms of enzootic icterus with its dramatic kidney pathology, the chemical pathology gives little indication of the severity of these changes and is most misleading as regards prognosis.

Liver Lesions and Disturbances of Bilirubin Metabolism

The icterus of geeldikkop has been classified as an intrahepatic cholestasis[3]. Apart from severe bile pigmentation and some fatty infiltration which may vary from mild to extensive, the liver cells are usually free from any visible signs of destruction. Bile pigment is scattered diffusely throughout the liver, both the Kuppfer and the parenchymal cells being

heavily loaded with bilirubin. A most important aspect of the pathology is that in general no bile pigment can be demonstrated in the canaliculi and the bile ducts usually appear empty. The appearance of the gallbladder contents at autopsy is variable, but non the less very important. In cases where the gastro-intestinal atony precedes the onset of symptoms, and this seems to be the rule, the gallbladder is usually found to be distended with a large amount of very concentrated dark green tarry bile. In the early or advanced cases[3] of the diseases however, in which the gastro-intestinal stasis has developed some time after the initial onset of symptoms, the gallbladder may contain a small amount of viscous almost colourless bile; the typical "white bile" seen in intoxications with the icterogenic triterpene acids.[1, 4, 11, 12]

The icterus in geeldikkop is characteristically intense and the bile pigments appearing in the blood are bilirubin mono and diglucuronides as well as bilirubin; there usually being present more of the conjugated pigments than the latter. This is illustrated by the figures presented in Table 6; representing various stages of the disease. Values for total plasma bilirubin of between 30–40 mgm per cent are by no means uncommon in severe cases. In such cases bilirubinuria is negligable in spite of the fact that more than 50 per cent of the pigment is in the conjugated form.

In 1933 Quin[13] reported finding that sheep dosed orally with the plants *Lippia rehmanni* and *Lippia pretoriensis* developed the typical icterus and photosensitization of geeldikkop. The brilliant work of Rimington and Quin which lead to the indentification of the icterogenic agent, icterogenin, has been reviewed in an earlier paper in this series.[1] The subsequent work on the action of the triterpene acids on biliary excretion in the rabbit and the correlation of chemical structure with icterogenic activity of these compounds is to be found in the recent papers of Heikel et.al[12], Brown[4], Brown et.al[11] and Anderson et.al[14]. The author and his colleagues have shown conclusively that there is an exceedingly high degree of specificity in the icterogenic action of potent compounds. They have demonstrated that pre-requisites for high icterogenic activity are (*a*) a hydroxyl group at carbon atom 3 on the triterpene molecule, (*b*) that this hydroxyl must be β equatorially orientated; the α epimer being quite inactive and (*c*) the side chain present at carbon atom 22 must be angelic acid. If this is removed the icterogenicity of the compound disappears. There is no evidence at all of kidney damage in the triterpene induced jaundices. This is a most important point.

The criteria upon which the assay for icterogenic action of these compounds is based are; the compound should produce within 8 hours after intraperitoneal administration to rabbits, a marked and steady drop in (*a*) the volume of bile excreted per hour, (*b*) the quantity of bilirubin excreted per hour, and the liver should be innocent of any visible structural changes attributable to the compound at the end of the test period of 8 hours. The technique is discussed in a recent publication by Brown and co-workers.[11]

The icterus seen in natural cases of geeldikkop is identical in all respects to that produced in sheep following administration of active triterpenes such as icterogenin. The jaundice produced in sheep by these

compounds is however much less severe, the total plasma bilirubin seldom exceeding 15 mgm per cent and bilirubinuria is pronounced.

After a critical study of the histopathology of cases of naturally occurring geeldikkop and triterpene induced jaundice it is apparent that the nature of the block to hepatic pigment excretion is the same in both instances although the causal agents may differ. The stereoisomer specificity of the most active triterpenes points to the involvement of some specialized enzyme system in this disturbance. The essential lesion appears to be thus entirely biochemical in nature.

The icterus induced by active triterpenes is much more transient than in most cases of geeldikkop, seldom lasting more than 48 hours after a single effective dose of any of these compounds. The severity of the icterus in geeldikkop must thus in part be due to a failure in renal excretion of conjugated pigments. This is well illustrated by the chemical pathology and histopathology.[4] There is also some evidence of disturbances of bilirubin conjugation in geeldikkop.[4]

The jaundice seen in acute enzootic icterus is for the greater part an intense retention icterus following on the haemolytic crisis; values for total plasma bilirubin of up to 30 mgm per cent being quite common in these cases, most of the pigment being in the unconjugated form.[4]

The liver pathology in this condition depends to a large extent on the stage of the disease encountered. In a first acute haemolytic episode the histopathology is much the same as that seen in typical cases of geeldikkop; however in the chronic cases an atrophic cirrhosis of the liver is invariably encountered.[3, 4]

Bromsulphalein Retention

The results obtained in geeldikkop and triterpene induced jaundice with the bromsulphalein (B.S.P.) test are most interesting and are fully described elsewhere.[4] In geeldikkop B.S.P. is cleared rapidly from the circulating blood by the liver parenchyme but remains in the hepatic cells due to a total block in the excretion mechanisms for this dye and thus does not appear in the bile. It is also apparently not excreted in the urine. In the case of the triterpene induced jaundices marked retention of the dye in the bloodstream, i.e. failure to clear the compound from the circulation is observed, persisting for at least 48 hours after administration of the drug. It appears in the urine of these cases within 12–24 hours after administration.

Since there is no histological evidence of liver damage in triterpene induced jaundice it is assumed that the mechanisms for hepatic B.S.P. excretion are affected in a similar manner to those responsible for bilirubin excretion. The hepatic mechanisms for excretion of the dye into the bile are however far more seriously disturbed in the case of Geeldikkop as also is the secondary renal pathway of excretion.

B.S.P. retention is variable in enzootic icterus and depends to a large extent on the liver pathology in any particular case. The primary defect revealed by this test is a retarded removal of the dye from the circulation by the liver. Whether hepatic excretion of the dye is interfered with in these cases is not yet known.

Photosensitization

This symptom varies from mild to extremely severe in geeldikkop and together with the severe icterus is a diagnostic feature of the disease. The photodynamic agent concerned is the magnesium free porphyrin phylloerythrin, normally excreted in bile adsorbed on to colloids such as bile acid complexes.[15] In geeldikkop and triterpene induced jaundice excretion of this pigment is as affectively blocked as it would be in a complete obstruction of the common bile duct. Since no conjugation of this pigment appears to take place, it is clear that the biochemical block is situated at the level of the membrane between the hepatic cell and bile canaliculus.

Photosentization is much more severe and persistent in geeldikkop than in triterpene induced jaundice, persisting in the former for up to 3 weeks after its first sudden appearance and is in the latter condition seldom evident for longer than 72 hours after the onset of symptoms. The persistence of the condition is in direct relation to the severity of the kidney lesions in geeldikkop, since the normal sheep is able to excrete this compound in the urine should the hepatic pathway be interfered with.[4]

In the severely photosensitive cases of geeldikkop there is a simultaneous block of both the hepatic and renal excretory pathways for phylloerythrin, since none is detectable in the urine from the early and acute cases of this disease. The transience of the symptom in triterpene induced jaundice is due in part to the fact that renal excretion of the pigment is unimpaired and that the damage or inhibition of the hepatic excretory mechanisms appears to be mild and temporary.

In the case of enzootic icterus the dramatic symptoms of photosensitization are seldom if ever seen. The condition is however never the less present, but in a very mild form and is normally evidenced by some slight necrosis of the lips, nostrils, eyelids, tips of the ears and in some instances coronitis. In this syndrome the severe gastro-intestinal atony commences sometime before the appearance of the acute haemolytic crisis and at the onset of this symptom is usually advanced to a stage in which there is extremely severe dessication of the rumenal, omasal and caecal contents, the duodenum and ileum being devoid of ingesta. Phylloerythrin absorbtion from the gut must thus be at a minimum level even before the symptoms of the condition are first noticed.

Hypercupraemia

For many years it has been known that conditions very similar to enzootic icterus may result from a high dietary copper intake and for some considerable time it was thought that enzootic icterus was essentially a chronic copper poisoning, since amounts of copper ranging from 80–4500 p.p.m. (on a dry basis) were found in livers of cases of this disease, while some of the Karoo plants were found to contain high but not dangerous levels of this element.

As will be seen from Tables 7 and 8, hypercupraemia and markedly increased liver copper levels are encountered in both geeldikkop and enzootic icterus. It has been clearly demonstrated by the author that these are due to a simultaneous block in the excretion of copper by the primary

hepatic and secondary renal pathways for this element.[4] No disturbances of copper metabolism have been observed in triterpene induced jaundice and common bile duct obstruction in sheep, where the kidneys are unaffected and in severe nephrosis or nephritis in which cases there is no disturbances of liver function.

It would appear from these studies on the chemical pathology of geeldikkop, enzootic icterus and all the conditions mentioned that there is in the sheep an inherent relative in sufficiency in the mechanisms for copper excretion. The primary pathway for copper excretion in this species is via the bile and should this be disturbed the kidneys may secondarily assume this role. The slightest disturbances of both avenues of excretion simultaneously tends to a rapid and severe retention of copper in the body. Such relative defects in the excretion of waste products are not uncommon, since similar examples are to be found in uric acid excretion in the human, iron excretion in humans and animals and bilirubin conjugation and excretion in the horse.

Since there is no histological evidence of damage to the structure of the liver, it must be assumed that in geeldikkop the block to the hepatic excretion of copper must, as in the case of bilirubin, B.S.P. and phylloerythrin, be a purely biochemical one involving transport mechanisms across the hepatic cell membranes or the permeability of these membranes themselves.

The Severe Stress Reacton and Electrolyte Imbalances

These are fully discussed by the author elsewhere and the interested reader is referred to this paper.[4] Suffice it to say that there is in both syndromes marked evidence of severe reactions to the various stressing influences mentioned and extremely severe imbalances of water and electrolytes may be observed in these cases. These findings are in general very difficult to interpret because of the co-existence of renal lesions and disturbed adrenal function, and the fact that sheep do not always follow the classical patterns of chemical pathology of adrenal hypo or hyperfunction observed in the human or other species.

It is sufficient for the purposes of this paper to merely sum these changes up in the following considerably simplified manner: The early phases of geeldikkop simulate rather closely the classical "alarm reaction" of the General Adaptation Syndrome and during this period marked sodium retention is strongly in evidence. This phase is followed by a period of relative electrolyte stability, and then in cases which terminate fatally by a period of complete adrenal exhaustion characterised by extremely severe sodium, chloride and water depletion. An extremely severe hypoglycaemia often appears early in the disease and is a prominent finding in cases of an advanced stage of the disease.

Similar patterns of electrolyte imbalance may be seen in the acute cases of enzootic icterus and hypoglycaemia is a constant finding in all cases with severe gastro-intestinal atony. Ketosis is a frequent complication of these cases if the animal was in good condition. The plasma electrolyte and blood sugar figures from chronic cases of this disease show few significant deviations from normal.

Discussion

From the foregoing text it is obvious that both syndromes are conditions in which a number of most important and essential metabolic pathways are simultaneously disturbed, very often with fatal consequences to the animal concerned; the presence of mild to severe kidney and adrenal distrubances contributing in no small measure towards the mortality rate during an outbreak.

At the present time there are still many and important gaps in our knowledge of the aetiology of these two syndromes. During the past two years considerable progress has been made which has served to fill in some of these gaps or shed some light on others. Our present philosophy on the aetiology of these conditions is presented in the following passages.

The role which selenium may play in the genesis of the various metabolic disturbances is not clear yet. The facts that it is present in dangerous amounts in the tissues of affected animals and that there is a close correlation between the selenium content of tissues and the nature of the syndrome seen, are certainly significant. When what is known so far as regards the occurrence of selenium in the Karoo vegetation and its relation to the various epizootiological factors mentioned are considered, the case for participation of low grade selenosis in the aetiology of these conditions becomes even stronger. There are possibly many other as yet unknown factors which may have to be considered since neither syndrome in its typical form can be considered as resembling the classical chronic selenosis of stock described in the literature.

Selenium is known to inhibit very strongly numerous dehydrogenases in the body notably succinic dehydrogenase, pyruvic oxidase, triose phosphate dehydrogenase, glutathione and many others.[16] In the these two important diseases the essential biochemical lesions are (*a*) marked interference with the normal metabolism of the erythrocytes, leading to increased fragility, decreased longevity and failure to reduce methaemoglobin. This, as has been stated, may be due in part to inactivation of G-6-P-D; (*b*) some interference in the conjugation of bile pigments and dyes like B.S.P., but more important an almost total incapacitation of the mechanisms responsible for the transfer of bilirubin glucuronides, B.S.P. conjugates and phylloerythrin across the membranes of the hepatic cells and nephrons with inability thus to excrete these compounds via the normal or secondary avenues of elimination. There is important evidence from the work on the icterogenic triterpenes that the failure in excretion of these compounds may be due to selective inhibition of certain transport systems or due to alterations in membrane permeability in the cells concerned. When the disturbances in nitrogen and copper excretion are considered as well, it would appear that membrane permeability considerations are most important.

The transfer of substances across cellular membranes has received considerable universal attention during the past few years. An involved discussion of this topic is completely beyond the scope of this paper, but it is relevant and pertinent to consider briefly some of the known facts about transfers or movement across membranes, against the background of the foregoing discussion.

Many cell membranes are known to consist of an outer and inner protein monolayer, between which are at least two monolayers of lipid structure. Movement of substances across cell membranes is believed to take place by one or more of the following processes[17]:—

1. simple diffusion which is energy independant;
2. restricted diffusion, where the rate of diffusion is altered by the characteristics of the membrane; either the lipid or charge characteristic being concerned.
3. facilitated diffusion, which is enzyme mediated and requiring immediate metabolic energy. A high degree of specificity is involved in transfers of this nature;
4. exchange diffusion in which molecules within the membrane structure act as complex forming carriers;
5. active transport, which constitutes movement across a concentration gradient or electrochemical potential and is energy dependant and enzyme catalysed;
6. pinocytosis. This is believed to be one means by which macromolecules can enter and move across cell membranes. A molecule of the correct configuration attaches itself to the outside of a cell membrane where certain receptor groups are believed to be situated. The membrane then encapsulates the molecule concerned, leading to the formation of a pinocytic vesicle. This in turn breaks loose from the parent membrane forming a pinocytic vacuole within the cytoplasm of the cell; the membrane of the vacuole subsequently dissolving allowing the macromolecule to move across the cell and if necessary to be extruded again by reverse pinocytosis. This is believed to be one manner in which fat is absorbed or albumin excreted in the small intestine.[17]

Whatever the mode of passage of any particular substance through a cell membrane, the following facts govern the rate of entry or outward movement[17]:—

(*a*) In many instances the rate of diffusion is directly proportional to the polarity of the diffusing substance e.g. fat soluble substances penetrate certain membranes faster than other substances do.

(*b*) Certain hormones are believed to alter the permeability of membranes to certain substances.

(*c*) The rate of movement of a biological substance through a membrane varies directly with its concentration, the area of the membrane, the mobility of the substance within the membrane and the total "driving forces" involved. The latter include concentration gradients, potential differences, solvent "drag" which relates to the existence of pores in a membrane and hydrostatic pressure differences.

Very little indeed is known of the nature of the transfer of bilirubin or B.S.P. conjugates, phylloerythrin and copper across the hepatic cell or nephron membranes, but the recent work with the icterogenic triterpenes on biliary excretion in rabbits[12, 11] and careful consideration of the chemical pathological studies of the various syndromes mentioned in this

paper suggests that the transfers involved take place by facilitated, exchange or at least restricted diffusion. The mode of diffusion is probably not the same in all instances.

It is thought that if selenium is in any way concerned with the aetiology of geeldikkop and enzootic icterus, it probably causes a certain amount of damage to various enzyme systems particularly those supporting the various transfer mechanisms and the glycolytic cycle, sufficient to weaken these considerably. If the precipitating stressor influences are strong enough to cause an initial degree of adrenal embarrassment such as is observed in the preclinical cases of geeldikkop[3, 4] the sudden withdrawal of hormones such as the adrenal gluco or mineralo-corticoids might have serious effects on the normal functioning of such weakened metabolic systems. The effects of severe prolonged secondary stress such as gastro-intestinal atony, ketosis, photosensitization, nephritis, intercurrent infections etc., would indeed be catastrophic.

Clark[18] has noted the appearance of appreciable amounts of a yellow pigment in the plasma of sheep subjected to mild forms of stress. Only about 2–3 mgm per cent of this pigment is bilirubin. During the course of some work on adrenalectomy in sheep, amounts of bilirubin of up to 5 mgm per cent were detected in the plasma of cases receiving no supporting therapy after bilateral excision of these glands, just prior to death. Whether this represents a failure in the systems supplying energy for conjugation is not known, but it is interesting in view of the role which severe stress plays in the aetiology of geeldikkop.

Which syndrome is to make its appearance in any flock or area would depend thus upon a host of circumstances, prominent amongst which would be: the selenium intake and thus the degree of pre-existing damage to the metabolic systems concerned, nutrition, management, age and the presence of continued stressing influences. With regard to age, immaturity of numerous enzyme systems, for instance those responsible for bilirubin conjugation and excretion, would increase their susceptibility towards toxic agents such as selenium. For this reason geeldikkop is very often seen even in young lambs, but is in these animals comparatively mild presumably bacause phylloerythrin formation and intake of toxic vegetation are comparatively limited.

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The Editor of the Onderstepoort Journal of Veterinary Research is thanked for permission to reproduce in this paper Tables 1, 2 and 3.

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TABLE 1

Selenium analyses on tissues from cases of Enzootic Icterus E.I.) and Geeldikkop (G.D.K.)

[All results are expressed as micrograms (mcg.) selenium per gram of tissue on a wet basis. A dash in the columns below indicates that no material was available for analysis. The letters GDK/EI indicate a mixed Geeldikkop/Enzootic Icterus Syndrome as established by histopathological examination.]

Sheep No.	Disease Condition	Liver mcg. Se	Kidney mcg. Se
Lam E.I.	E.I.	11.5	3.0
Groot Skaap E.I.	E.I.	14.0	14.0
Goat ex Grahamstown	E.I.	11.0	14.0
Avondrus No. 1	E.I.	5.5	0
Grootfontein No. 1	E.I.	11.5	—
Irene No. 1	E.I.	4.0	—
Albertsgraf No. 1	E.I.	4.0	—
Grootfontein No. 2	E.I.	10.0	—
Grootfontein No. 3	E.I.	3.0	—
Albertsgraf No. 2	E.I.	8.5	—
Visagie ex Ryksen	E.I.	11.5	11.0
Steenkamp No. 1	E.I.	20.0	—
Steenkamp No. 2	E.I.	0	—
Fraserburg No. 1	E.I.	3.0	7.0
Fraserburg No. 2	E.I.	7.0	8.5
Fraserburg No. 3	E.I.	17.0	10.0
Fraserburg No. 6	E.I.	—	34.0
Fraserburg No. 10	E.I.	8.5	8.5
Fraserburg No. 13	E.I.	10.0	0
Fraserburg No. 14	E.I.	—	4.5
Fraserburg No. 21	E.I.	3.0	11.5
Fraserburg No. 23	E.I.	0	0
Sheep Thornton	GDK	0	—
No. 3	GDK	0	—
No. 6	GDK	3.0	11.5
No. 7	GDK	0	—
No. 9	GDK	0	—
No. 14	GDK/EI	11.0	0
No. 14A	GDK/EI	8.5	1.0
No. 16	GDK	6.0	25.5
No. 20	GDK	3.0	14.0
No. 24	GDK	0	—
Jaagvlakte No. 1	GDK	0	—
Rooivlakte No. 1	GDK	8.5	0
Ratelfontein No. 1	GDK	5.5	0
Ratelfontein No. 2	GDK	8.5	0
Celeryfontein No. 1	Normal Ewe?	8.5	0
Celeryfontein No. 2	Aged normal ewe	8.5	0

TABLE 2

Selenium analyses on tissues from sheep used for experimental work in Victoria West

[All results are expressed as micrograms (mcg.) selenium per gram of tissue on a wet basis].

Sheep No.	Liver mcg. Se	Kidney mcg. Se
7054	3.0	0
7055	0	11.5
7056	0	1.5
7057	0	0
7059	0	0
7060	0	28.0
7061	0	3.0
7062	1.0	0
7064	0	0
7065	0	0
7066	0	0
7067	0	0
7068	4.0	0
7069	5.5	0
7070	0	0
7071	0	0

TABLE 3

Selenium analyses on tissues from normal healthy Onderstepoort sheep

[All results are expressed as micrograms (mcg.) selenium per gram of tissue on a wet basis.]

Sheep No.	Liver mcg. Se
5393	0
9269	0
7629	0
5512	0
8735	0
7604	0
7303	1.5
9814	1.5
9725	0
8634	3.0
10382	0

TABLE 4

The selenium content of plants believed to be concerned in the aetiology of Enzootic Icterus and Geeldikkop. (All results are expressed as migrograms (mcg.) Selenium per gram of dry plant material.

Species	District	Mcg. Se/gm.
Chrysocoma tenuifolia	Fraserburg	62.0
Chrysocoma tenuifolia	Fraserburg	11.5
Chrysocoma tenuifolia	Sutherland	3.0
Chrysocoma tenuifolia	Victoria West	3.0
Chrysocoma peduncularis	Meltonwold	13.0
Chrysocoma coma-aurea	Fraserburg	53.0
Chrysocoma coma-aurea	Bloemfontein	18.0
Nestlera prostrata	Beaufort West	71.0
Nestlera prostrata	Fraserburg	34.0
Nestlera prostrata	Sutherland	5.5
Nestlera humilis	Loxton	12.0
Nestlera humilis	Aberdeen	9.0
Eriocephalus spinescens	Beaufort West	28.0
Eriocephalus ericoides	Three Sisters	62.0
Eriocephalus ericoides	Aberdeen	11.0
Eriocephalus ericoides	Victoria West	3.0
Eriocephalus ericoides	Sutherland	20.0
Eriocephalus ericoides	Loxton	13.0
Eriocephalus glaber	Fauresmith	28.0
Galenia africana	Victoria West	28.0
Tribulus terrestris	Reddersburg	0
Tribulus terrestris	Fauresmith	3.0
Tribulus terrestris	Calvinia	0
Tribulus terrestris	Calvinia	6.0
Tribulus terrestris	Murraysburg	1.5
Tribulus terrestris	Beaufort West	0
Tribulus terrestris	Fraserburg	0
Tetragonia arbuscula	Fauresmith	14.0

TABLE 5

The Selenium content of Karoo vegetation considered as either excellent grazing types or inferior plants harmless to animals. (All results are expressed as micrograms (mcg.) Selenium per gram of dry plant material)

Species	District	Mcg. Se/gm.
Helichrysum anomalum	Grahamstown	0
Atriplex mummularia	Beaufort West	5.5
Walafrida saxatilis	Fraserburg	1.0
Salsola geminiflora	Victoria West	5.5
Salsola nigrescens	Fauresmith	5.5
Salsola tuberculata	Fraserburg	0
Salsola glabrescens	Fraserburg	0
Salsola tuberculata	Fraserburg	0
Pentzia incana	Fraserburg	0
Pteronia pallens	Fraserburg	0
Hertia pallens	Vosburg	0
Mesembryanthemum spinosum	Fraserburg	0
Elytropappus rhinocerotis	Fraserburg	0
Monechna species	Fraserburg	0
Phymaspermum aciculare	Fauresmith	7.5
Geigeria africana	Campbell	4.0
Sideroxylon inerme	Grahamstown	0
Protea tenex	Grahamstown	0

TABLE 6

Plasma Bilirubin Levels in cases of Geeldikkop. (All values are given in mgm per cent)

Sheep No.	Nature of Case	Total Bilirubin	Conjugated Bilirubin	Bilirubin
A	Early and acute cases (3–7 days' standing)	18.8	10.6	8.2
B		37.51	24.38	13.13
C		31.25	20.00	11.25
E		20.63	12.50	8.13
F		25.00	15.63	9.37
H		11.26	6.25	5.01
I		12.50	6.68	5.62
D	Advanced cases (7–14 days' standing). With the exception of Case D, all were *in extremis*	7.51	6.25	1.26
E		37.51	21.88	15.63
J		20.63	13.75	6.88
K		40.62	25.63	14.99
L		21.88	11.88	10.00
M		29.38	17.50	11.88
N		37.51	23.13	14.38
O		30.00	17.50	12.50
Y	Cases of 14–21 days' standing. Z was a recovering case; Y and Z1 were *in extremis*	37.51	24.38	13.13
Z		1.88	1.25	0.63
Z1		22.50	13.75	8.75

TABLE 7

Plasma copper values for field cases of Geeldikkop, Enzootic icterus. Normal Karoo sheep and normal Onderstepoort sheep. (All values are expressed as mgm per cent)

Geeldikkop	*Mgm %*	*Enzootic Icterus*	*Mgm %*
Early cases.....	0.13–0.38	*Acute cases*.....	0.21–0.79
Number of cases: 16....	(0.24)	Number of cases: 23....	(0.35)
Advanced cases.....	0.20–0.53	*Chronic cases*.....	0.11–0.25
Number of cases: 17....	(0.33)	Number of cases: 54....	(0.23)
Long standing cases.....	0.18–0.32		
Number of cases: 8....	(0.23)		
Normal Karoo Sheep	*Mgm %*	*Normal Onderstepoort Sheep*	*Mgm %*
Number of cases: 24....	0.12–0.14 (0.13)	Number of cases: 27....	0.06–0.13 (0.09)

Average values for each group of cases are indicated in parenthesis.

TABLE 8

Liver copper values for cases of Geeldikkop, Enzootic Icterus and normal Karoo sheep. (All values are expressed in mgm. per 100 gm. of wet liver tissue. Normal values for Onderstepoort sheep range between 9.0–14.8 mgm per cent)

Sheep No.	Syndrome	Mgm./ 100 gm.	Sheep No.	Syndrome	Mgm./ 100 gm.
3	G.D.K.	43.3	7054	Normal	25.0
6	G.D.K.	25.1	7055	Normal	15.8
7	G.D.K.	70.8	7056	Normal	19.2
9	G.D.K.	41.7	7057	Normal	20.0
14	G.D.K.	56.7	7058	Normal	18.3
14a	G.D.K.	43.3	7060	Normal	19.7
16	G.D.K.	41.7	7061	Normal	18.4
20	G.D.K.	158.3	7062	Normal	19.2
24	G.D.K.	13.3	7064	Normal	20.8
Lamb Smith	E.I. (acute)	12.4	7065	Normal	17.6
Sheep Smith	E.I. (acute)	66.8	7066	Normal	20.8
5128	E.I. (acute)	121.2	7067	Normal	16.9
5121	E.I. (acute)	78.8	7068	Normal	20.8
5132	E.I. (acute)	201.5	7069	Normal	13.3
5123	E.I.	63.2	7070	Normal	21.7
5116	E.I.	172.0	7071	Normal	24.4

(The abbreviations G.D.K. and E.I. in the columns above represent geeldikkop and enzootic icterus respectively).

DISCUSSION

PROFESSOR R. CLARK. The papers presented by Dr. Basson yesterday and Dr. Brown today represent two outstanding advances in veterinary research, both being based upon intense observation and very hard work. Dr. Brown has proved that there is a big possibility of selenosis playing a role in many disease states in the Karoo. Some of the material on which this paper is based was presented at a recent Congress of the New York Academy of Sciences in New York earlier this year, and much of it has been done in collaboration with Professor Claude Rimington in London, specifically the work on the icterogenic triterpenes.

DR. G. L. MULLER. Has selenium intoxication any bearing on abortion in Angora goats in the Karoo?

ANSWER. If anything, it merely plays a minor role as a possible predisposing factor only. We have examined livers from aborted foetuses and normal foetuses from goats in the areas concerned, and have found rather high amounts of selenium in their livers, certainly higher than in the maternal animals. (Authors note: It is likely from recent work done on the *chrysocoma* species that selenium is incriminated in the aetiology of enzootic alopecia (Kaalsiekte) in goat kids in the Cape Midlands).

DR. H. J. TERBLANCHE. Dr. Brown has told us that the sheep has a high resistance to selenium intoxication. What is the position as regards other animals in the Karoo?

ANSWER. The sheep is naturally the most common animal in the Karoo. We have little information as regards equines, but have had cases of geeldikkop in cattle reported to us. We have seen cases of enzootic icterus in angora goats and geeldikkop amongst herds of steenbuck. Classical selenosis was of course first described in cattle and horses in the Americas.

DR. R. J. HOWELL. You have mentioned the relationships between selenium and sulphur. Is there any value in feeding sulphur to affected animals?

ANSWER. It is very difficult to reverse the symptoms of selenosis by giving sulphur. Inorganic sulphur is ineffective and there is considerable difference of opinion as to which organic forms alleviate the symptoms. Cystine and methionine are variously cited as having beneficial effects. Arsenic is apparently of some value and seems to displace selenium from the compounds where it is present.

DR. D. E. TRUTER. How widespread is the occurrence of selemniu in the tissues of Karoo sheep? Have any selenium analyses been performed on Tribulus and the Salsolas?

ANSWER. I probably spoke rather too rapidly whilst dealing with this section because of time considerations. The highest amounts of selenium are found in sheep and plants emanating from the enzootic icterus areas, viz. the Nuweveld, Roggeveld, Hantam and Camdebo Mountains. As we go further north so we find less selenium in plants and animals but more geeldikkop. Tribulus contains on the whole negligable amounts of this element and variable but low amounts have been encountered in some salsolas. Tribulus must be considered important only as a stressor. It's saponins have been shown to have a paralysing action on the gut. It is often the most common edible plant on many farms just after the summer rains have fallen.

DR. J. W. GROENEWALD. There is today some considerable confusion regarding trace elements. Ten years ago, perhaps, the field was relatively uncomplicated. Today the various inter-relationships are most confusing. Does Dr. Brown suggest that in the Karoo one avoids supplementation of feeding with selenium entirely? What is the position regarding white muscle disease in these areas?

ANSWER. I would most certainly advocate that selenium should not be used in these areas, unless it is proved beyond doubt that it is necessary. In the Karoo, areas of high selenium content in the vegetation apparently alternate with patches where selenium may be deficient. I believe that the first cases of white muscle disease to be described in this country were found near Rosmead and de Aar, areas where geeldikkop and enzootic icterus do not usually occur as far as we know. One can expect selenium deficiencies to arise on farms where irrigation is extensively practised and the animals are fed solely on lucerne or hays from such lands. We have as a good example Dr. R. C. Tustin's experiences with white muscle disease on the Vaal-Hartz irrigation scheme. Selenium deficiencies might also be expected to occur in the coastal areas where the rainfall is high.

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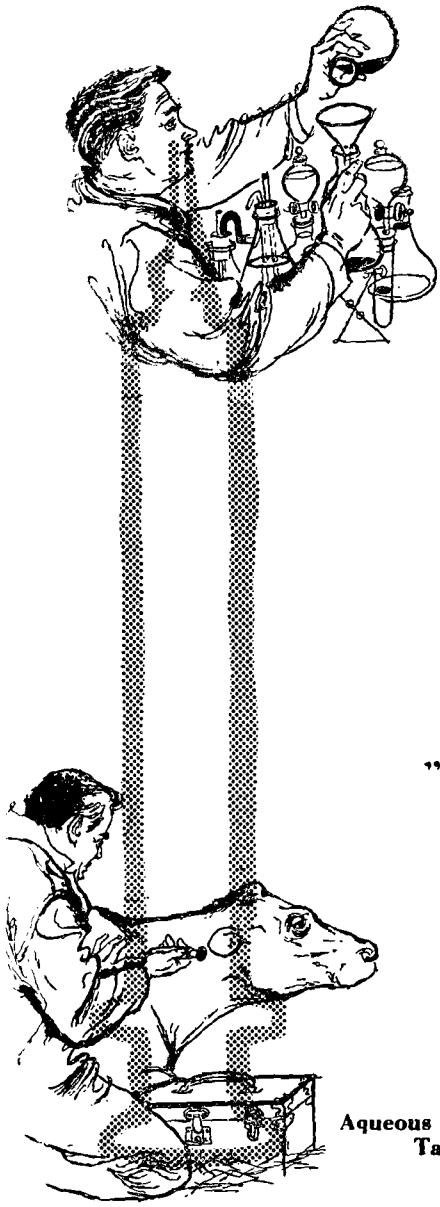

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TREATMENT OF HEARTWATER IN SHEEP AND LARGE-SCALE IMMUNIZATION AGAINST HEARTWATER IN SMALL STOCK

J. D. POOLE

DR. POOLE enlarged on various aspects of his paper, which was published in four parts prior to the congress.

The opener of the discussion, PROF. VAN DER WALT, pointed out that the small stock owner in heartwater areas was faced with one of two alternatives — either to dip very regularly and thoroughly and keep his stock completely tick-free, or to immunise. He went on to refer to the immense cost and difficulty of keeping animals tick-free which prevented great areas from being used for small stock farming.

Although heartwater immunisation in small stock was not unknown, it remained for Dr. Poole, with his large scale field experiments to show that this procedure was feasible, economical and could be carried out without serious losses.

DR. POOLE is to be congratulated and thanked for the practical way in which the experiment was carried out on large numbers of animals. His work will undoubtedly contribute much to the opening up of large areas of heartwater infected country for the farming of small stock.

There was a lengthy discussion on the paper, during which the following features of the subject were ventilated.

PROFESSOR ALEXANDER pointed out the danger of infecting sheep for the purpose of using them as donors for production of heartwater blood for immunization purposes. He said that the production of heartwater blood was an intricate process and attention had to be paid to the details in the methods used and the regularity of reaction in animals infected was of primary importance in the success of the immunization process. For instance, prolonging the period of storage of the blood would prolong the incubation period in the animal infected with that blood.

Various members raised the question as to the incubation period with frozen blood. DR. POOLE pointed out that the incubation period would be longer than with fresh blood.

The question of losses in immunised animals after winter, was also raised. Dr. Poole pointed out that the immunity depended for its maintenance on periodic reinfection and that immunity could be lost within 6 weeks in certain instances in the absence of reinfection. His opinion was that rigid tick control measures were probably the cause of this loss of immunity and that one remedy would be to reinfect such animals during winter.

In answer to questions in connection with the actual day on which treatment should be carried out, Dr. Poole indicated that it was extremely important to wait until the day or days indicated in his recommendations, because early treatment at the first rise in temperature is not as successfull and relapses will be experienced several days later.

BOOK NEWS

The vast amount of knowledge and experience gained in animal reproduction in recent years have brought forth two more books of outstanding value to the research worker, teacher, student, veterinarian and all others interested in this subject. They are:—

THE SEMEN OF ANIMALS AND ARTIFICIAL INSEMINATION; edited by J. P. Maule. This is a worthy successor to Anderson's classic work of the same title published in 1945. It is written by a number of specialists who deal with all aspects of semen and artificial insemination in no less that ten different species of animals. R6-45.

REPRODUCTION IN FARM ANIMALS; edited by E. S. E. Hafez; consists of contributions from 22 internationally know specialists, and deals with all aspects of reproduction in cattle, sheep, horses and poultry. It is clearly written and concise. Probably no other book on reproduction contains so much valuable information in 367 pages. R8-90.

Henning's "Animal Diseases in South Africa" is now out of print, and date of publication of a new edition is not yet known. THE INFECTIOUS DISEASES OF DOMESTIC ANIMALS by Hagan and Bruner, which is now in its fourth edition, is a valuable substitute. R9-60.

The revised and enlarged fourth edition of SHEEP HUSBANDRY AND DISEASES by Fraser and Stamp is a most useful book, not only for the farmer and breeder, but also for veterinarians in sheep areas. R3-90.

ANIMAL VISION by R. H. Smythe is a most fascinating, entertaining and informative book for veterinarians as well as all animal lovers who are curious to know what the world looks like to our animals, and how the degree of vision miraculously conforms to the animals' natural requirements, R2-75.

To anyone wanting to know how animals love, fear and hate the same way as we do, and many other factors regarding the mentality of animals, we recommend ANIMAL PSYCHOLOGY by R. H. Smythe, which is a scientific study but really reads like a novel. . R6-25

ROBERT BAKEWELL, PIONEER LIVESTOCK BREEDER, by Pawson, is the first book published on the life and work of the best known agriculturist of all time and the founder of modern breeding practice. It should be in possession of everyone interested in livestock breeding. R2-75.

The sixth edition of O. C. Bradley's well known TOPOGRAPHICAL ANATOMY OF THE DOG, revised by Professor Grahame, has been adapted to meet the changing needs of the clinician, research worker and student. It constitutes a most useful text and reference book. R3-90.

WRITING A TECHNICAL PAPER by Menzel, Jones and Boyd is a little book which should be available to every scientist. It will greatly enhance the value of scientific articles and save editors many headaches. R2-75.

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FOOT AND MOUTH DISEASE IN GAME ANIMALS

M. J. N. MEESER

Dr. Meeser enlarged on his paper and gave support to his talk by projecting some very interesting slides.

The following is a brief resume of the discussion which took place.

DR. P. S. SNYMAN. Dr. Snyman gave a review on the history of the disease in South Africa. He pointed out that although lesions were observed in game, they were not then incriminated as carriers of the disease. It was only in the late forties that it was realised how important a part game played.

As far as fencing is concerned, it must be realized that such a fence as had been erected on the Kruger National Park cannot be expected to be 100 per cent effective and we must always remain alert. Here also the importance of the observations made by Dr. Meeser is obvious. If the normal migration routes of game can be changed, the chances of carrying infection out of the Park, are very much smaller.

DR. P. A. BASSON. In Suidwes-Afrika het wild 'n baie belangrike rol gespeel in die verspreiding van die siekte. Ek wil egter daarop wys dat letsels op die apex van die tong en tussen die kloue gereeld gesien is. 'n Interessante letsel wat opgemerk is, is die letsel op vlakvarke se knieë wat waarskynlik veroorsaak word deur hul gewoonte om op die knieë te wei.

DR. A. ALBERTYN. Die owerhede moet geluk gewens word met hierdie poging om Bek- en Klouseer te bekamp. Vandag is die samewerking met die Parkeraad baie hartlik maar dit was nie altyd die geval in die verlede nie en niemand wou toe glo dat wild draers was nie.

MNR. R. KNOBEL (Direkteur, Nasionale Parkeraad). Ek wil graag sê dat die Raad vandag baie dankbaar is vir die mooi samewerking met die Departement Landbou Tegniese Dienste. Die mak dier is vanselfsprekend van groot belang vir die land maar hy is bly om te sien dat die belangrikheid van die wilde dier ook vandag besef word.

DR. M. C. LAMBRECHTS. Die vordering en sukses van die omheining van die Nasionale Kruger Wildtuin is hoofsaaklik te danke aan die hulp en medewerking van die Parkeraad.

Hoewel die sub-tipes van die A, O en C virusse in Europa en Asië tot in „detail" uitgewerk is, is baie min bekend oor sub-tipes van Afrikaanse Bek- en Klouseer. 'n Groot veld lê nog hier braak.

Dit is ons erns om die siekte te bestry soos gesien kan word in die groot bedrae geld wat aan kampanjes bestee word. Nietemin word gehoop dat met navorsing op hierdie gebied ons met groter vertroue die toekoms tegemoet gaan.

DR. M. DE LANGE het mnr. de Bruin bedank vir die pragtige rolprent oor die omheining wat nie sonder gevare en moeilikhede voltooi is nie.

The very appropriate film INYAMAZANE which preceeded Dr. Meesers talk was much appreciated by all.

This film gives details of the fencing of the Kruger National Park and of how the animals have accustomed themselves to the fence.

DEMONSTRATIONS ON THE PRODUCTION, RECOVERY, PRESERVATION AND TRANSFER OF OVA: THE PUDENDAL BLOCK IN THE BULL AND RAM: THE COLLECTION OF BOVINE SEMEN BY MASSAGE OF THE AMPULLAE

S. J. VAN RENSBURG I. S. MCFARLANE

DR. I. S. MCFARLANE gave two most practical and informative demonstrations on the per-gluteal method of anaesthetising the pudic nerve in bulls and rams, and on obtaining semen from bulls by massage of the ampullae.

In both, the anatomical structures involved, were very clearly explained with the aid of both fresh and preserved specimens and blackboard drawings.

An article on pudendal block will appear in the next issue of this Journal.

MASSAGE OF THE AMPULLAE

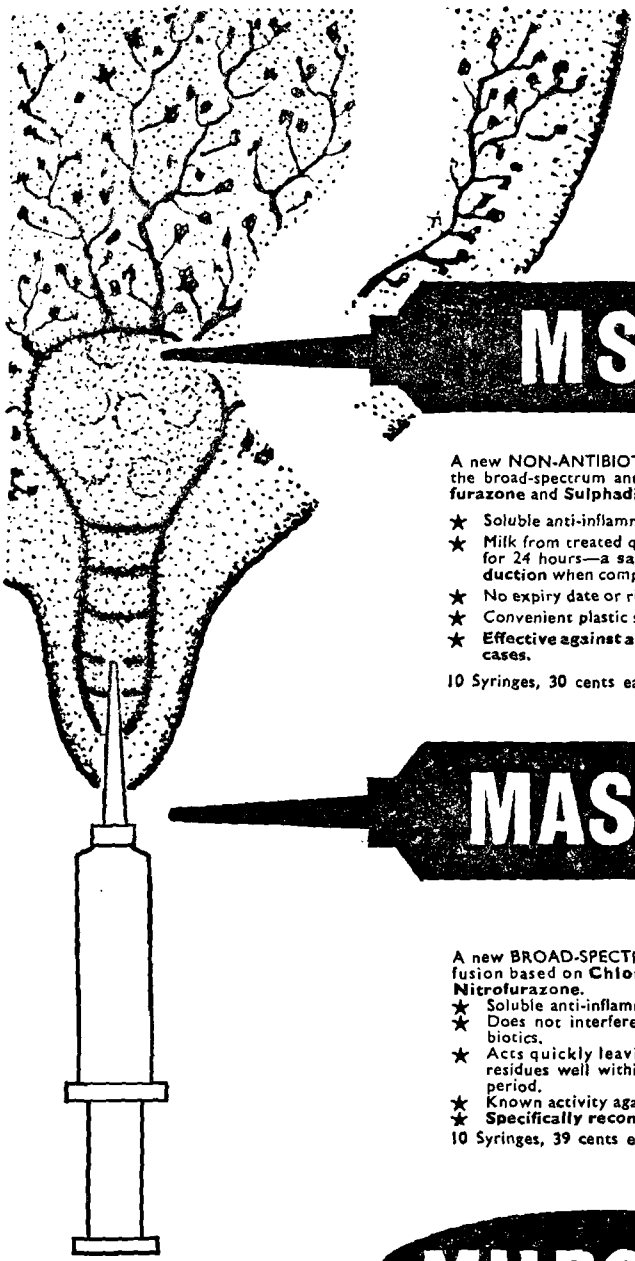
The advantage of this is that it enables the practitioner to obtain semen in cases when bulls are not trained to the artificial vagina and where electrical stimulation is not possible.

Previous sexual stimulation of the bull is desirable, but otherwise he should not be subjected to excitement or harsh treatment either before or during the operation.

The prepuce and surrounding areas are thoroughly washed previously, and an artificial vagina at the right temperature but with the cone and collecting tube inverted, are used for collecting the semen.

Evacuation of faeces and all other manipulations in the rectum must be gentle. Palpation of the seminal vesicles and ampullae cause a preliminary discharge of clear fluid from the accessary glands. This is not collected.

No violent backward and forward massaging is done. Instead the ampullae are stripped by placing the index and middle fingers over their distal ends and firmly drawing these two fingers backward over the ampullae pressing them against the pelvic floor. This is done three or four times, and with the last backward stroke the fingers are drawn right back against the blunt anterior extremity of the bulbo-methral muscle thus bringing about ejaculation of the semen.



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PRELIMINARY COMMUNICATION ON THE CULTIVATION OF *BESNOITIA BESNOITI* (MOROTEL, 1912) IN TISSUE CULTURE AND EMBRYONATED EGGS

R. D. BIGALKE — Section of Protozoology, Veterinary Research Institute, Onderstepoort

SUMMARY

1. The cultivation of proliferative and cyst organisms of *B.besnoiti* in lamb and calf kidney cultures is recorded.

2. A method ensuring sustained growth in tissue culture with a high yield of organisms is described.

3. The cultivation of proliferative organisms of *B.besnoiti* in embryonated eggs, characterized by the development of yellowish-white foci in the membranes, is recorded.

INTRODUCTION

Besnoitia besnoiti is the cause of a disease in cattle which is of considerable economic importance in certain regions of South Africa. It has been determined that sheep, goats, rabbits and guinea pigs, are susceptible to artificial infection with this parasite[1]. No attempts have been made as yet to grow the organism in tissue culture or developing chicken embryos.

Toxoplasma gondii (Nicolle and Manceaux, 1909), which is related to *B.besnoiti*, is easily cultivated in tissue culture and embryonated eggs. Chernin and Weller[2] observed as many as 2.5 million parasites per c.c. in mouse embryo cultures infected with mouse peritoneal exudate. In embryonated eggs proliferation is rapid, causing death after 5 to 6 days with the formation of numerous yellowish-white foci up to 3 m.m. in diameter, consisting of necrotic material, mononuclear leucocytes and free and intracellular toxoplasma[3, 4].

Besnoitia jellisoni Frenkel, 1953, a parasite of the white-footed mouse (*Peromyscus maniculatus* (Wagner) Clooger) of North America, can be grown in embryonated eggs[5].

An attempt was therefore made to grow *B.besnoiti* in tissue culture and fertile hen's eggs with the object of producing an antigen for serological and quantitative studies.

MATERIALS AND METHODS

A. TISSUE CULTURE

Inoculum

It has been shown that proliferative organisms of *B.besnoiti* are fairly numerous in the testis of artificially infected rabbits. Rabbits showing severe oedema of the scrotum were exsanguinated at the height of the acute phase of the disease. The testis was removed aseptically, ground in

a mortar and 5 to 10 c.c. of medium added. The resulting suspension was filtered through sterile guaze. Cyst organisms were obtained from a piece of skin removed by biopsy from a naturally infected bull. Thin slices of skin containing numerous cysts were placed in Hank's Solution containing 2,000 units penicillin, 2,000 micrograms streptomycin, 1,500 micrograms neomycin and 40 micrograms fungizone per c.c. for 4 days. The cysts were then crushed in a mortar and 5 c.c. medium, containing 500 micrograms neomycin per c.c. in addition to the usual antibiotics (*vide infra*) added.

Cells

Trypsin-dispersed kidney cells were set up according to the method of Youngner 1954)[6] as modified by Bodain[7]. The temperature of incubation was $\pm$ 36° C. throughout.

The medium consisted of Hank's solution containing 10 per cent cattle serum, and 500 units penicillin, 500 micrograms of streptomycin and 2 to 4 micrograms fungizone per c.c. Unless otherwise stated, roller tubes containing 1.0 c.c. of medium were used.

Cells were not used before growth was more or less confluent. The medium was changed prior to use and thereafter ever 3 to 4 days. Initially tubes were left stationary for 48 hours after infection, but this was dispensed with when it was found that proliferation was equally satisfactory in tubes rolled almost immediately after infection.

Tubes were examined under a binocular microscope at a magnification of 40X.

Counts

Only extracellular, typically crescentic parasites were counted in a haemocytometer. No stain was used. As no extracellular organisms could be found to count in testis inoculum in most cases, smears were made from the testis used for preparing the inoculum. Organisms were invariably present, usually 3 to 4 per microscopic field.

Staining methods

Roller tube cultures were fixed with Bouins fluid and permanent preparations made by a modification[8] of the method described by Enders and Peebles[9]. These preparations, as well as smears, were stained with Giemsa.

Experimental

Pilot tests

Lamb and calf kidney cultures were inoculated with 0.2 c.c. of rabbit testis inoculum. A fair number of extracellular organisms were present in smears made from centrifuged medium on the 7th day. Intracellular organisms could be found in small numbers in permanent preparations: 0.2 c.c. of medium was subinoculated into each of a further series of cultures. Growth was considerably slower, however and the strain was lost in spite of the fact that subinoculation was delayed to the 11th day. Permanent preparations which were made subsequently, of second generation cultures, revealed that intracellular organisms only became numerous on the 19th and 20th day after infection.

Preliminary titrations in vitro

The pilot test indicated that *B.besnoiti* multiplies more profusely in the 1st than in the 2nd generation, in spite of the fact that there were more extracellular organisms in the latter inoculum. Intracellular organisms could not be counted but were probably always present in small numbers.

A series of calf and lamb kidney cultures was infected with testis inoculum from two different rabbits. After 10 to 14 days, cytopathogenic changes (cp.), consisting of focal shrinkage, rounding off, fragmentation and loosening of cells leaving empty spaces in the sheet of cells, gradually spreading to involve the whole sheet, were noticed (Fig. 1.)

When these changes were fairly pronounced the media from a few tubes were pooled. A tritration of 10^{-1} to 10^{-8} of medium originating from calf kidney cultures and harbouring $\pm$ 1,165,000 organisms per c.c. was done in further calf kidney cultures. A 10^{-2} to 10^{-7} titration of medium originating from lamb kidney cultures harbouring $\pm$ 560,000 organisms per c.c. was done in further lamb kidney cultures: 3.0 c.c. of the same medium was inoculated into a Roux flask containing similar cells.

In all cases cultures were examined for at least 14 days after infection and discarded after 21 to 24 days if no cytopathic effects were evident.

Results

In calf kidney cultures infection only took place at a 10^{-1} dilution i.e. $\pm$ 116,500 organisms set up an infection whereas $\pm$ 11,650 failed to infect.

No infection took place in lamb kidney tubes i.e. $\pm$ 5,600 organisms failed to infect, but the flask inoculated with $\pm$ 1,680,000 organisms became infected.

COMPARATIVE TITRATIONS IN VITRO TO DETERMINE THE MINIMUM INFECTIVE DOSES (I.D. 50/C.C.) OF MAINLY EÔTRACELLULAR AS OPPOSED TO MAINLY INTRACELLULAR ORGANISMS

Preliminary titrations indicated that relatively few, if any, of the extracellular parasites present in the medium were infective. It was therefore decided to compare the infectivity of organisms present in the medium with that of organisms remaining in the tubes after the medium had been decanted. Previous studies have shown that intracellular parasites were plentiful in cultures showing numerous extracellular organisms in the medium (*vide infra* — Morphology of *B.besnoiti* in tissue culture).

After the medium had been decanted the remaining cells were removed from the walls of the tubes with saline containing trypsin and versene (A.T.V.) after the method of Madin and Darby[10]. Four different series of titrations with a strain of *B.besnoiti* maintained in lamb kidney cultures were performed at various intervals. Mechanical and/or chemical disintegration of heavily parasitized cells, or fragments of cells, during the process of harvesting of cells by A.T.V., was probably responsible for the presence of larger numbers of extracellular organisms in the cell suspension than in the medium.

The minimum infective doses were calculated according to the method of Reed and Muench[11].

Results (Table)

In three out of four titrations the I.D. 50/c.c. was significantly lower (two logs or more) when cells removed by A.T.V. constituted the inoculum as compared with the conventional method of passage.

Severe cytopathogenesis occurred concurrently with the appearance of large numbers of free organisms in the medium of the lower dilutions. The lower the infective titre the longer was the time interval before degenerative changes took place. In high titres cp. changes were apparent after 5 to 6 days.

Maintenance of B.besnoiti in Tissue Culture

B.besnoiti of rabbit testis origin has been maintained in lamb kidney tissue culture for 4 generations by subinoculation of 0.1 c.c. aliquots of medium at the height of infection. Counts of over a million parasites were obtained, the highest being $\pm$ 1,360,000 per c.c.

Titrations of cyst organisms of B.besnoiti in vitro

Lamb kidney cultures were used. Only one experiment was conducted. The inoculum contained $\pm$ 78 million organisms per c.c. and the minimum infective titre was $10^{-2,\,5}$ or $\pm$ 246,700 organisms per c.c. A lack of viability, comparable with that of extracellular organisms in tissue culture medium, was evident.

Morphology of B.besnoiti in tissue culture (Figs. 2 and 3)

Permanent preparations were made at various stages of proliferation in tissue culture.

Initially intracellular parasites were rare, occuring either singly or in pairs. Almost invariably they appeared to be lying in vacuoles, a clear zone surrounding each individual parasite like a halo (Fig. 2). Multiplication by binary fission was apparently synchronous, leading to the formation of aggregations of parasites consisting of multiples of two i.e. two, four, eight, sixteen and thirty-two. At the latter stage parasites were lying on top of each other and were difficult to count accurately. Nothing resembling mature or immature cysts of *B.besnoiti* was seen. Colonies of parasites were usually rosette-shaped, but sometimes resembled a bunch of bananas.

There was a marked resemblance to *Toxoplasma* in tissue culture. However, medium from infected cultures inoculated into rabbits from time to time produced typical besnoitiosis reactions. Skin sections taken four weeks after the febrile reaction from rabbits that survived the acute phase of the disease revealed the typical, large, thick-walled cysts of *B.besnoiti.*

B. Embroyonated Eggs

Rabbit testis prepared as for use in tissue culture, or medium from infected tissue cultures served as the infective inoculum. Eggs were injected into the chorioallantoic sac, or into the yolk sac, or by the

stab-method. The chorioallantoic membranes, and in some cases the yolk sac membranes, were harvested for serial passage, preparation of smears or biological tests. Eggs were incubated at ± 37°C.

Initially, 9-day-old embryonated eggs were used. Inoculation with 0.2 c.c. tissue culture medium containing ± 810,000 extracellular parasites per c.c. failed to cause mortality. Although smears made from harvested membranes failed to reveal any parasites, a biological test performed on rabbits gave positive results. The same applied to eggs receiving 0.2 c.c. medium containing ± 380,000 organisms per c.c., to eggs injected with 0.2 c.c. rabbit testis inoculum and those injected with 0.5 c.c. citrated rabbit blood.

When 7-day-old embryos were injected with 0.5 c.c. testis inoculum one egg infected via the chorioallantoic sac died on the 19th day. Smears from the membranes showed fairly numerous free and some intracellular parasites. Membranes from the remaining eggs were harvested on the 20th day, homogenized in Hank's solution containing antibiotics, filtered through sterile gauze and passaged into a second generation. From the second generation onwards circumscribed yellowish-white foci varying from 0.5 to 4 mm. in diameter developed in the chorioallantoic and yolk sac membranes (Fig. 4). Histologically these foci consisted of necrotic material surrounded by cellular infiltration and rather numerous intra — and extracellular parasites.

The strain has been passaged for 6 generations and the mortality rate has increased. Starting on the 11th day after infection in the 2nd generation it progressed to the 7th day in the 3rd and 4th generations and to the 5th day in the 5th and 6th generations.

DISCUSSION

The resemblance in behaviour between *B.besnoiti* and *T.gondii* in tissue culture and fertilized eggs was very striking. Not only were morphological features indistinguishable, but the cytopathogenic effects, biological properties of the organisms and pathological changes produced in eggs virtually indentical. There was a slight quantitative difference in so far as that the yield of *Besnoitia* was less than that described for *Toxoplasma*. Biological tests on rabbits proved that the parasite concerned was in fact *Besnoitia*, but the close relationship between the two has been accentuated.

Lack of infectivity of extracellular organisms of *B.besnoiti* was similar to that experienced with *T.gondii* in mouse peritoneal exudate[12, 13]. This was responsible for slower proliferation in the second and subsequent generations than the first, a phenomenon which has also been observed with *Toxoplasma* in tissue culture[14]. It is probably due to "loss of infectivity of parasites suspended in the culture medium", as suggested by Lund *et al* for *T. gondii*[13].

Maintenance of *B.besnoiti* in tissue culture has been considerably simplified by the use of A.T.V. to remove the cells from the walls of culture vessels. The obvious explanation for the high infectivity obtained by this method lies in the large numbers of heavily infected cells in the inoculum, from which viable organisms are liberated that can enter new cells immediately.

CONCLUSION

It is evident that cultivation of *B.besnoiti* in tissue culture and embryonated eggs is a biological tool with a great potential value. The production of an antigen for serological studies should be possible.

In vitro screening of drugs is now feasible. It may be possible to establish the L.D.^{50} for rabbits, which would simplify chemotherapeutic studies considerably. It should also lead to an improvement in our understanding of host-parasite relationships.

ACKNOWLEDGEMENTS

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TABLE I

Comparative titrations of tissue culture medium and cells serving respectively as sources of B.besnoiti.

Generation in tissue culture	Medium containing mainly extracellular organisms			Suspension of cells removed with A.T.V.		
	No. of organisms per cc. inoculum	ID 50 per cc. (titre)	ID 50 per cc. (organisms)	No. of organisms per cc. inoculum	ID 50 per cc. (titre)	ID 50 per cc. (organisms)
2	100,000	$10^{-1.5}$	3125	490,000	10^{-4}	49
3	170,000	$10^{-1.33}$	8095	300,000	$10^{-2.66}$	656
3	210,000	$10^{-1.66}$	4594	340,000	$10^{-3.66}$	74
4	110,000	$10^{-1.33}$	5145	150,000	$10^{-3.66}$	33

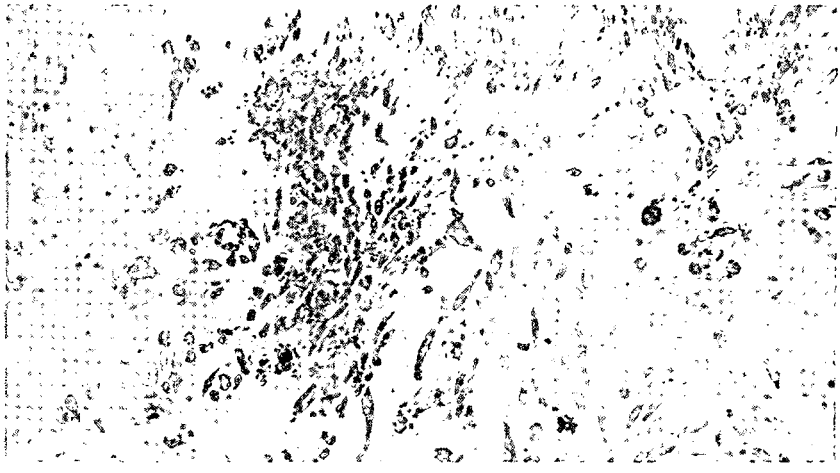


Fig. 1.—Cytopathogenic changes produced by *B. besnoiti* in lamb kidney roller cultures. Unstained x 76.

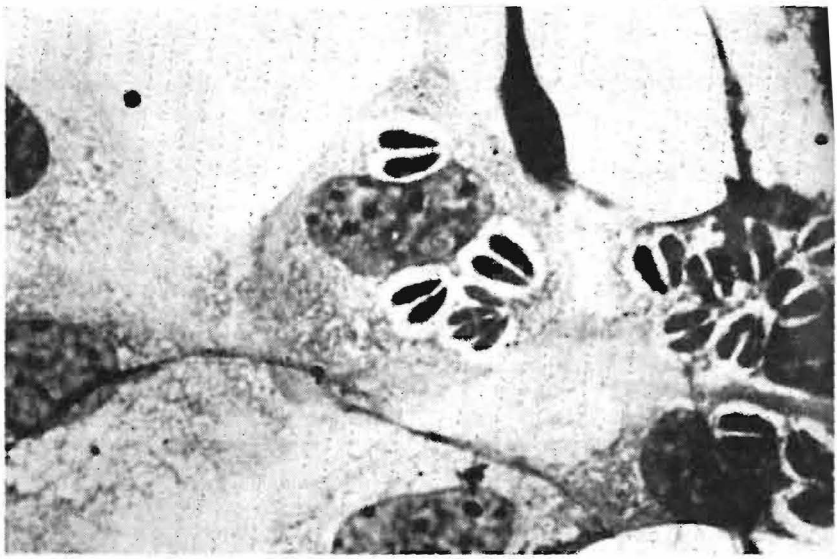


Fig. 2.—*B. besnoiti* in lamb kidney roller culture. Permanent preparation stained Giemsa x 1,200.

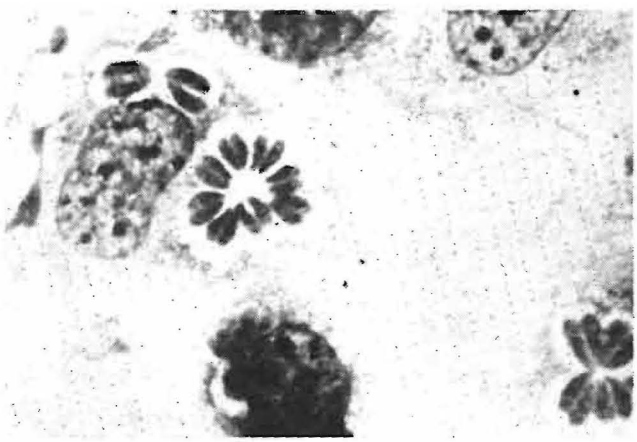


Fig. 3.—As in Fig. 2, showing a rosette.

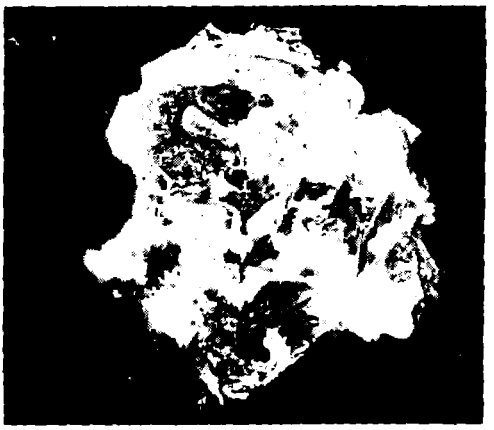


Fig. 4.—White foci produced in the chorioallantoic membrane by *B. besnoiti.*

DISCUSSION

In opening the discussion Dr. Jansen said that the work represented a major break-through in the systematic study of besnoitiosis. The contribution had not come by chance but by persistent hard work, and new fields had now been opened up from which many practical results could be expected. The time was not far distant when a diagnostic serological test and a vaccine would be available. He said that he would like to congratulate Dr. Bigalke on this major contribution to Protozoology.

DR. SMIT enquired whether besnoitiosis had been transmitted to dogs and mentioned that single free *Besnoitia* parasites resembled those of *Toxoplamma gondii* very closely.

DR. LENTE VAN DER MERWE enquired whether any remedies had been tested against the organisms grown in tissue culture and mentioned that the incidence of the disease appeared to be increasing in the bushveld.

DR. S. J. VAN RENSBURG stated that Dr. Bigalke and himself had studied the influence of besnoitiosis on pregnancy in sheep and goats. Of 14 animals infected in various stages of pregnancy, only one had had a normal pregnancy. The infection in the others had resulted in either foetal absorption, abortion, maceration or premature births. Natural cases of besnoitiosis in sheep have never been observed in the field but was worth looking out for.

DR. SCHUTTE asked whether the methods of natural transmission of the disease had yet been determined.

In reply DR. BIGALKE said that he had not undertaken transmission experiments in dogs but that this had been done by Dr. Pols without success. He considered that this should be attempted again using larger

infecting doses of the organisms. In cattle the majority of infections produced artificially resulted in mild and even subclinical cases. This was probably the reason why earlier workers recorded negative results when attempting to transmit cyst organisms of the parasite. He suggested that the question of species susceptibility be re-investigated.

Free forms of *B.besnoiti* and *T.gondii* were so similar that he could not differentiate them on morphological grounds.

Dr. Bigalke said that Dr. Pols had tested a wide range of drugs without any success. The same applied to a number of drugs tested by himself.

Besnoitisis can be transmitted mechanically by tsetse flies and *Tabanus* sp. He was convinced that mechanical transmission of the disease commonly occurred in nature, but was not certain whether biological transmission also took place.

THE HEALTH OF THE WEANLING PIG

R. K. LOVEDAY

In introducing his paper, DR. LOVEDAY pleaded for the profession to play an active and informed role in the prevention of swine disease. Failure to do so led to this important field of service being taken over by unqualified persons to the detriment of farmer and veterinarian alike.

Ascariasis as a cause of unthriftiness in weaner pigs had virtually disappeared with the use of washable floors. He could recall only two occasions in over 350 detailed pig necropsies performed during the past four years when a significant number of *Ascaris* worms were observed in the small intestine. The clinical study of severe experimental Ascaris infestations had shown that such infestations did not provoke chronic coughing in pigs. The persistent coughing heard in some pig herds was probably due to enzootic pneumonia.

Diarrhoea was the commonest health disturbance seen at weaning and was generally of a non-specific nature and of limited duration. This mild disturbance was usually associated with feed changes or adverse housing conditions. Several specific intestinal infections of a more prolonged and serious nature could occur within the first month after weaning with grave economic consequences. In this category fell the severe diarrhoeal diseases caused by haemolytic strains of *Escherichia coli*, by *Salmonellae* and by *Vibrio coli*. Swine dysentery, believed to be caused by *V. coli*, was a particularly dangerous pig disease which spread rapidly in a piggery and caused severe growth retardation and some 10 per cent mortality. At autopsy the bowel lesions were confined entirely to the large intestine, and this feature was of diagnostic assistance. Stained smears of faecal mucus revealed large numbers of round cells and associated vibrios. Clinical relapses were common and recovered animals remained infective carriers for a long time.

In the pig repeated attacks of catarrhal enteritis of whatever origin led to mucosal necrosis and fibrosis, these changes being accompanied by chronic diarrhoea and permanent unthriftiness. This lesion, the so-called "necrotic enteritis" was therefore irreversible and non-specific, and was commonly found in many "runt" pigs. Dietary deficiency of niacin was also believed to be a predisposing cause of this lesion and the relative unavailability of the niacin in maize to the pig should therefore also be borne in mind.

The introduction was followed by the showing of several colour slides of the lesions of parakeratosis and the rapid resolution of such lesions when zinc was administered in the ration. Dr. Loveday cited an increase in weekly liveweight gain from 4 to 11 pounds seen in such recovering animals within 7 days of commencing medication.

Opening the discussion, DR. F. B. W. DUCASSE drew attention to the prevalence of inherited traits in many commercial herds. The two commonest examples seen were scrotal hernia and intersexuality, the latter trait having an incidence of about 7 per cent as seen at the Estcourt Bacon

Factory. Muscle degeneration was another important condition recently observed and might also have a genetic background. It was very necessary to warn farmers about these dangers before they became too widespread

DR. I. CANHAM enquired about the possibility of encountering drug-fast bacterial strains in pig. Dr. Loveday replied that numerous drug-fast strains of *E. coli* had been identified during the past few years; resistance to tetracyclines being particularly common.

DR. R. K. REINECKE agreed that *Ascaris* infestation was no longer a problem to pig producers where satisfactory hygienic measures were instituted. He felt that piperazine was an expensive drug and sanitation procedures were obviously more economical.

DR. J. W. GROENEWALD stressed the need for suitable trace mineral supplementation of rations and the value of zinc in preventing parakeratosis. Iron was not required in South Africa since local cereals contained adequate quantities of this element, but copper, zinc and manganese could be added with advantage.

DR. MAY of Salisbury, Southern Rhodesia, cited a very wasting diarrhoea of porkers in Rhodesia caused by severe *Trichuris* infestation. Superfine phenothiazine had proved an effective treatment. Dr. Loveday pointed out the need for correct sanitation in controlling this direct life-cycle nematode.

THE BUSINESS MEETING

MINUTES OF THE FIFTY-SEVENTH ANNUAL GENERAL MEETING HELD IN THE AUDITORIUM OF THE FACULTY BUILDING, ONDERSTEPOORT, ON WEDNESDAY 26TH SEPTEMBER, 1962

PRESENT

Dr. H. P. Steyn (President), Prof. R. Clark (Vice-President), the Secretary (Dr. A. M. Diesel) and the following members: Abrams, L., Adelaar, T. F., Albertyn, A. A. L., Alexander, R., Badenhorst, J. A., Bakker, S. K., Barnard, B. J. H., Barrie, N., Basson, P. A., Bekker, P. M., Bisschop, J. H. R., Bisschop, P. J. R., Blomefield, L. C., Boardman, N. H., Bosch, J., Bosman, P. P., Botha, H., Botha, H. N., Breytenbach, C. M., Brookes, J. W. A., Brown, J. M. M., Brummer, W. A. S., Buhr, W. H. B., Canham, I. S., Cameron, C., Cavanagh, F. E., Chase, W. H., Cilliers, S. D., Cloete, P. R., Coetzee, H. G., Coetzee, L., Coles, J. D. W. A., Colly, L. P., Davies, P. V. A., de Abreu, E. F., de la Harpe, P., de Jager, L. A., de Lange, M., Dent, G. C., de Villiers, O. T., de Wet, G. J., de Wet, J. M., de Wet, P. D., Dickson, Campbell, Doré, J. L., Ducasse, F. W. B., du Plessis, J. L., du Plessis, W. A. J., du Toit, I. F., Ebedes, H., Edwards, L. T., Ehret, W., Erasmus, B. J., Erasmus, J. M., Eschenburg, W., Frean, J. R., Flight, C. H., Fourie, P. J., Greathead, M. M., Grosskopf, J. F. W., Hellberg, H. F., Hempstead, F. D. J., Hodkin, H. M., Hugo, P. P., Hofmeyr, C. F. B., Horak, I., Howell, C. J., Howell, P. G., Howell, R. J., Hurter, L. R., Irwin, D., Jansen, B. C., Jarvie, D. J., Joubert, P. G., Kempster, Z. P., Kluge, E. B., Kritzinger, P. B., La Grange, A. B., Lambrechts, M. C., le Riche, E. O., le Roux, J. M. W., le Roux, D. J., Louw, G. J., Loveday, R. K., Lubbe, A. M., Malan, W. du T., Mansvelt, P. R., Marais, J. S. C., Marlow, C. H. B., Marnewick, J., Mason, J. H., Masters, P. M. S., McDonald, C. T., McFarlane, I. S., McIntosh, B. M., Meara, P. J., Meeser, M. J. N., Meltzer, D. G. A., Meredtih, C. D., Morford, L. R., Morris, J. J., Muir, R., Muller, C. J., Muller, G. L., Naudé, T. W., Nelson, H., Nicholson, C. S., Nixon, R. C., O'Brien, S. V., Oosthuizen, J. J., Ortlepp, R. J., Osbourn, D. E., Osrin, R. B., Owen, N. C., Pienaar, J. G., Pols, J. W., Poole, J. D. H., Posthumus, P. J., Reinecke, R. K., Robinson, E. M., Robson, T., Roos, C. J., Ryksen, W. J., Scheuber, J. R., Schneider, D. J., Schnetler, J. F., Scholtz, H. E., Schultz, K., Schutte, J. R., Smit, J. D., Smuts, T., Snijders, A. J., Snyders, S. L., Snyman, J. H. D., Snyman, P. S., Sutton, G. D., Solomon, Susan, Terblanche, H. J. J., Terblanche, M., Theron, T. A., Thomas, A. D., Thompson, G. E., Thornton, D. J., Townsend, G. H., Trace, C., Trengove, R. B., Truter, D. E., Tustin, R. C., Uys, P. L., van den Heever, L. W., van der Merwe, G. F., van der Merwe, J. P., van der Merwe, L., van der Walt, K., van Drimmelen, G. C., van Heerden, K. M., van Heerden, J. S., van Niekerk, J. W., van Rensburg, G. F. J., van Rensburg, S. J., van Rensburg, S. W. J., van Schalkwyk, I., Wacher, D. C. L., Wacher, P. P. C., Warnes, W. E. J., Weiss, K. E., Wessels, T. C. W., Wheeler, W. J., Winterbach, P. B., Worthington, R., Zwarenstein, J.

APOLOGIES FOR ABSENCE

Barnard, W., de Boom, H. P., de Kock, G., Malherbe, W., Tarr, A. F., Viljoen, J. H. B., Viljoen, W. C., Viljoen, P. R., Matthew, A., Watt, J., Williams, G. J.

ITEM. 1.—CONFIRMATION OF THE MINUTES OF THE PREVIOUS MEETING HELD AT DURBAN, ON 27TH SEPTEMBER, 1961.

The meeting being legally constituted, proceeded to consider the Agenda after the President had signed the minutes of the previous meeting, as being correct.

In welcoming the members, THE PRESIDENT requested the meeting to stand in reverence of the following members who had passed on:—

De Waal, D. J., Grist, A. G., Green, H. H., Henning, M. W., Hamlyn, W. P., le Roux, P. L., Smith, P. R. B., Schatz, W.

The meeting, being legally constituted, proceeded to consider the agenda, the President having been authorised to sign the minutes of the previous meeting as being correct (published in the December 1961 issue of the Journal of the S.A.V.M.A.).

THE PRESIDENT in welcoming all members expressed the wish that the deliberations would be fruitful.

ITEM. 2.—MATTERS ARISING FROM THE MINUTES OF THE FIFTY-SIXTH ANNUAL GENERAL MEETING

(*a*) RESOLUTIONS FROM THE F.FTY-SIXTH ANNUAL GENERAL MEETING

(*i*) *FORMATION OF AN ASSOCIATION OF ARTIFICIAL INSEMINATORS*

DR. MCFARLANE discussed and proposed the following resolution which was seconded by DR. D. J. LE ROUX and unanimously adopted:

"That this 56th Congress of the S.A.V.M.A. welcomes the formation of a constituted Association of Artificial Inseminators and instructs Council to investigate the possibility of affiliating this Association with the S.A. Veterinary Medical Association."

(ii) LEEMTE IN VEEARTSENYKUNDIGE OPLEIDING

DR. LA GRANGE het op 'n moontlike leemte gewys in die opleidingskursus van veeartse wat deur die Fakulteit tans gereël word. Sonder om enigsins refleksie op die verantwoordelike owerhede te werp, meen hy dat die kursus 'n breë veeteelt opleiding behoort in te lyf. Hy het die volgende voorstel gemaak wat deur dr. K. M. van Heerden gesekondeer was en deur die Vergadering algemeen aangeneem:

„Dat hierdie Vergadering ons Raad versoek om in die lig van die nuwe rigtings in ons veeteeltnywerheid, byvoorbeeld, dierevoortplanting, K.I. Nywerheid, genetika, voedingsleer en veeteelt in die algemeen ens., 'n ondersoek moet instel of ons huidige B.V.Sc. kursus ons as veeartse volledig genoeg toerus om 'n leidende rol in hierdie nuwere rigting te vervul".

RESOLUTION (i)

THE PRESIDENT having referred to investigations undertaken by the sub-committee, the meeting agreed to leave the matter of affiliation of the

Association of Artificial Insemination Technicians of the Republic South Africa, in obeyance for the present.

DR. MCFARLANE was elected as the representative of the Association on the Council of the A.A.I.T.R.S.A.

RESOLUTION (ii)

DIE PRESIDENT het daarop gewys dat die onderkomitee (prof. R. du Toit en drs. A. B. La Grange, J. D. Coles, M. de Lange, M. C. Lambrechts, H. P. Steyn en die sekretaris (dr. A. M. Diesel) nog steeds met die saak besig is. Die Dekaan van die Fakulteit van Veeartsenykunde sal mettertyd die opinie van die Fakulteit aan die Raad van S.A.V.M.V. oordra.

Die saak word dus vir behandeling tot die volgende Jaarvergadering uitgestel.

DR. JANSEN het gemeld dat die veeartsraad ook in die saak betrokke is en daartoe deur die veeartswet gemagtig is.

(*b*) THE USE OF THE TITLE M.R.C.V.S.

THE PRESIDENT referred briefly to the reciprocity provision of the Veterinary Act and indicated the difference between the title of M.R.C.V.S. as obtained after examination and the same title acquired by payment of a subscription to the Royal College of Veterinary Surgeons.

DR. JANSEN enlarged on the subject of reciprocity between the Veterinary degree of the University of Pretoria and British graduates.

He referred to the changes brought about by the exclusion of South Africa from the Commonwealth mentioning that the "Foreign Register" had now taken the place of the Supplementary (Commonwealth) Register.

In his opinion the guide to professional conduct (clause 5 (*g*)) prohibits the use of the M.R.C.V.S. unless this is acquired by examination.

DR. P. S. SNYMAN considered that good relations between the M.R.C.V.S. and the South African degrees should be encouraged and not be disturbed.

DR. J. D. COLES informed the meeting that he was an M.R.C.V.S. by subscription. The fee was R12.60 (£6.6.0.).

Dr. Max Sterne, now of the Wellcome Foundation, England, was also a member.

DR. THORNTON advised that he was the holder of the M.R.C.V.S. by subscription.

DR. DAVIES said he too was privileged to use the title by payment of subscription.

After further discussion the following resolution was proposed by Dr. Jansen, seconded by Dr. P. S. Snyman and carried unanimously:

> It is the considered opinion of the representative body of veterinarians attending the 57th Annual General Meeting of the S.A.V.M.A. that use of the title M.R.C.V.S. on nameplates or prescription pads is not permissible in the Republic of South Africa, when it has been obtained as a result of the payment of a fee solely for the purpose of admission to the Register of the College. When admission to that register results from passing a prescribed examina-

tion, carried out by the Royal College duly constituted as an examining body, use of this title in the Republic is permissible.

Note

(i) It is emphasized that this interpretation of the status of the title M.R.C.V.S. does not affect in any way the present reciprocity arrangements between the Royal College and the Veterinary Board.

(ii) This resolution is to be published in the Journal of the Association for the information of all registered veterinarians.

(c) REFRESHER COURSES AT THE VETERINARY FACULTY

PROF. R. DU TOIT, Dean of the Faculty of Veterinary Science, informed the meeting that difficulty was at present being experienced in arranging these refresher courses, because of the lack of facilities, time and personnel.

As soon as the staff position had improved the question would be re-examined.

PROF. R. CLARK referred to the feeler which had been put out last year through the medium of a circular. The response was very good and it was clear from the replies that the course should extend over a period of two weeks, during July and should include specific subjects.

THE PRESIDENT expressed the wish that Faculty would continue to give the matter its urgent attention and hoped that the courses would be instituted and developed.

ITEM 3.—ANNUAL REPORT BY THE PRESIDENT ON THE ACTIVITIES OF THE COUNCIL AND OF THE ASSOCIATION.

Ladies and Gentlemen:

It is with regret that I have to announce the death of the following colleagues during the past year: Prof. M. W. Henning, Drs. D. J. de Waal, A. G. Grist, W. P. Hamlyn, P. R. B. Smith, W. H. G. Schatz, P. L. le Roux. Dr. Harry Green passed away too; he was not a veterinarian but had been closely associated with the profession.

Will you please stand in respect, to the memory of these colleagues.

I now proceed to give you a brief resume of the activities of your Council during the past year.

Council met seven times in all and disposed of the usual volume of routine business, with which I need not burden you.

In addition there were a large number of meetings of Standing Committees and Special Committees.

During the year a number of Special Committees have functioned, albeit somewhat intermittently. These are the Committee to investigate the applications of the Code of Ethics to veterinarians in commerce, a Committee to enquire into the possible necessity for improving the B.V.Sc. curriculum in regard to teaching subjects with an animal husbandry bias, or the necessity for teaching veterinary students more animal husbandry, and a Committee to propose amendments to the Veterinary Act.

Progress will be reported in both these matters today.

As, however, certain members have written expressing concern about any modification of the Code of Ethics to suit veterinarians in commerce, I should state now that there is no likelihood of that happening. Any special modification of the Code to suit one particular group would virtually mean the creation of a second Code or a Code within a Code This is unthinkable, and I can assure members that Council would not permit such a step.

The third Committee appointed to draw up proposed amendments to the Veterinary Act was a direct result of my interview with the Minister of Agricultural Technical Services. The Minister has kindly agreed to make the proposed amendments a Government measure, which means that the measure will in all probability be placed before Parliament at the next session. In fact Mr. le Roux has undertaken to do this, and the measure has been in the hands of the Government law advisers for some months. You have all received a draft of the proposed amendments and it would appear that very few changes will be made in the final draft submitted to Parliament.

During the year a Committee presented evidence before the Commission of Enquiry into Abattoir or Allied Facilities. We were very well received indeed and although this does not necessarily mean that all or any part of our recommendations will be accepted we nevertheless feel extremely optimistic about the final outcome. One recommendation, which undoubtedly received support from other sources, was implemented almost immediately. That was the recommendation that immediate steps be taken to prevent the cruelty to animals involved as a result of the accumulation of thousands of head of live stock at abattoirs during peak slaughter periods during the year.

Other Committees which represented Council were: a Committee to present evidence on ionized radiation, one on antibiotics in milk and food stuffs and one on the training of meat or health inspectors. In addition there was a Committee to present evidence on the dangers of making dangerous drugs too easily available to the public.

A matter of general interest which was dealt with during the year was a request from the S.A. Kennel Union for an expression of opinion by this Association as to whether or not cropping of dogs ears constituted any form of cruelty. After communicating with authorities in America, Great Britain and Germany, we expressed the opinion that no cruelty was involved provided the operation was done by a veterinary surgeon with proper anaesthesia and after care.

I wish to draw your attention to one or two items in our Balance Sheet and Income and Expenditure Account. First of all there is a satisfactory excess of income over expenditure of R664.08. This in spite of the fact that our Secretarial Fees and Salaries have risen from R672.00 for 1960–61 to R1,783.47 for 1961–62. The Journal caused a loss of R1,612.60 as compared to a loss of R2,043.00 for the previous year. This loss on the Journal is serious, but you will notice that there is a considerable reduction in the loss suffered as compared with the previous year.

This was the first year that we have had a Secretary employed full time, but he was not in full time employment for the whole financial year. Consequently we must expect a considerable increase under the heading Secretarial Fees and Salaries for the current year. However the reduction in the loss on the Journal is directly attributable to the activities of our full time Secretary and I confidently expect a considerable reduction in this loss as time goes on. Our advertising rates have been raised and this should further assist in reducing the loss on the Journal.

There is one item of particular interest and that is that our Durban Conference last year showed a profit of R230.38 and that in spite of increased costs in connection with a lady clerk who was taken from Pretoria to Durban and subsistence for our Secretary. The previous year the Congress was run at a loss of R315.00.

There are additional item of expenditure arising as a direct result of running our own office i.e. rent R279.84, a telephone account amounting to R77.05.

Other items of additional expenditure are included under the heading miscellaneous. These include such items as travelling and subsistence for the President and Secretary when attending Branch Meetings. I attended only one Branch Meeting at Pietermaritzburg during the current year.

The attendance of a representative of Council at Branch Meetings seems most desirable, but if Branches could collaborate through the parent body, in such a way that as many meetings as possible could be attended on a single itinerary considerable expense could be saved.

The prospects for reducing expenditure and increasing revenue seem to be good especially as our full time office gets into its stride, but in the meantime every percaution must be taken to keep expenditure down.

ITEM 4.—AMENDMENTS TO THE VETERINARY ACT (ACT NO. 16 OF 1933)

DR. JANSEN gave a brief summary of all the amendments which were contemplated with short explanations in support of the proposed changes.

THE PRESIDENT thanked Dr. Jansen and the meeting expressed its appreciation to him for his clear summary of the suggested amendments.

DR. S. W. J. VAN RENSBURG raised the matter of increased representation on the Veterinary Board, but the meeting was not in favour of his proposed amendments.

PROF. CLARK proposed a vote of thanks to all persons who had been responsible for the amendments now being attended to by the Minister.

ITEM 5.—MEMBERSHIP

(*a*) *Deaths*

The meeting expressed its regret and in the usual manner honoured the memory of the following members who had passed on during the year:—

Dr. Henry Hamilton Green — (4.12.61); Jackie George, Grahamstown (22.10.61); Daniel Johannes de Waal, Rusape, Northern Rhodesia (21.12.61); Michiel Wilhelm Henning (1.3.63); Phillipus Lodewicus le

Roux, England (11.5.62); Albert George Grist (9.5.62); W. P. Hamlyn (2.3.62); P. R. B. Smith (August 1962); W. Schatz (17.9.62).

(*b*) *Resignations and Removals from the list of Membership*

None.

(*c*) *Election of new Members*

The following were unanimously elected as members of the Association:—

HOLDERS OF B.V.SC. (PRETORIA) DEGREE

Bauling, E. C. B., P.O. Box 30, Calvinia.
Coetzee, L., Onderstepoort.
Conradie, S. W., Blue Cross Veterinary Hospital, Newlands, Cape.
Couborough, R. I., P.O. Box 124, Bryanston, Johannesburg.
Campbell, C. O., c/o Director of Agriculture, Windhoek, S.W.A.
du Buy, W. J. C., P.O. Box 41, Eshowe, Natal.
du Preez, J. H., Private Bag 9005, Pietermaritzburg.
Gaensler, J. G., 29 Murray Street, Waverley, Johannesburg.
Leeb-du Toit, E., P.O. Box 502, Bloemfontein.
Marnewick, J. J., c/o Polikliniek, Germiston.
Naude, L. F., 120 Arcadia Street, Malmesburgy, Cape.
Neethling, D. A., Swerwerskraal, Privaatsak 516, Potgietersrus.
Petrick, S. W. T., P.O. Box 217, Pretoria.
Purchase, H. G., 101–202 Cherry Lane, East Lansing, Michigan, U.S.A.
Richardson, A. J., c/o 58 Longmarket Street, Pietermaritzburg.
Smit, P. J., P.O. Box 110, Delmas, Transvaal.
Schmidt-Dumont, A. M. A. (Miss), c/o Director of Agriculture, Windhoek, S.W.A.
Schutte, A. P., Onderstepoort.
Trace, C. G. N., De Beers Ranch, P.O. Shangani, S.R.
Trengove, R. B., State Veterinarian, Upington.
van Tonder, E., State Veterinarian, De Aar.
van Heerden, W. W., P.O. Box 102, Outjo, S.W.A.
Verceuil, L., Veterinary Department, Fort Jameson, N.R.
Viljoen, J. H., P.O. Box 108, Middelburg, Cape.

HOLDERS OF M.R.C.V.S. AND OTHER DEGREES

Browne, V. A. D., P.O. Box 8012, Causeway, Salisbury, S.R.
Colly, A. H. J., P.O. Box 65, Choma, N. Rhodesia.
Harrow, W. T., I.C.I. Pharmaceuticals, Macclesfield, England.
Sharpe, J. J., c/o 42 Northway, Durban North.
Nobre, J. M., Director do L.C.P.V., Nova Lisboa, Angola.
Townsend, G. H., Veterinary Research Laboratory, Private Bag, Lobatsi, Bechuanaland.

(*d*) *Honorary Associate Membership*

THE PRESIDENT advised the meeting that Council wished to recommend the following persons as being eligible for the bestowal of Honorary Associate Membership. The original proposers had adequately supported their suggestions and Council was satisfied that these persons had fulfilled the requirements of the constitution of the Association, and deserved the honour.

Dr. Bernard Maul Clark — Secretary for Health, Pretoria.

Dr. Basil Anthony Dormer — King George V. Memorial Hospital, Durban.

Prof. Arthur Kipps — University of Cape Town, Private Bag, Rondebosch.

Dr. Karl Friederich Meyer — United States of America.

The meeting unanimously approved them as Honorary Associate members of the South African Veterinary Medical Association.

ITEM 6.—CONSIDERATION OF REPORTS

THE PRESIDENT reminded the meeting that the Income and Expenditure Accounts and Balance Sheet had been submitted to all members and that both the Finance Committee and Council and considered these statements.

THE SECRETARY then read the following Reports to the meeting:—

1. THE FINANCE COMMITTEE

The following members serve on this Committee:

Dr. R. A. Alexander
Dr. M. de Lange
Dr. M. C. Lambrechts
Dr. S. W. J. van Rensburg
Dr. A. M. Diesel (Secretary and Convenor)

The Committee has been active throughout the year, making recommendations to Council on matters such as:—

(*a*) Loans to Students.

(*b*) Disbursements from the Benevolent Fund (Mrs. Runciman and now Mrs. Hamlyn).

(*c*) Attending to matters concerned with arrear subscriptions of members, outstanding debts to the Book Fund etc.

In respect of the *Income and Expenditure Account and Balance Sheet* for the period ended 31st March, 1962 — statements which have been sent to all members, the following information is given, additional to the report by the Auditors.

(1) EXCESS OF EXPENDITURE OVER INCOME OF JOURNAL

The amount of R1,706.60 was given in the report and R1,612.60 in the statement. This item covers sale of reprints R94.00, paid in advance which is included in the statement to avoid an adjustment in provision for December, 1961 and March, 1962, issues.

To avoid any confusion the Auditors are willing to adjust the figure in the report to conform to statement figure viz: R1,612.60.

(2) ALLOCATION AUDIT FEE

Benevolent Fund	R10.00
Book Fund Suspense	R30.00
Revenue and Expenditure (Subs.)	R30.00
Journal Expenses	R20.00
Revenue and Expenditure	R30.00
	R120.00

(3) MISCELLANEOUS EXPENSES

The miscellaneous expenses are made up by the following:

Expenses Representative to World Vet. Congress	R67.65
Dr. Cumming Expenses Representative to Australian Vet. Congress	R66.55
Subscriptions World Vet. Organisation	R88.37
Subscription Australian Vet. Organisation	R29.20
Subscription Government Gazette	R4.00
Post Office Box Rental (½ year)	R2.50
Post Office Box Rental	R5.00
Dr. Diesel (Travel Exp. Pietermaritzburg)	R10.00
Dr. Steyn (Travel Exp. Pietermaritzburg)	R45.00
Dr. K. v. d. Walt (Travel Exp. Pietermaritzburg)	R5.00
Wreathes	R9.00
Dr. Sutton — Gratuity	R50.00
	R88.37
Credit — Petty Cash Dr. Loveday	R2.93
	R379.34

The amount of R15.17 was written off on the recommendation of the Finance Committee — e.g. Exchange etc. on Journal-sub., and one member sub. The Prize Fund Reserve is a Trading Account — so the amount was written off against this account.

2. GENERAL PURPOSES COMMITTEE

The following members serve on this Committee:

Prof. R. Clark
Dr. M. de Lange
Prof. R. du Toit
Prof. C. F. B. Hofmeyr
Dr. M. C. Lambrechts
Dr. A. M. Diesel (Secretary and Convenor)

This Committee has been responsible together with the President, Dr. van den Heever and Dr. Wheeler in compiling and delivering evidence before the Commission on Abattoir and Related Facilities.

It has also, in collaboration with the Editorial Committee, constituted the Congress Committee which has been responsible for planning and organizing the present Congress.

3. THE EDITORIAL AND LIBRARY COMMITTEE

The following members serve on this Committee:

Prof. R. Clark
Prof. H. P. A. de Boom
Dr. L. W. van den Heever
Prof. K. van der Walt
Dr. A. M. Diesel (Secretary and Convenor)

This Committee has met from time to time to consider matters concerning the Journal and its publication.

It has now decided to meet on the first Friday of each month to discuss articles which have been submitted, galley — and page-proofs and in general all matters concerned with the publication of the Journal.

4. THE DISCIPLINARY COMMITTEE

The following members serve on this Committee:

Prof. C. F. B. Hofmeyr
Dr. B. C. Jansen
Dr. A. F. Tarr
Dr. L. W. van den Heever
Dr. A. M. Diesel (Secretary and Convenor)

The members of this Committee, except Dr. Jansen and in collaboration with the President, Dr. van Schalkwyk, Dr. Purchase, Dr. McFarlane, Professor S. van Heerden and Dr. J. D. Coles, have been responsible for the investigations carried out in connection with the correct behaviour of Veterinarian in Commerce.

The meeting unanimously adopted the Financial Statements and Balance Sheet.

ITEM 7. PUBLICATION OF THE JOURNAL OF THE ASSOCIATION

THE SECRETARY informed the meeting that the application to the Department of Education, Arts and Science for financial aid in the publication of the Journal, had not succeeded.

The required form had again been completed and sent forward in anticipation of greater success for the current year.

ITEM 8.—VETERINARIANS IN COMMERCE

THE PRESIDENT briefly outlined the work of the Sub-Committee which investigated the matter and the recommendations which it had made.

After a brief discussion the following resolution, which had been proposed by Dr. Jansen and adopted unanimously at the Meeting of Council held on 24th September 1962, was again proposed to the A.G.M.

> "Wat betref die optrede van veeartse in kommersiële ondernemings, maak die professionele gedragskode voorsiening vir die beoefening van hulle beroep in ooreenstemming met die belange van alle ander lede van die professie. Die Raad van die S.A.V.M.V. besluit dat die professionele gedragskode in gees en letter van toepassing is op veeartse in kommersiële ondernemings in sover hulle ook geregistreer is onder Wet 16 van 1933".

The meeting unanimously adopted this proposal.

THE PRESIDENT informed the meeting that the Sub-Committee had been requested to prepare a memorandum briefly setting out its findings. This would be attended to by Council.

ITEM 9.—CURRENT COMMITTEES OF INVESTIGATION

THE PRESIDENT informed the meeting of the action taken by Council and the Sub-Committee which had in each case been appointed for the purpose of collecting and presenting evidence to Committees of Investigation. Professors Hofmeyr and van der Walt were still due to give their final evidence to the Commission of Investigation on Ionised Radiation. Evidence had been presented to the Commission on Abattoir and Related Facilities.

THE PRESIDENT also referred to the Committee of Investigation into the training of Health and Meat Inspectors by the Department of Education, Arts and Science, on which Dr. P. J. Meara represented the Association. The Public Health Group had been requested to make recommendations to Council in regard to the matter.

ITEM 10.—AMENDMENTS TO THE CONSTITUTION

Having given due and formal notice in terms of the requirements of the Constitution of the Association, Dr. D. H. G. Irwin moved as follows:—

PROPOSED CHANGES IN THE CONSTITUTION OF THE SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

CHANGE ARTICLE 36 (1) TO READ:—

There shall be a Council consisting of eleven elected members. From among themselves they shall elect a President and a Vice-President each year. Additional members of the Council shall include all Honorary Life Vice Presidents of the Association, besides co-opted members. As provided in clause 39 hereof, these include the Secretary, the Treasurer and the Editor of the Journal of the Association, and any other Member of the Association as is considered desirable by Council. Only elected members of the Council have voting rights in that body. (Persons elected to the position of Honorary Life Vice President before the adoption of this constitutional revision retain voting powers on the Council).

IN ARTICLE 36 (ii), DELETE

as the President, the Vice-President

IN ARTICLE 36 (iii) DELETE

(other than the Honorary Life Vice-Presidents),

BUT ADD

elected, so that it reads thus

year, one-half of the elected members of the Council or the number nearest . . .

IN ARTICLE 36 (iv) DELETE

. . . President, Vice President . . ., so that it reads thus:

. . ., *giving a list of the persons nominated as Members to serve on the Council, in terms of . . . etc.*

Dr. Irwin spoke in favour of his proposals.

The two proposals were independently seconded and voted on, but BOTH WERE REJECTED by the meeting by a considerable majority.

ITEM 11.—WORLD VETERINARY ASSOCIATION

DR. B. C. JANSEN conveyed greetings from the Secretary/Treasurer of the World Veterinary Association. Dr. B. C. Jansen had been asked by W.V.A. to represent it at the 1962 Congress of S.A.V.M.A.

THE SECRETARY informed the meeting that the annual subscription to the W.V.A. had been paid — viz R46.30 (463 members at 10c per member).

ITEM 12. THE NEW STATE VETERINARY SERVICE

DR. LAMBRECHTS in addressing the meeting, intimated that much thought had been given to the new set-up before it had finally been agreed to.

The intention was to create a broad-base Animal Health Service, in place of the narrower infectious disease control which had previously operated. To do this, diagnostic centres covering the whole country, would be created.

Thirty-five (35) such centres would be arranged for the present — 26 in European areas, 8 in Bantoestans, and one in game observation areas.

The overall scheme would centre on the control of animal diseases with a readily available diagnostic service.

This service would be available to colleagues and their co-operation would be encouraged. Only where no colleagues were in practice would the service deal directly with the public except in the intended global approach.

The scheme visualised a National Veterinary Survey, worked out in fair detail, and supported with data collected by Hollerith machines.

In consultation with the Research Institutes and the Departments concerned the scheme includes animal disease eradication e.g. T.B. and C.A. control schemes, schemes for the control of parasites, lice, keds etc.

The officers of the Field Services will go out and find their problems, conduct surveys, and apply diagnostic methods. When diagnosis is difficult the services of the Research Institute will be sought.

Field research projects will be undertaken: co-ordinating and recording services are to be provided. The activities of the Field Services will work in very close collaboration with the Research Institute.

The Field Services will concern itself with non-proclaimed diseases: many approaches of which will have to be worked out. There will be no time or opportunity to deal with individual cases of ailing and sick animals.

A Veterinary Extension Service is visualised, and so is specialised training of veterinary personnel. By this approach the organization is likely to assist all veterinarians and the public very materially.

Veterinary colleagues in practice will be invited to assist. There will be a need to lay down certain nominal fees, which will have to receive Treasury approval.

In Britain all diagnostic services are undertaken by the State and when full coverage is effected, the farmers are likely to call in private veterinarians to an increasing extent.

The scheme purports to improve the veterinary profession as a whole.

DR. JANSEN in addressing the meeting explained the attitude of the Onderstepoort Research Institute as regards the sale and distribution of vaccines by private companies.

A building which would cost some R1,000,000 was soon to be erected at Onderstepoort.

The distribution of Onderstepoort vaccines was offered to commercial enterprise on a wholesale basis and under certain conditions viz:—

1. The sale of the vaccine is dependent on a certain amount of profit — Onderstepoort is a non-profit making Institute. A discount of 33⅓ per cent had been agreed to on conditions that:—
   (*a*) Onderstepoort would not supply every vaccine in unlimited quantities.
   (*b*) The firms handling the vaccine must agree to distribute at least R15,000 of vaccine per annum and must arrange their depots to the satisfaction of the Chief of the Veterinary Research Institute. These depots are subject to inspection by officers of Veterinary Field Services.

2. Other conditions appropriate to these transactions, were laid down e.g. Bank guarantees etc., some vaccines only to be sold to the Veterinary profession, etc.

Dr. Jansen explained that the Veterinarian was granted a discount of 12½ per cent. He was not regarded as a commercial distributor.

The discussion which followed the addresses of Drs. Lambrechts and Jansen, were appreciative of the assurances given, and hopeful that the new Veterinary Services would result in happy relations to all concerned. The hope was expressed that the hard work which meant much to private veterinarians would not be interrupted. By and large the development of regional diagnostic laboratories was welcomed by veterinarians.

DR. DORE favoured the appointment of a small committee drawn from veterinarians in the Department of Agricultural Technical Services and from local private practitioners. This committee to operate for about one year.

THE PRESIDENT considered that teething troubles were bound to arise and that ways and means could be found to overcome the difficulties.

DR. LAMBRECHTS in replying answered several questions which had been raised. Farmers would be encouraged to deal with private practitioners.

There may only be 26 diagnostic laboratories in the country which comprises 400,000 square miles.

DR. JANSEN in replying mentioned that before the scheme was launched, Onderstepoort Research Institute disposed of 52,000,000 doses of vaccines. By the end of June this year a total of 68,000,000 doses had been disposed of.

ITEM 13.—NOTIFICATION OF ELECTION OF COUNCIL MEMBERS

The Secretary intimated that the votes cast at the recent election of Office Bearers for the year 1962/63 were counted and recorded by himself and three members on the 22nd August, 1962.

The following members were elected for the ensuing year.

PRESIDENT — Dr. H. P. Steyn (no contest)
VICE PRESIDENT — Prof. R. Clark
MEMBERS OF COUNCIL — Dr. J. D. Coles
Dr. M. de Lange
Dr. M. C. Lambrechts
Dr. A. F. Tarr

A poll of 58 per cent was recorded and there were no spoilt papers.

ITEM 14.—GENERAL

DR. ZWARENSTEIN suggested that an indication of the attendance at Meetings of Council should be given, when the names of candidates were submitted for election.

THE PRESIDENT suggested that this was hardly necessary as members of Council were not allowed to miss more than two meetings without an explanation. All members of Council pulled their weight.

DR. FREAN gave a brief account of his recent visit to the Congress of the Austrian Veterinary Association.

ITEM 15.—THE VENUES FOR THE 1963 AND 1964 CONGRESS

After a brief discussion it was agreed that the 1963 Congress (Animal Health Year) be held in Pretoria.

If necessary the opening ceremony could be held in Town, at night.

THE PRESIDENT was of the opinion that the Prime Minister should be approached to open the Congress in 1963.

It was agreed that the 1964 Congress be held at Cape Town.

ITEM 16.—RESOLUTIONS

Following on earnest discussions related to the subject concerned the meeting adopted the following three resolutions by majority decision.

Besluit No. 1

Voorsteller — Dr. B. C. Jansen
Sekondant — Prof. O. T. de Villiers

Ten spyte van die feit dat siektebestryding in hierdie land met groot welslae tot dusver uitgevoer is, voel die 57ste Jaarkongres van die S.A.V.M.V. dat die noodsaaklikheid van die opleiding van grotere getalle

veeartse nodig geword het. Die owerhede word beleefd versoek om die noodsaaklikheid van die stigting van 'n tweede veterinêre fakulteit deeglik te oorweeg.

Besluit No. 2

Voorsteller — Prof. C. F. B. Hofmeyr
Sekondant — Dr. B. C. Jansen

Die 57ste Jaarkongres van die S.A.V.M.V. is van oordeel dat, ten spyte van uitnemende veterinêre prestasies van die verlede, daar uitgebreide onkunde aangaande die professie bestaan, en dat die professie gevolglik nie na waarde waardeer word nie.

Hierdie Kongres versoek dus die Raad S.A.V.M.V. om grondige ondersoek in te stel na moontlikhede wat alle beskikbare publisiteitsmedia bied en die te benut om, as deurlopende beleid die professionele beeld onder alle bevolkings groepe reg te stel.

Resolution No. 3

Proposer — Dr. J. L. Doré
Seconder — Dr. Dent

This 57th Annual General Meeting of the S.A.V.M.A. hereby resolves to request the Council of the S.A.V.M.V. to set up a sub-committee consisting of members of the Department of Agriculture and Private Practitioners to devise satisfactory means for the inauguration of Diagnostic Centres.

Resolution No. 4

After further discussion the following resolution was proposed by Dr. Jansen, seconded by Dr. P. S. Snyman and carried unanimously.

It is the considered opinion of the representative body of veterinarians attending the 57th Annual General Meeting of the S.A.V.M.A. that use of the title M.R.C.V.S. on nameplates or prescription pads is not permissible in the Republic of South Africa, when it has been obtained as a result of the payment of a fee solely for the purpose of admission to the Register of the College. When admission to that register results from passing a prescribed examination, carried out by the Royal College duly constituted as an examining body, use of this title in the Republic is permissible.

Besluit No. 5

After a brief discussion the following resolution, which has been proposed by Dr. Jansen and adopted unanimously at the Meeting of Council held on 24th September, 1962, was again proposed to the A.G.M.

„Wat betref die optrede van veeartse in kommersiële ondernemings, maak die professionele gedragskode voorsiening vir die beoefening van hulle beroep in ooreenstemming met die belange van alle ander lede van die professie. Die 57ste Jaarvergadering van die S.A.V.M.V. besluit dat die professionele gedragskode in gees en letter van toepassing is op veeartse in kommersiële ondernemings in sover hulle ook geregistreer is onder Wet 16 van 1933".

The meeting unanimously adopted this proposal.

DIE TWEEDE JAARVERGADERING VAN DIE REPRODUKSIE GROEP VAN DIE S.A.V.M.V.

(Gehou te Onderstepoort op 27 September 1962)

Die vergadering word gehou in teenwoordigheid van 27 lede. Prof. S. W. J. van Rensburg tree op as Voorsitter.

Die notule van die vorige vergadering word voorgelees en na aanname word dit deur die Voorsitter onderteken.

Voortspruitend uit vorige aangeleenthede doen dr. La Grange aan die hand dat meer gespesialiseerde publikasies aan die lede beskikbaar gestel moet word. Hy beoog sirkulêre wat deur hierdie groep versprei moet word.

Dr. McFarlane vra aan die President van die S.A.V.M.V. dat een hele agtermiddag gedurende die Kongresperiode aan die Reproduksiegroep afgestaan moet word vir demonstrasies en samesprekings.

Die President antwoord hierop dat dit hierdie groep vry staan om hulle eie vergadering te reël wanneer hulle wil maar dat die vergadering gedurende die Kongres spesifiek as 'n Besigheidsvergadering beskou moet word.

Verder wys hy daarop dat indien die Raad besluit dat die publikasies of demonstrasies soos deur hierdie groep saamgestel van nasionale belang is dan moet dit as deel van die Kongres ingesluit word.

Verkiesing van Ampsdraers

Dr. S. W. J. van Rensburg word herkies as Voorsitter.

Nadat Dr. McFarlane sy bedanking as Sekretaris ingedien het, word A. P. Schutte gekies om die pos te vul.

Drs. Wessels en La Grange sal vir nog 'n jaar dienspligte aanvaar.

Finansiele Verslag

Dr. McFarlane dui aan dat die Groep se geldelike bate op R42 te staan kom.

Algemeen

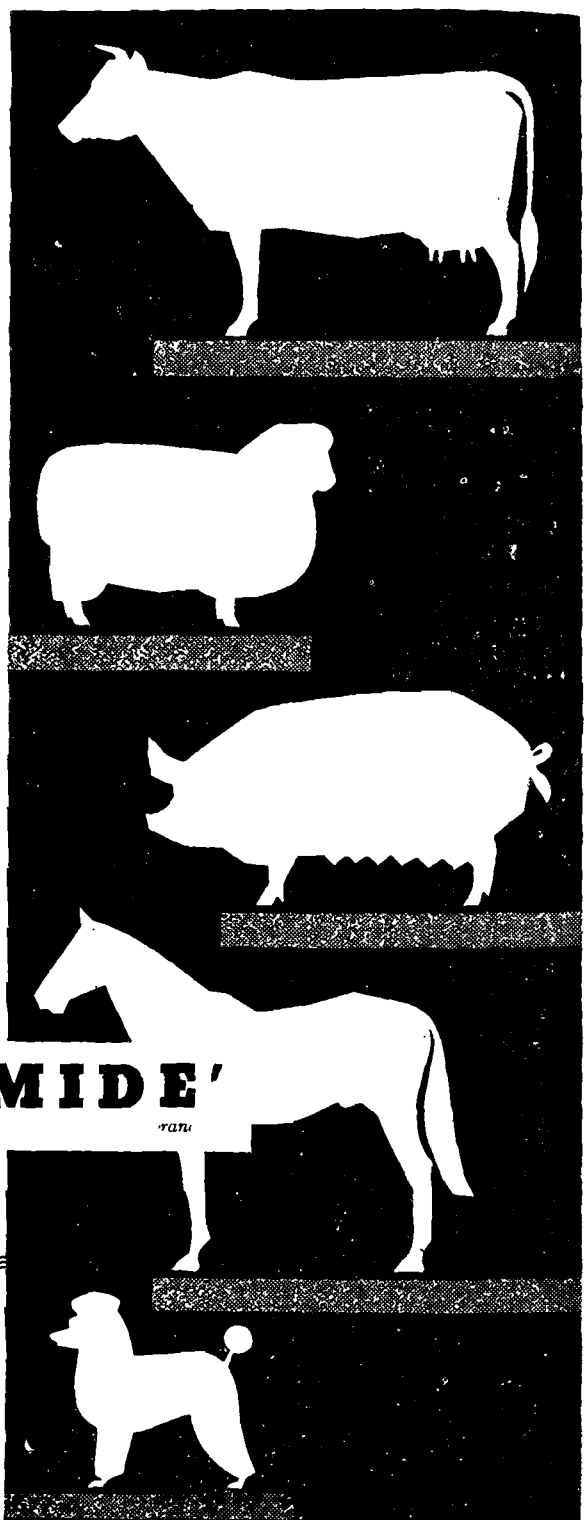
Prof. van Heerden gee 'n beknopte oorsig van sy onlangse besoek aan die buiteland. Verder wys hy op die belangrikke fasette wat reproduksie as entiteit aanneem.

Prof. van Heerden rig 'n versoek aan die lede vir kliniese materiaal ten opsigte van opleiding vir studente in Genesiologie.

Hierop antwoord dr. H. P. Steyn dat hy saamstem met prof. van Heerden dat Onderstepoort nie toegerus is om die stygende aantal studente te voorsien van kliniese materiaal nie.

Dr. K. M. van Heerden vra dat die Ram-vrugbaarheidssertifikate soos deur S.A.V.M.V. uitgereik aan lede gestuur moet word sodat gepoog kan word om 'n gelyke standaard te handhaaf.

Dr. H. P. Steyn stel voor dat die vergadering verdaag.



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S.A.V.M.A. — VETERINARY PUBLIC HEALTH GROUP

SIXTH ANNUAL GENERAL MEETING

The 6th Annual General Meeting of the Group took place under the chairmanship of Dr. W. Wheeler at Onderstepoort on Wednesday, 28th September, 1962. Twelve members were present: several not being able to attend due to the lateness of the time of meeting.

The following matters were discussed:

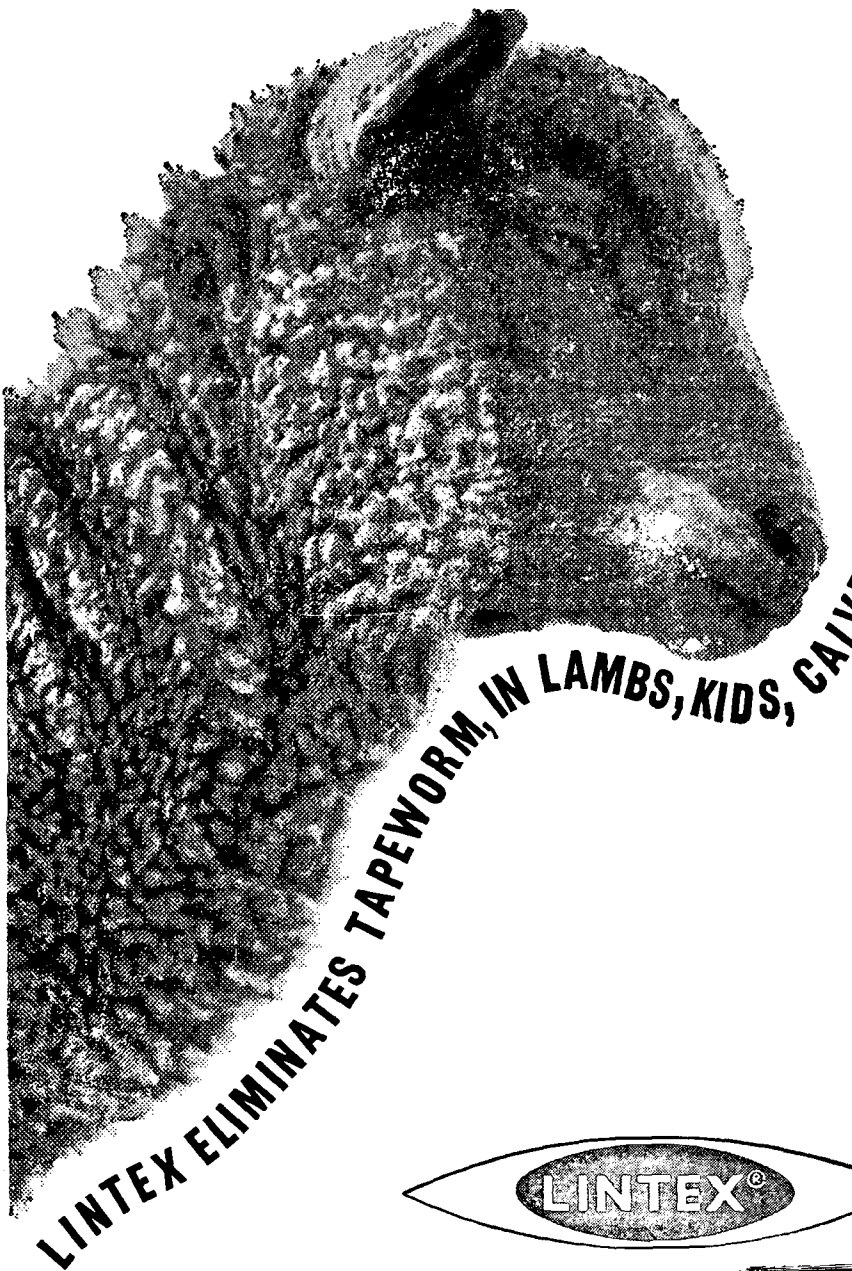
Membership of the World Association of Veterinary Food Hygienists;

Relationship between State Veterinary salaries and those approved by the State Department of Health for payment by local authorities;

The Abattoir and Related Facilities Commission — progress report;

Antibiotic contamination of milk supplies and the use of indicator dyes;

Post graduate courses — M. Vet. Med. Dipl. Vet. Public Health.



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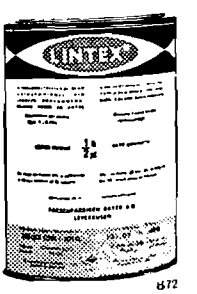

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A SHORT REPORT OF THE EXHIBITS STAGED AT THE 1962 ANNUAL CONGRESS

(Compiled by each firm separately)

Anatomy Section Faculty of Veterinary Science Onderstepoort.

The Department of Anatomy, Histology and Embryology of the Faculty of Veterinary Science exhibited a number of permanent demonstration dissections. There were dissections of the blood vessels (arterial and venous) of the limbs and head of the horse, ox and dog; joints of the various animals to demonstrate the joint capsules and ligaments; dissections to show the muscles of the limbs of the dog; wax models of the development of the pharynx of the sheep — reconstructed from serial sections.

These specimens form part of a collection which is built up for an anatomy museum and are used as aids in teaching.

This was an outstanding exhibit.

Burroughs Wellcome (S.A.) Ltd.

Burroughs Wellcome & Co. (S.A.) Ltd., among the interesting exhibits at the above Congress, prominently displayed the following products:—

'*Ancaris*'

'ANCARIS' is a new anthelmintic product developed by the Wellcome Foundation Ltd. for the treatment of Hookworm and Roundworm infestation in dogs. It is a combination of piperazine phosphate and thenium, a drug first synthesised at the Wellcome Research Laboratories. Thenium is closely related to bephenium, which is widely used as an anthelmintic in human medicine ('Alcopar'). It is highly effective against *Ancylostoma caninum* and *Uncinaria stenocephala* and has a level of activity also against *Toxocara canis*. Piperazine phosphate has been incorporated to enhance the action against *T. canis*.

Each tablet contains:

Thenium Base	125 mgm.
Piperazine (Hexahydrate).....	250 mgm.

'ANCARIS' thus provides a one day safe, well tolerated and effective anthelmintic for the treatment of ancylostomiasis, uncinariasis and ascariasis in dogs.

'*Epivax-Plus*'

'EPIVAX-PLUS' is a freeze-dried vaccine prepared from a mixed suspension of a living egg-adapted strain of distemper virus and living contagious hepatitis virus adapted to grow in pig kidney tissue culture. Both viruses have been passaged until they have lost their virulence for the dog while retaining their ability to stimulate a high level of immunity against distemper, hard-pad disease and contagious hepatitis.

A single injection of "Epivax-Plus' stimulates lasting immunity against these diseases in susceptible dogs.

Pregnant Mares' Serum (P.M.S.)

P.M.S. is a standardised preparation, prepared by a special "freeze-drying" process from serum collected from pregnant mares when the level of gonadotrophic hormones is at a maximum.

It contains anterior pituitary-like gonadotrophins of high potency and is principally follicle-stimulating in effect, although some luteinising hormone is also present.

Pregnant Mares' Serum is chiefly used to stimulate follicle development in maiden heifers.

'Temadex' Skin Dressing (Veterinary)

This is a compound ointment, designed for the treatment of parasitic skin diseases in dogs. It contains four therapeutic substances, each of which has a specific action against various ectoparasites.

FISONS CHEMICALS S.A. (PTY.) LTD.

The highlight of the exhibition at Onderstepoort 1962, was the *Imposil* 200 *stand.* It displayed and illustrated the latest results obtained in a series of injected and control pigs. The Imposil 200 pigs being almost twice the weight of the control group.

The claims made are substantiated by reports from users.

Great interest was shown by both Veterinarians and Students.

GLAXO — ALLENBURYS S.A. (PTY.) LTD.

Canilep — New Quadrivalent vaccine against Canine Distemper, infectious Hepatitis, Leptospirosis (Canicola and Icterohaemorrhagi).

Betsolan Injection — Intramuscular injection of Betamethasone for Bovine Ketosis or allergic conditions.

Dapsetyn — Intramammary infusion of Chloramphenical and Dapsone for cases of resistant Mastitis.

Dequadin Eye and Wound Powder — For specific and non-specific Keratitis in sheep and cattle.

SURGICAL DIVISION (GLACO-ALLENBURYS)

New Tungston-Carbide needle holders.
Polypropathene bowls.
Avanti stainless steel.
Sandra medicated plastic boilable sheeting.
General surgical instruments.
P.M. Gauntlets.
Sanitex syringes. "Interchangeable".
Willows teat dilators.
Sterilizers.
Catgut "Sterilon" and "Deknatel"
Water tap suction apparatus.
Dressing drums.
Glass jars and boxes.

GURR SURGICAL INSTRUMENTS (PTY.) LTD.

Exhibited their usual items — *B-P Rib-Back Blades*; *Everetts Injection Equipment*; *Bardic Disposable Tubes*; *Intracaths*; *Gowlands Diagnostic Sets*; *Pearsalls silk*; *Templar Suture Needles*; *Sheffield Scissors*; *etc.*, all designed to give quality service with economy in cost.

GOLDFIELDS VETERINARY MEDICAL SUPPLIES

The exhibit which aroused most interest was a *synthetic multifilament suture* which is used internally. It is much stronger than catgut and though it is not dissolved it is accepted by the body on account of its having a chemical structure similar to albumen.

It can be sterilized by autoclaving or by boiling in water. It is cheaper than catgut.

I.C.I. SOUTH AFRICA (PHARMACEUTICALS) LTD.

The products shown are specialities which have evolved as the result of original I.C.I. research, and are now recognised as playing a vital part in modern treatment.

"*Dispolac*", — Dispersible Penicillin for the treatment of Mastitis.

"*Mintic*", — Liquid worming remedy for cattle and sheep, a highly effective remedy against all roundworms of the intestine.

"*Promintic*", — A new drug with unique mode of action and high activity against the whole range of mature and immature intestinal worms causing parasitic gastro-enteritis in sheep and cattle.

"*Fluothane*", — A new inhalation anaesthetic, safe, potent, non-explosive and non-inflammable.

"*Fulcin*", — Is the I.C.I. name for Griseofulvin, an antibiotic for the oral treatment of ringworm in veterinary practice.

LIBAGRIC (PTY.) LTD.

Besides the wider variety of veterinary and agricultural books this firm also had on view the most recent new publications in these two fields such as—

Veterinary Radiology (Carlson); Reproduction in Farm Animals (Hafez); The Semen of Animals and Artificial Insemination (Maule); Evaluation of Fertility in the Bull and Boar (Herrick and Self); Handbook on Tropical Disease (British Veterinary Association); Wild Flowers of Transvaal (Letty); and Breeder and Boffin (Allen Fraser).

New revised editions of well known books included Veterinary Anaesthesia and Analgesia (Wright and Hall), 5th edition; Monnig's Veterinary Helminthology and Entomology (Lapage), 5th edition and Merck's Veterinary Manual, 2nd edition.

MAYBAKER (S.A.) (PTY.) LTD.

The stand drew attention to the world wide research facilities of the M & B organisation, which are centred upon the modern Research Institute at Dagenham.

In increasing numbers and volume M & B brand veterinary products are being produced in the Republic's expanding M & B plant in Port Elizabeth.

Typical products of M & B research and/or of Maybaker production exhibited were:

"*LARGACTIL*" — the yardstick by which all other phenothiazine derivatives are judged.

"*M & B* 693" — the pioneer sulphonamide, proven over nearly two and a half decades.

"*ROVAMYCIN*" — a narrow spectrum antibiotic particularly suited to the veterinarians diagnostic approach to mastitis and *Staph. aureus* infections.

"*VALLERGAN*" — the latest phenothiazine derivative, unique in possessing potent antihistamine properties.

M.S.D. (PTY.) LTD.

M.S.D. exhibited an interesting range of preparations.

MILBORROW & CO. (PTY.) LTD.

Milborrow & Co. (Pty.) Ltd. exhibited a full range of specialised instruments and the following formulations which were presented to South African Veterinarians for the first time.

MSM Nitrofuran — Sulphonamide (Non-Antibiotic) Mastitis Infusion
MASTEX Chloromphenicol — Nitrofuran Mastitis Infusion
ELSAL-20 Concentrated Intravenous Electrolytes
ELSAL Oral Electrolyte Pdr.
IODET Self-indicating iodophor Sanitiser.

OPTICAL INSTRUMENTS (PTY.) LTD

Messrs. Optical Instruments (Pty.) Ltd., of B.P. Centre, Johannesburg, again had a most representative range of *CARL ZEISS* Microscopes and Spectro-photometric instruments on display, besides *SARTORIUS* balances, *HERAEUS* Ovens and Incubators, *METROHM* pH-meters, *JENAER GLASWERK SCHOTT* & General laboratory glassware and other useful laboratory apparatusses of the usual high standard.

PHILIPS MULLER MEDICAL (S.A. PHILIPS (PTY.) LTD.)

Displayed a very interesting exhibit.

PFIZER LABORATORIES SOUTH AFRICA (PTY.) LTD.

Had a prominent display of useful preparations.

PROTEA SURGICAL AND DENTAL SERVICES

Had on display a wide range of instruments and sundries, including a *Medicon Vaginal Speculum* for dogs and cats at R6.50.

Disposable Gloves in packs of 100, were exhibited as well as *Nylon Film* for auto-claving instruments, which can be used from 40–50 times and is completely impervious to grease, oil and water, but permeable to steam.

A range of Kidney Dishes and Bowls appeared to be well received by the veterinarians.

Surgical catalogues, printed in English and Afrikaans, were also distributed.

Protea Pan Africa Pharmaceuticals Ltd.

Exhibited an interesting range of preparations.

Parke Davis Laboratories (Pty.) Ltd.

The highlight of the Parke Davis Exhibit was their celebrated *chloromycetin veterinary tincture* 10 *per cent*, which was of particular interest to visiting veterinary surgeons.

An impressive photographic album was on view, indicating the progress which Parke Davis has made in this country by currently manufacturing approximately 95 per cent of their products, including chloromycetin, in the Republic of South Africa.

A. S. Ruffel (Pty.) Ltd.

A. S. Ruffel had on show their usual complete range of Veterinary Remedies, Instruments, and Veterinary Specialities.

The Ciba range of Veterinary Specialities including:

Vecortenol (Potent Economical Corticosteriod).

Vetidrex (Bon-Mercurial Diuretic).

Vetibenezamine (Anti-Histamine) as well as *Vecortenol-Vioform Ointment*

were on view and very well received.

The Palmer Cap-Chur eêuipment was on show and its use in rabies control was fully discussed.

S.A. Cyanamid (Pty.) Ltd.

The exhibit was based on four products for veterinarians only, the main theme being *Staphylococcus Aureus Toxoid Slanetë Strain No.* 7 for the prevention of Mastitis of Staphylococcal Origin. Having now been tested under South African conditions for twelve months this product is being actively promoted for sale to dairy farmers through veterinarians.

Targot Mastitis Ointment and *Varizyme Streptokinase-Streptodornase* — Human Plasminogen Enzyme Combination, both useful products for the treatment of mastitis were exhibited.

D.N.P. Disophenol Parenteral, a brand new product for the treatment of hookworm in dogs was introduced to the profession for the first time in South Africa. This is a safe, effective and economical remedy for this troublesome parasite.

S.A. Commercial House (Pty.) Ltd.

Prevention of Bacterial Contamination from Hands to Cans

The firm of S.A. Commercial House (Pty.) Ltd. who may be regarded as a major supplier of specialised anti-infection products to the medical and veterinary profession, exhibited the following products.

GILL LIQUID GERMICIDAL SOAP, Containing Hexachlorophene (G-11)

The germicidal liquid soap, containing Hexachlorophene, sold under the Trade Mark, GILL. Today Gill Soap is firmly established as a time-saving, non-irritating and effective germicidal soap.

SURGE VET LIQUID ANTISEPTIC SOAP

The potential beneficial skin degerming properties of Hexachlorophene liquid soaps, initiated the use of this type of soap as a means of preventing the spread of mastitis organisms.

The germicidal soap *SURGE VET* is made available to dairy farmers for washing cows' udders and milkers' hands, thereby attacking cutaneous organisms and preventing spread of mastitis. Due to the substantivity of the active ingredient Hexachlorophene, regeneration of infective organisms *between* washings is obviated, thus providing continuous insurance against infection.

SURGE G-11 ANTISEPTIC MILKING SALVE

Another product utilising Hexachlorophene is the washable emulsion milking salve sold as "*SURGE*". Containing as it does germ killing quaternary ammonium compounds, plus compatible detergents synergistically incorporated: *HYDET* provides a product that will clean physically and act germicidally in ONE single operation.

Smith Kline & French Laboratories

SKF Laboratories displayed their new freeze dried live fowl typhoid vaccine — "*Nynar*". This single dose vaccine, which contains strain 9R *Salmonella gallinarum*, was developed in Great Britain in association with the Animal Health Trust. It has been proved in mass trials to be safe and effective and does not interfere with the agglutination test.

Also featured on this stand were the Company's well known range of nitrofuran preparations: "*Neftin*" — to control a wide range of poultry diseases; "*Neftin*" *tablets* — for calf paratyphoid; "*Bifuran*"— for coccidiosis in poultry and enteritis in pigs; "*Furacin*" *soluble ointment* — a topical antibacterial dressing; and "*Furadantin*" tablets for urinary tract infections in small animals. Two other products were displayed: "*Pragmatar*" *ointment* for seborrheic conditions and "*Iodex*" — the well established iodine ointment.

Sterling Drug S.A. (Pty.) Ltd. (Winthrop Laboratories S.A. (Pty.) Ltd.)

Messrs. Sterling Drug S.A. (Pty.) Ltd., exhibited a number of their products.

CAS. F. THACKRAY (S.A.) (PTY.) LTD.

A selection of "Thackray" Surgical Instruments suitable for veterinary use were displayed, together with *Davis & Geck Catgut Sutures and Ligatures.*

Plastic *Veterinary Surgeons' Aprons*, manufactured entirely in South Africa, were on display, as well as specimens of the latest types of *Plastic Disposable Syringes and Needles.*

Portable Autoclaves were shown, also illustrations of the "*Almor*" *Stainless Steel Sterilisers* which are manufactured in Cape Town, and for which "Thackray" are the Sole Selling Agents for South Africa, South West Africa and the Central African Federation.

Another interesting Exhibit was the *Samson Respirator*, which could be adapted for use on animals.

J. R. WATKINS CO. (AFRICA) (PTY.) LTD. (CORN STATES LABORATORIES)

The following products exhibited by The Watafrica Manufacturing Co. (Pty.) Ltd., P.O. Box 489, Springs, drew much interest:

TYLOCINE — 50 mg. up to 200 mg/cc concentration
— a new broad-spectrum antibiotic with no known contra-indications;
— Very reasonably priced at 75c (7/6) per gram.

AMBEX — a prompt, pure amino acid replacement of depleted protein, fluids and electrolytes.

AEROSOL MERTHIOLATE — an economical, convenient and practical way of applying merthiolate for pre-surgical skin preparation, for wound antisepsis, and disinfectant for vaccination sites.

WILD OF SOUTH AFRICA (PTY.) LTD.

Wild of South Africa have this year entirely concentrated on exhibiting Microscopes and their accessories. There was, in particular from students, a very keen interest in the *M11 Laboratory Travelling Microscope* which is particularly suited for on the spot investigations outside the Laboratory. Furthermore, Wild offer so many combinations with the same basic stands to meet the students' financial possibilities.

Furthermore, the *Stereomicroscopes Wild M4 and M5*, together with the new revolutionary Drawing attachment have found the particular interest of the Congressists. It was gratifying to see the popularity and confidence enjoyed by Wild products in veterinary circles.

THE OPENING OF THE TRADE EXHIBIT

The VICE-PRESIDENT, Professor R. Clark, in opening the Trade Exhibit paid tribute to the exhibitors and to the President and Secretary of their Association, all of whom had been responsible for the record display of veterinary preparations, instruments and appliances, which were on view for the benefit of the veterinarians attending Congress.

MR. M. STABLER — Secretary of the Exhibitors Association in thanking Professor Clark for the tribute paid to his members, presented the S.A.V.M.A. with a cheque for R295.00 indicating that the amount of R69.24 which still had to be paid in would bring the *total to* R364.24.

This amount represented a donation from the Exhibitors to the Benevolent Fund of the S.A.V.M.A.

PROFESSOR CLARK thanked Mr. Stabler and the exhibitors for this generous contribution to the Benevolent Fund. He then congratulated Mr. P. Goddin of Maybaker, for organizing an additional contribution to the Benevolent Fund by the sale of propelling pencils, which realised the handsome sum of R86.50.

(Photo reproduced by the kind permission of "The Pretoria News".)

The Minister of Agricultural Technical Services, the Hon. Mr. P. M. K. le Roux, views the Trade Exhibit in company with His Worship the Mayor of Pretoria, Mr. E. Smit, the President of the Association, Dr. H. P. Steyn, and the Secretary of the Photo Exhibitors Association, Mr. M. Stabler.

The Honorable Mr. P. M. K. le Roux and His Worship The Mayor, kindly consented to spend a little time viewing the Trade Exhibits. This gesture was very greatly appreciated by the Exhibitors. The photographs indicate the interest with which this visit was undertaken.

(Photo reproduced with the kind permission of "Die Vaderland", Pretoria.)

The Minister of Agricultural Technical Services, the Hon. Mr. P. M. K. le Roux, handles a "Mercy Gun" exhibited at the Veterinary Congress. While his worship the Mayor of Pretoria Mr. E. Smit looks on.

THE ADJUVANT EFFECT OF FREUND'S COMPLETE ADJUVANT, BAYOL F AND ALUM ON THE IMMUNE RESPONSE TO EPSILON TOXOID

B. C. JANSEN, Section of Bacteriology Veterinary Research Institute, Onderstepoort

In the course of investigating the improvement of the antigenicity of *Clostridium welchii* type D epsilon toxoid, the following adjuvants were used: Freund's complete adjuvant, Bayol F and alum. Sheep without any history of having been injected with epsilon toxoid and without any detectable epsilon antitoxin in their sera were selected for the experiment. They were divided at random into three groups of eight. The materials for injection were prepared so that each dose of 2.5 ml. contained 100 Lf trypsin activated epsilon formoltoxoid and further in the case of:

(*a*) *Alum:* the mixture contained 2.0 per cent alum and the pH was adjusted to 5.5;

(*b*) *Bayol F:* two ml. Bayol F was added to 0.5 ml. toxoid and shaken to emulsify immediately before use;

(*c*) *Freund's adjuvant:* two ml. adjuvant was added to 0.5 ml. toxoid and shaken to emulsify.

Each sheep received two subcutaneous injections at an interval of three weeks, a different group being used for each adjuvant. They were bled three times at weekly intervals commencing one week after the second injection, and the antitoxin values of their sera determined individually. These were expressed in Wellcome units and are recorded in Table I.

TABLE I

The Antitoxin Values (Units/ML) of Sera of Sheep Injected with Epsilon Toxoid Plus Different Adjuvants

Sheep No.	ALUM			BAYOL F			FREUND'S ADJUVANT		
	Bleeding			Bleeding			Bleeding		
	1	2	3	1	2	3	1	2	3
1	30.0	30.0	15.0	1.5	3.0	6.0	150.0	750.0	1500.9
2	15.0	15.0	10.0	3.0	5.0	30.0	30.0	150.0	500.0
3	30.0	30.0	15.0	3.8	15.0	10.0	375.0	1500.0	1500.0
4	15.0	15.0	7.5	01.0	10.0	6.0	50.0	150.0	500.0
5	10.0	5.0	3.8	2.0	4.3	30.0	1500.0	3750.0	3750.0
6	7.5	6.0	5.0	15.0	37.5	30.0	750.0	1500.0	1500.0
7	7.5	5.0	3.0	15.0	30.0	15.0	500.0	1500.0	1500.0
8	10.0	10.0	4.3	3.0	7.5	6.0	375.0	3750.0	3750.0
Geometric Mean Value	13.55	11.49	6.716	4.68	7.97	13.11	254.90	972.00	1433.00

From Table I the superiority of Freund's adjuvant is obvious with respect to both the height of the response and its duration. The response in the Bayol F group is lower than in the alum group at the first bleeding, but at the third bleeding the position is reversed.

The advantages to be gained from adjuvants other than alum are being investigated further.

Footnote:

While this communication was prepared for publication, the following article reporting essentially the same results appeared in print:

Sterne, M.; Batty, Irene; Thomson, A.; and Robertson, J. M. Immunisation of sheep with Multi-component Clostridial Vaccines. Vet. Rec. 74: 909-913.

J. S. Afr. vet. med. Ass. XXXIII (4) 1962.

RABIES IN SOUTHERN RHODESIA: 1900 TO 1961

D. K. SHONE,* Veterinary Research Laboratory, Salisbury

(Received for Publication, August, 1962)

SUMMARY

A review of the 1902–1913 rabies epizootic in Southern Rhodesia is given.

The probable origin and subsequent spread of rabies following a path formed by African occupied areas is given for the 1950–1961 epizootic.

The diagnostic techniques and control measures employed in Southern Rhodesia to combat the outbreak of rabies are given.

The incidence of cases in domestic and wild animals is given and it is suggested that rabies infection in wild animals is of limited importance in the long range dissemination of the disease in Southern Rhodesia. The vaccination of dogs was sufficient to control and eradicate the disease without recourse to campaigns against wild animals.

INTRODUCTION

Southern Rhodesia comprises an area of 150,333 square miles lying between the Limpopo and Zambesi rivers (15°–22° E. longtitude). It is completely land locked, being bounded by Northern Rhodesia to the north, Portuguese East Africa to the east, the Republic of South Africa to the south and the Bechuanaland Protectorate to the west.

The European population in 1911, was estimated as being 23,700 and the African population as 750,000. In 1956, the European population was 177,124 and the African population was estimated as 2,540,000.

HISTORICAL

The period 1900 *to* 1950

Southern Rhodesia was free of rabies in 1900. In 1902, the disease was diagnosed in the Bulawayo area. The diagnosis was confirmed by biological tests in rabbits. According to Edmonds (1922) the old men amongst the Matabele as well as the Africans living in the vicinity of Umtali, stated that the disease was prevalent in the country in their young days, but eventually disappeared. Edmonds (1922) considered that there was little doubt that the disease was introduced into Southern Rhodesia from some place north of the Zambesi river, as at that time there was a considerable amount of traffic between Southern and North Western Rhodesia, and that travellers had reported that the disease was widespread in the latter territory. It was also reported that Lewanika, Chief of the Barotse, had, before his departure for England to attend the coronation of King Edward VII, given instructions for the destruction of all the dogs belonging to his people because of the presence of rabies in his country.

The control measures adopted in Southern Rhodesia consisted of the muzzling of all the dogs in the affected areas, together, with the destruction of stray dogs. At that time, there were no restrictions, such as a dog tax, on the number of dogs, and there were large numbers present throughout the country amongst which were innumerable numbers of ownerless dogs. In the first three months of operations 9,483 dogs were destroyed by the police and after the end of 19 months the figure was 60,000.

In 1904, a diminution in the number of cases in dogs took place, but cases were reported to be occurring in wild carnivora. In 1907, practically every district in the territory was infected and a country wide muzzling order was imposed and the registration of all dogs in the territory was commenced.

It was found impossible to enforce the muzzling order, and in 1909 it was abandoned, and regulations were promulgated which provided that all dogs within a suspected infected area should be kept within a safe enclosure or chained up for a period of not less than 6 weeks.

In the following two years the incidence of cases once again decreased but in 1912 a serious recrudescence occurred, as a result a Dog Tax Ordinance was promulgated. In 1913 there was only one confirmed outbreak of rabies and subsequent years were free of any outbreaks. The eventual control and eradication of disease was directly ascribed to the application of the Dog Tax Ordinance which resulted in an enormous diminution in the numbers of African owned dogs.

Southern Rhodesia remained free of rabies from 1914 to 1938 when a rabid dog was reported at the Victoria Falls. Confirmation of rabies was obtained using material from 2 of 4 dogs which had been bitten and which subsequently developed symptoms of rabies. Biological tests were undertaken in rabbits. In view of the freedom of the country from rabies for 25 years and the proximity of the case to the border, it was considered that the dog in question had originated in Northern Rhodesia.

Southern Rhodesia remained free of rabies for a further 13 years when rabies was confirmed in a dog in the Gwanda area in August, 1950. (Annual Reports 1900–1950).

The Period 1950 *to* 1961

It is considered that rabies entered Southern Rhodesia in 1950 across the southern and south western borders over a distance of approximately 200 miles from Beit bridge westwards. The earliest introduction appeared to have been into the Tuli area from the Bechuanaland Protectorate with a later introduction from the Republic of South Africa in the Beit Bridge area.

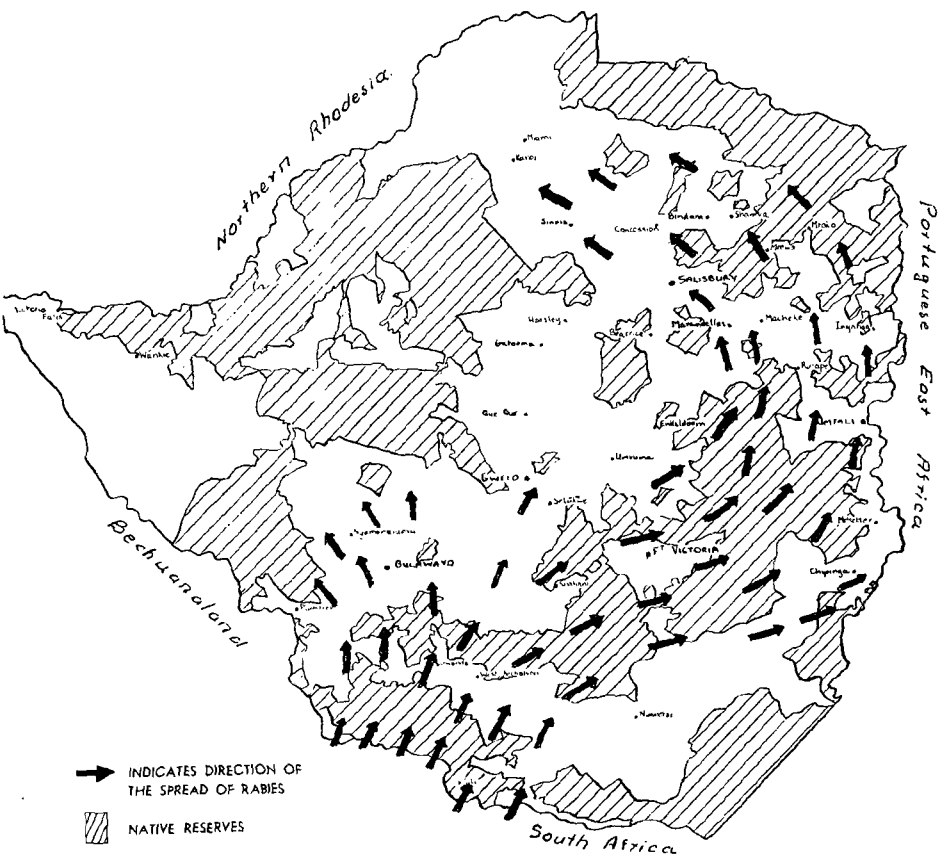
The disease is thought to have probably been introduced through Africans crossing the border to Bechuanaland and the Transvaal in order to purchase cheap grain and taking their dogs with them on these transactions. (Adamson, 1954).

Following the initial introduction of the disease it quickly spread and within 6 months had extended some 200 miles into the interior of the Colony.

A westward and eastward spread then took place. Map I depicts the subsequent spread of the disease. It will be noted from this map that

after spreading in an easterly direction it swerved northward along the eastern border, and then followed a giant curve to the west, ultimately reaching beyond Sinoia. Map I was compiled after plotting geographically all the confirmed cases occurring over the period 1950 to 1961.

The eastward and subsequent spread of the disease appears to follow roughly a path formed by African occupied land. The African occupied land is depicted in Map I.



DIAGNOSTIC SERVICES

In view of the virtual absence of rabies from Southern Rhodesia for a period of 37 years from 1913 to 1950, no routine rabies diagnostic service was in operation, and one of the first essentials was to establish such a service. In the initial period of the outbreak, examination of specimens was undertaken by the Onderstepoort Laboratories in the Republic of South Africa but, as the local facilities were built up, their services were gradually dispensed with.

Initially, it was felt that most value would be obtained from a diagnostic service based upon a histological examination of hippocampus

sections for the presence of Negri bodies. In the initial stages, owing to the limited number of mice available, biological examinations were undertaken on a few selected cases. This was eventually extended to include all histologically negative cases, histologically positive human cases and histologically positive vaccinated dogs.

It was accepted that in the initial stages a number of cases of rabies would not be diagnosed in the absence of a biological examination of all specimens. Subsequently the number of cases found to be histologically negative, biologically positive was in the region of 10 per cent.

Submission of Specimens

Special boxes were supplied to all offices of the Department of Veterinary Services for the submission of rabies specimens. These boxes are constructed of half inch wood with dove tailed joints, a screw on lid, and are divided into two compartments. One compartment holds a pint sized, wide mouthed, fruit preserving jar, containing sterile 50 per cent glycerine in saline solution, in a metal container with a push on lid. The metal container is completely surrounded by an absorbent material, such as sawdust. The other half of the box is similarly prepared except that the fruit jar contains 10 per cent formol-saline. Adhesive bandage is wrapped around the lid of each glass jar as well as around the lid of the metal container.

Instructions issued are that on the removal of a brain it was to be divided longtitudinally and perpendicularly between the cerebral hemispheres. One half of the brain was placed in the bottle containing glycerine saline solution and the other half in the bottle containing the 10 per cent formol-saline solution.

All the boxes are painted red and clearly marked *rabies*. The boxes are despatched ready for use from the laboratory.

All specimens are submitted to the laboratory by passenger train and a full history of the case accompanies each specimen. A telegram despatched at the same time as the specimen ensures that non arrival of specimens can be immediately investigated.

Histological Examination

On receipt of a specimen at the laboratory the hippocampus is removed from the formalized specimen and examined histologically for the Negri bodies. The procedure followed, enables a diagnosis, based upon a histological examination, to be given within 4 hours of the receipt of a formalin fixed specimen.

On receipt of the specimen, the hippocampus is removed and two cross sections approximately one tenth of an inch thick are cut. These sections are washed in tap water for 5 minutes and then drained on

absorbent paper. The two sections are then passed through the following solutions for the indicated times:

Acetone	5 minutes
Acetone	25 minutes
Butyl alcohol 1 part Acetone 3 parts	2 minutes
Butyl alcohol 3 parts Acetone 1 part	2 minutes
Butyl alcohol	2 minutes
Butyl alcohol.....	2 minutes
Molten paraffin wax..	15 minutes
Molten paraffin wax..	30 minutes

The two sections are blocked together and the mould placed in a refrigerator to hasten setting. After approximately 20 minutes, ribbon sections, 4 microns thick, are floated onto albumin treated slides and dried. The wax is melted and removed with xylol. The xylol is removed by washing with absolute alcohol.

The following solutions and procedures are employed in the staining:

Solution I—

Basic fuchsin....	1.8 gms.
Methyl alcohol..	50 ccs.
Glycerine	50 ccs.

Solution II

Methylene Blue ..	1.0 gms.
Methyl alcohol..	50 ccs.
Glycerine	50 ccs.

Solution III—

9 per cent solution of Potassium hydroxide diluted 1:220 in distilled water.

Solution IV—

2 per cent colphonium (resin) in 90 per cent alcohol.

The slide to be stained, is flooded with a solution prepared by mixing one drop of solution I with one drop of solution II and making the volume up to 2.5 cos. with solution III. The slide is heated at steaming point for 5 minutes and then washed in tap water with solution IV until no more red colour flows from the sections, and the line of blue staining cells in the hippocampus is clearly visible. Further decolourization is stopped by washing with absolute alcohol followed by xylol and the section is then mounted.

The cytoplasm and nuclei of the cells stain blue and the background is pink. The erythrocytes stain, a carmine colour and the quality of the staining can be judged by examination of the erythrocytes. The Negri bodies stain red are well differentiated and prominent and the blue staining inner structure well stained.

Biological Examination

The specimen preserved in 50 per cent glycerine-saline is stored at 4°C until the results of the histological examination becomes available, following which the biological tests are undertaken. A rough

10 per cent emulsion of brain tissue in normal saline is prepared, to which is added 1,000 units penicillin and 1,000 micrograms streptomycin per cc. The emulsion is lightly centrifuged and 0.03 cc quantities injected intracerebrally into each of eight mice, 5 to 7 weeks old.

The mice are inspected daily and a histological examination for Negri bodies undertaken on the brains of all mice which die after the 3rd day following injection.

The mice are kept under observation for a period of 35 days after which the test is deemed negative.

The longest incubation period recorded was 29 days.

Biological examinations are undertaken on all histological negative cases, on all human cases as well as on all positive histologicals of vaccinated dogs.

THE INCIDENCE OF RABIES IN VARIOUS SPECIES

In the 11 year period 1950 to 1961 a total of 893 cases of rabies were confirmed by laboratory examination in 7 domestic species and 5 wild animal species. One of the latter species, the single case in a baboon, should not strictly be included in this group as it was in fact a tame baboon which was attacked by a rabid dog.

The number of cases of rabies confirmed amongst the various species is detailed in Table I. As can be expected the greatest number of cases were in dogs. These figures cannot be taken as a true reflection of the number of cases which occurred, as for example specimens from only 5 sheep of a total of 47 cases known to have occurred in a flock of sheep were submitted for examination.

It is probable that the figures are a fairly true reflection, with exceptions such as the one quoted above, of the occurrence of rabies in the European occupied areas.

Only a fraction less than five per cent of the 893 cases originated from African areas, though the larger proportion of the estimated 250,000 dogs in the country in 1950 were African owned, and were to be found in the 41,950,000 acres occupied by Africans. It can be safely assumed that the incidence of rabies in these areas was probably greater than that occurring in the European occupied areas.

These African occupied areas are not only poorly supplied by telephone, but the African is very reluctant to report cases of rabies owing to the restrictions which follow. The extent to which the African would go to avoid reporting cases can be judged from the following incident when a rabid dog bit five children. The dog was killed and burnt. It was only after the death of one of the children, and when a second one became ill, that the occurence was reported. Ultimately, 4 of the 5 children died. Rabies was confirmed in two of the cases.

The presence of rabies in animals in the European areas can be used as a pointer of the presence of the disease in adjacent African occupied land.

TABLE I

The number of confirmed cases in various animal species over the period 1950 *to* 1961

	Dogs	Cats	Cattle	Sheep	Horses	Donkeys	Pigs	Jackals	Civet Cats	Badger	Hyena	Baboon	Total
1950 (4 mths.)	4												4
1951.....	112	1	1	1	1								116
1952.....	129	1	14	6				33	3	4			190
1953.....	102	4	5		1			7				1	120
1954.....	149	2	8	3	1	1	1	7			1		173
1955.....	84	1	4					12					101
1956.....	47		2					1					50
1957.....	41	2	2		1			9		2			57
1958.....	33							6					39
1959.....	25	1	1					1					28
1960.....	12												12
1961.....	2												2
Total.....	740	12	37	10	4	1	1	76	3	6	1	1	892

INCIDENCE IN DOMESTIC ANIMALS

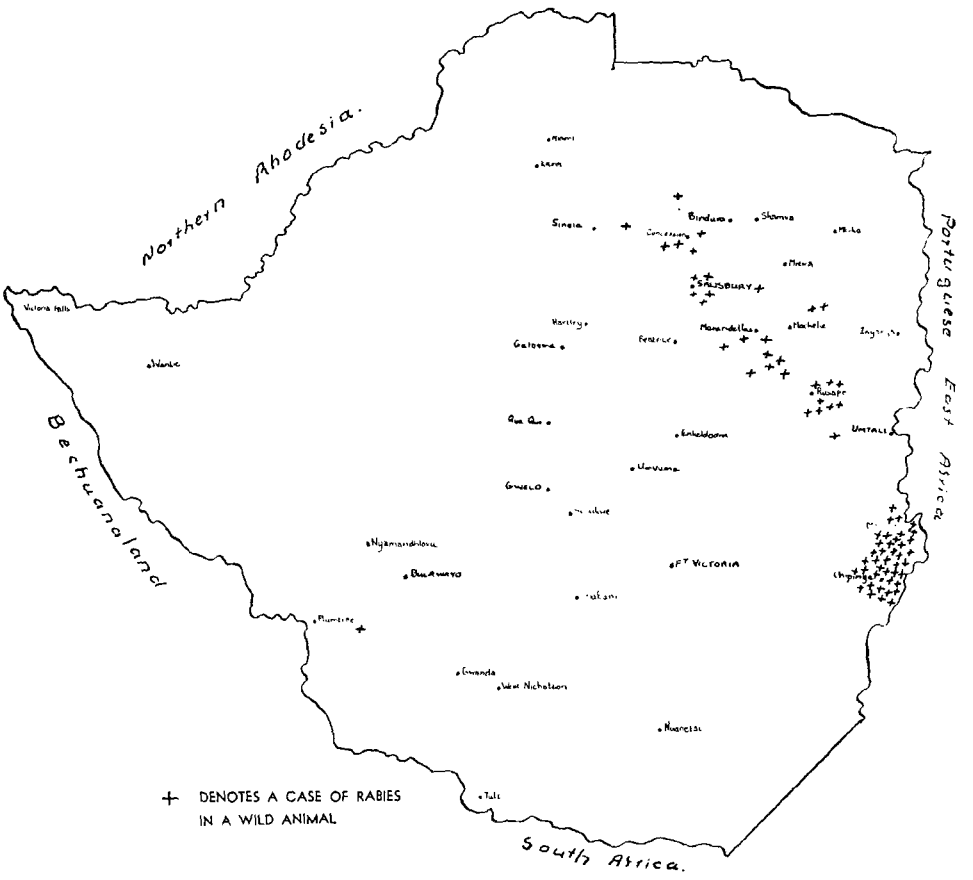
From Table I it will be seen that apart from dogs, the greatest number of confirmed cases is recorded as being in cattle, but as has been mentioned earlier, it is known that as far as sheep are concerned, only five specimens from a total of 47 affected sheep were submitted for examination. Apart from this case the figures can probably be accepted as reasonably accurate for the European occupied areas.

A number of outbreaks amongst cattle and sheep were ascribed to attacks by rabid badgers (*Mellivora capensis*).

INCIDENCE IN WILD ANIMAL SPECIES

It will be noted from Table I that by far the greatest number of cases in wild animals occurred amongst jackals. The distribution of the confirmed cases of rabies amongst wild animals over the 11 year period 1950 to 1961 has been depicted in Map II. It will be noted that most cases occurred in the Chipinga and Melsetter areas of the Eastern Districts. The figures cannot be taken other than to indicate the presence of the disease amongst the wild carnivora as it is known that many more cases

were observed in the Eastern Districts than were obtained for submission. (Williamson 1961).



The report of 47 deaths in a flock of sheep from rabies has already been mentioned. It was suspected that the animal which attacked the sheep was a honey badger (*Mellivora capensis*) (Darbyshire 1953).

Incidence in Humans

In the 11 years there were 16 confirmed cases of rabies in humans, of which 6 received the full number of prophylactic doses of a Pasteur type vaccine. The administration of the vaccine to 5 of these people commenced within 1 or 2 days of having been bitten. In one case the wounds had also been cleaned out with a pure carbolic solution within 30 minutes of the bites having been inflicted. Twelve of the cases contracted rabies as a result of dog bites. The source of infection of the other 4 cases is not known.

The shortest incubation period was 29 days and the longest 63 days.

No records are available of the number of persons who received anti-rabies treatment or the number who suffered from side effects induced by the vaccine.

CONTROL MEASURES

It was apparent from the outset that the major problem in combating the disease would lie in the African areas. In 1950 it was estimated that the dog population was 250,000 of which the majority were African owned. It is also considered that the African dog population is renewed every 18 months to 2 years, as a result of the harsh condition of neglect and semi-starvation to which they are subjected. (Adamson, 1954).

The control measures adopted were a tie-up of all dogs within a 20 mile radius of an infected locus and the destruction of stray and ownerless dogs.

The tie-up orders were very unpopular with the general public, both European and African. The African in particular disliked this measure as it was their custom to allow the dogs to roam loose in order to forage for food. If the dogs were to be confined as was required, it meant that the owner was forced to provide it with food. It was soon obvious that the tie-up orders were not being complied with, and it was found virtually impossible to enforce it.

It was also found that illicit movements of dogs from infected to non-infected areas were impossible to prevent. Legally a permit was required to move any dog from one area to another.

At the same time as the tie-up orders and restrictions of movement were imposed, the destruction of stray and ownerless dogs was commenced. In the first year of operations 16,234 such dogs were destroyed.

These measures failed to contain the disease and it was being suggested that consideration should be given to the destruction of all dogs in an infected area.

The tie-up order and destruction of strays and ownerless dogs continued to be used throughout the campaign against the disease, but they assumed a secondary role to the main control measure, which was vaccination.

Vaccination Campaign

When in 1951, information was received of the development of the egg adapted Flury virus strain suitable for use in the immunization of dogs, it was decided to utilise this vaccine.

The first batch of vaccine was received from the United States of America in June, 1951, and the first dogs were vaccinated in the following month. Throughout the campaign, vaccine from the same manufacturer has been employed. The vaccine is air freighted to Salibury and after receipt the titre is determined in mice. Periodic checks are also made on vaccine which has been issued from the central store and may have been subjected to unfavourable conditions.

Initially, vaccination was only undertaken in the infected areas, but in October, 1951, an attempt was made to create an immune belt around

Salisbury in the path of the epizootic. This attempt did not succeed in stopping the advance of the epidemic but it prevented a massive outbreak within the Salisbury city area and its environs. In view of the number of dogs which were present in Salisbury the number of cases of rabies were remarkably few in number.

From 1951 until 1954, dogs were vaccinated on reaching the age of 5 months. It was compulsory for all dogs over the age of 5 months in a quarantine area to be vaccinated and by 1952 the whole country had been declared a quarantine area. Failure to have a dog vaccinated was a legal offence and subject to a fine or a penalty or both.

A fee of seven shillings and sixpence was levied on all European dogs vaccinated, and a fee of two shillings and sixpense on African owned dogs. These charges were later reduced to five shillings for European owned dogs and African owned dogs are done free of charge.

At the time of the administration of the vaccine, the dog is tattoed in the ear with a single number corresponding to the year in which vaccination is done.

A certificate is issued when the dog is vaccinated. This certificate was later amended to also serve as a permit for the movement of the dog from one area to another.

In 1954, the age at which the dogs were required to be vaccinated was reduced from 5 to 3 months of age. In 1956 this was again amended and it now became necessary for every dog in the country to be vaccinated twice. The first time is on reaching the age of 3 months and a second time is on reaching the age of 12 months.

Provision is also made for the revaccination of all dogs in a defined area should the need arise.

In Table II are detailed the number of doses of rabies vaccine which have been used annually during the current outbreak.

TABLE II

The number of doses of avianized Flury strain rabies vaccine used annually in Southern Rhodesia

	doses
1951 (4 months)	57,027
1952	123,583
1953	37,336
1954	121,054
1955	105,380
1956	84,221
1957	174,325
1958	135,357
1959	159,821
1960	141,959
1961	83,818
Total	1,223,881

RABIES IN VACCINATED DOGS

In the period 1951 to 1957, 115 cases of rabies were diagnosed in vaccinated dogs. Eighteen of these dogs had been vaccinated for less than one month, 23 dogs had been vaccinated for more than one month but less than six months. Fifty-three of the dogs had been vaccinated for more than 6 months. Six of the latter dogs hda been vaccinated twice and one had been vaccinated three times. (Annual Reports 1950–1960).

DISCUSSION

Rabies in wild animals as disseminators or reservoirs of infection, is a matter of some concern to all countries in which the disease exists. The role which the *Viverridae* play in the maintenance of rabies in certain parts of the Republic of South Africa, and the role played by the vampire bat in Central and South America are well known.

The position as regards other wild life is far from clear. In the two epizootics which Southern Rhodesia experienced infection of wild animals occurred. In the 1902–1913 epizootic infection in jackals occurred and the number of wild dogs (*Lycaon pictus*) decreased during the outbreak presumably from rabies (Edmonds, 1922). In the 1950–1961 epizootic rabies was confirmed in 5 wild animal species. Infection amongst jackals in the Chipinga and Melsetter areas of the Eastern Districts was particularly heavy. During both epizootics the fear was expressed that control and ultimate eradication would be virtually impossible, because of the presence of rabies in wild animals. Both epizootics were, however, brought under control and complete eradication achieved in one, and virtually complete eradication obtained in the other. In both campaigns control measures were aimed at the disease in dogs and virtually no action taken to control the numbers of wild animals. A bounty for jackals was offered in the 1950–1961 epizootic, but this did not induce any active campaign against these animals.

In Southern Rhodesia, therefore, the dog has been primarily responsible for the dissemination and the maintenance of the disease and wild animals have not, except to a minor degree, been responsible for maintenance and dissemination. In the 1902–1913 epizootic control and eradication was ultimately achieved by the implementation of a Dog Tax Ordinance which resulted in an enormous decrease in the numbers of dogs. In the 1950–1960 epizootic control was achieved by the creation of a high immunity level of the dog population in the country.

It has been suggested that the dog may act as a long range disseminator of rabies affecting wild animals, and that with its elimination the epidemic breaks down. The experience in Southern Rhodesia supports this suggestion, and additional support is provided by the reduction in the incidence of rabies in Eastern European countries, where prophylactic vaccination is practised and where the incidence in wild animals is low, whereas in Germany where vaccination is forbidden the incidence in wild animals is high (Anonymous, 1961). In disagreeing with this theory Anonymous (1961) points to the United States of America where vaccination is practised, yet the spread of rabies amongst wild animals continues

to grow. In such countries it is probable that factors outside of the practice of vaccination are involved. It is likely that a critical level of immunity for a particular dog population exists below which the number of susceptible dogs will be sufficient for the maintenance of the disease.

Southern Rhodesia is completely land locked and rabies is known to be present in all the adjoining territories. In the North, the Zambezi river offers a very effective barrier to straying dogs, but dogs in the incubation period may be brought into the territory as is suspected to have occurred with one case occurring in complete isolation to any others, or rabid dogs may cross by the bridges as it is suspected happened in 1938 at the Victoria Falls, and 1961 via the Kariba Dam wall.

In the east and west no such barriers exist, and to the south the Limpopo river only offers a barrier when in flood, at other times it is freely negotiable. Southern Rhodesia is threfore constantly exposed to the threat of reinfection from neighbouring territories, and the need to maintain a high percentage of immune dogs is vital. Unfortunately this is not proving an easy task, particularly in the vital African areas, due chiefly to political factors. There is a definite need to undertake control of such a disease on an inter territorial basis.

ACKNOWLEDGEMENT

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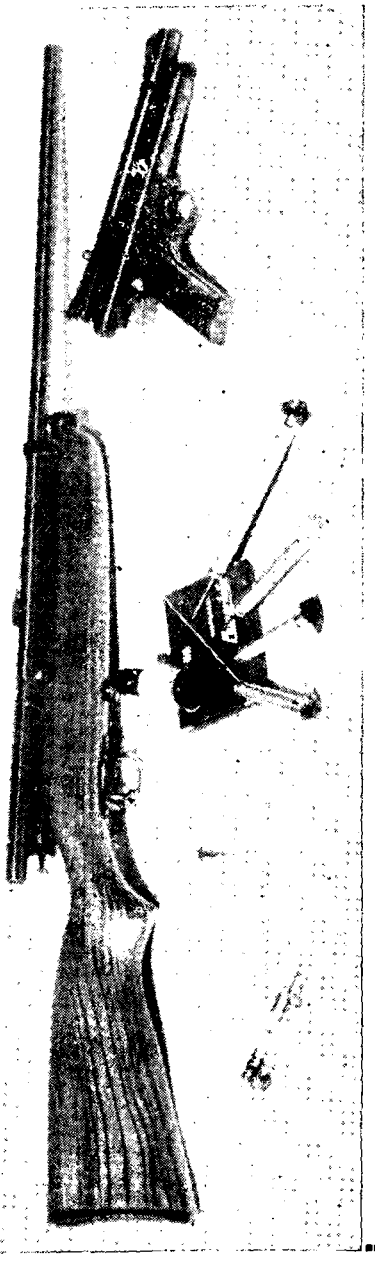

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THE TREATMENT OF SNAKEBITE IN ANIMALS

J. H. MASON, The South African Institute for Medical Research, Johannesburg

Received for Publication, August, 1962

SUMMARY

1. Users of antivenom should read the pamphlet accompanying the package immediately after receiving it.

2. If possible, but without wasting valuable time, the snake should be identified so that the appropriate antiserum may be given.

3. A large dose of serum should be injected as soon after the accident as possible. This dose should NOT be reduced for dogs and other small animals.

4. A tourniquet should be applied if the snake is an elapine and the site of the bite permits.

5. Apply suction.

6. Keep the animal quiet.

INTRODUCTION

Although the treatment of snakebite has been summarized in a fairly recent issue of a veterinary journal,[1] our Secretary, Dr. Diesel, suggested that it would be of interest and value if I wrote in more detail on the subject. In compiling this note, I have drawn extensively from a monograph by Christensen[2] who obtained information about snakebite from 509 questionnaires (98 of which dealt with bitten animals) issued by and returned to the Institute.

Type of snake responsible.—In order of decreasing importance — "uncertain", puff adder, ringhals, Cape cobra, mamba and berg adder, horned adder and night adder. The skaapsteker, boomslang and black-necked cobra were not mentioned in the questionnaires as biters of animals. Thus, except for the "uncertain" snakes (and some of these must have been puff adders) the chief culprit was the puff adder which is also responsible for most bites in man.

Animals bitten.—Dogs — 60 per cent; oxen — 30 per cent; horses — 3 per cent; cats — 2 per cent; sheep — 1 per cent; rabbits — 1 per cent.

Site of bite.—Dog — usually the head; ox — head and legs.

Seasonal distribution.—Much more frequent in summer than in winter.

TREATMENT

Most animals bitten by snakes are treated by the owner. This is an understandable and rational procedure not only because most accidents occur in country districts at some distance from a veterinarian but also because serum therapy, to be of most value, must be started soon after

the infliction of the bite. But although the practitioner is seldom called upon to deal with a bitten animal, he should know what to do and be able to give expert advice. It is obvious from the information given in questionnaires that some owners still adhere to outmoded methods in spite of the up-to-date advice given in the pamphlet accompanying the antivenom and in spite of the rubric on the box "Read Enclosed Pamphlet". Thus, the first piece of advice the veterinary surgeon should accept and offer is "Open the box and familiarize yourself with the instructions in the pamphlet". The box or preferably boxes should be stored in a refrigerator or cool place along with a sterilized syringe and needle but should be carried on the person of the owner, both for his own safety and for that of his animals, whenever he goes into the veld; a delay of an hour or more, and in the case of a mamba bite of minutes, can mean the difference between life and death.

Identification of snake: The polyvalent antivenom issued by the Institute "covers" the bites of all poisonous snakes of South Africa, except those of the mamba (black and green), the boomslang and the Gaboon adder (found in the St. Lucia district of Zululand). Although valuable time should not be lost trying to establish identification, it would be an advantage to know the type of sname responsible for the bite because a mamba antiserum and one with a high Gaboon adder antivenom content are on issue. The distribution of snakes is of some help in deciding the kind of serum to use. For example, mambas are rare in the High Veld but commoner in Zululand and in the coastal region of Natal; the ringhals is common in the High Veld, the Cape cobra in the Cape Province, the berg adder in hilly districts, and the puff adder in any warm part of the country. Perhaps the best general advice that can be offered is, "Lacking information on the culprit, inject polyvalent serum but if there is a possibility of a mamba being responsible, inject polyvalent mamba antivenom in addition. If the accident took place in the St. Lucia district, use Tropical antivenom (see later) which will cover the Gaboon adder. For boomslang bite, a monovalent antivenom is held at the Institute but is not on general issue."

Little reliance should be placed on the identification powers of laymen and none at all on those of Natives. As my colleague, Dr. J. D. Coles, facetiously said to me, "No self-respecting Native would ever admit that he was bitten by anything less dangerous than a black or a green mamba". Curators of snake parks have moments of quiet amusement when visitors positively identify harmless green and mole snakes as mambas. Identification of this kind probably accounts for the miraculous cures some people are so fond of recounting.

Serum Treatment: I have placed this first because, undoubtedly, the early administration of an adequate dose of antivenom is of much more importance than any other form of treatment.

I have records of the treatment of people bitten in snake parks by the Egyptian cobra, the green mamba and Jameson's mamba (not found in South Africa) where the appropriate serum was injected within minutes of the accident. When the victims had recovered from mental shock, they were able to resume their usual duties.

Dosage: The best answer is — "a large one"— particularly if the culprit was an elapine snake (cobra, mamba, ringhals) and if delay has

occurred. On no account should a wait-and-see policy be adopted. A minimum of 20 ml should be injected, increased to 30 ml, 40 ml and even 50 ml if the condition of the patient is critical.

Route of injection: Patients bitten by elapine snakes are best treated by the intravenous route but it must be borne in mind that a heterologous serum, except in the case of the horse, is being injected and thus must be given very slowly. Further it is doubtful if this route can be used in dogs other than by a veterinary surgeon and for this reason the layman will almost certainly inject subcutaneously and/or intramuscularly. When an adder is responsible, serum should also be injected into the site of the bite. If an adequate amount of antivenom is given in the first instance, there should be no need to inject further amounts.

Size of patients: Because the proportion of venom to body weight is larger in a dog or other small animal than in a large subject, the dose of antivenom should NOT be decreased. It may be anatomically difficult to inject 30 ml into a small Pekinese but the intraperitoneal route could be used in case of emergency. There are indications that dogs are particularly susceptible to puff adder venom.

First Aid and Other Measures

Tourniquet: In man, this is of value applied early to a limb if the snake is an elapine. The veterinarian should not forget to tell his client that it must not be left in place indefinitely. It should be removed for a minute after half an hour and then for a minute after each of two periods of twenty minutes and thereafter discarded. A tourniquet may do more harm than good when tied round a leg bitten by an adder because adder venom is cytotoxic and causes a swelling which may be increased by the oedema produced by a tight bandage.

Suction: Christensen[2] quotes Organe who said that envenomation can occur if the person who sucks with the unguarded mouth has decayed teeth or has had one or more teeth removed shortly before the act. This shows that some venom may be extracted by suction. However, Leopold, Huber and Kathan[3] and Leopold and Huber,[4] working with rattlesnake venom in rabbits, were unable to show that suction had a beneficial effect. If suction is applied, it should be done with a pump or with the mouth protected by a sheet of thin rubber. If the unguarded mouth is used, the risk of envenomation is greatly reduced if frequent "spitting out" is resorted to and if the mouth is finally rinsed out with diluted antiserum. Bleeding from the fang wounds should be encouraged.

Incisions: It is doubtful if these ever have much beneficial action. Leopold and his co-workers[3, 4] in the experiments just mentioned, found them to be without value. In the hands of laymen, they can be harmful because blood vessels, nerves and tendons can be severed and infection can be set up. But, at a later stage, incision of a swelling, particularly that caused by a puff adder, may be essential, in order to remove blood, pus and detritus.

Potassium permanganate: This old-fashioned remedy has been relegated to limbo. *If* permanganate could be brought into contact with the venom, it would destroy it. But to irritate an already inflamed area

by incising it and then further to inflame it with an irritant is not good practice.

Cryotherapy: Stahnke[5, 6, 7] is the chief proponent of this form of treatment of rattlesnake bites in the United States of America but his method has not found general acceptance. But even if it had value and were without danger, the immersion of a bitten limb in ice-cold water or the application of ice packs for hours on end would be difficult to carry out in animal practice.

Spitting snakes: If the venom of spitting snakes, the ringhals and the black-necked cobra, touches the eyeball, it may cause an intense, painful irritation. This is relieved if antivenom diluted in water (to reduce its cresol concentration) is used liberally as an eyewash. If the animal has not been bitten, there is no need to inject serum parenterally.

In nearly every popular article on treatment, milk is recommended as an eyewash. If serum is not to hand, milk is possibly as good as anything else although I can ascribe no special curative properties to it. copious irrigation with water or physiological salt solution would similarly dilute and remove unfixed venom.

Magnesium sulphate: Shircore[8] claimed that the injection of a solution of this salt into the site of a snakebite had a definite curative effect but Christensen and de Waal[9] showed that it was valueless in the treatment of guinea-pigs poisoned by the venoms of the Cape cobra and the puff adder.

Soap solution: Ahuja and Brooks[10] found that the infiltration of the bitten area with a 5 per cent solution of soap had a beneficial effect. Christensen and de Waal[9] confirmed this finding as it concerns the venoms of the Cape cobra and the ringhals but showed that the treatment may be harmful when puff adder venom is the poison.

Rest and Immobilization: The work of Leopold *et al*[3, 4] showed that, in rabbits, immobilization of the subject was of more importance than incisions and suction. As increased rate of blood flow will hasten absorption of venom, the patient should be kept as quiet as possible.

Nostra and Native Muti: Once or twice yearly I receive requests by Europeans to test a remedy or preventive, usually a powder, concocted by Natives from roots, bark and herbs. The writers are apparently convinced of the almost magical properties of the powder. It has always to be rubbed into the fang wounds, unincised or incised, but sometimes it has to be swallowed in addition. All samples tested in the Institute have proved valueless, either in prevention or cure.

Antivenoms available

1. *Polyvalent Anti-snakebite Serum*:
   Effective in the treatment of patients bitten by South African snakes, except mambas, the Gaboon adder and the boomslang.
2. *Tropical Anti-snakebite Serum*
   As (1) but effective against Gaboon adder venom in addition.
3. *Polyvalent Mamba Anti-snakebite Serum*
   Effective against the bites of the black, green and Jameson's mamba.
4. *Boomslang Antivenom*

A small amount of this monovalent serum is held at the Institute and will be issued only to treat patients definitely bitten by a boomslang. The venom of this snake does not usually kill rapidly. The serum is available on request only.

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J. S. Afr. vet. med. Ass. XXXIII (4) 1962.

THE ACTIVE IMMUNIZATION OF THE HORSE AGAINST TETANUS

A PLEA

J. H. MASON and A. W. SCHAAFSMA, South African Institute for Medical Research Johannesburg.

We occasionally receive an urgent call for antitoxin from one or other colleague who has been asked to treat a horse, usually a race horse, suffering from tetanus. As a rule, the veterinarian had been consulted *on the day after the trainer noticed that the animal was not well* which means that it had been showing symptoms for at least twenty four hours when the practitioner arrived at the stable.

On most occasions, the trainer collected the antitoxin at our Institute, giving us the opportunity of asking him why he did not immunize his stud. The stock answer was that he feared the injections would "put the animals off".

If treatment by sedation, antitoxin and rest gave a horse a 90 per cent chance of recovery, there might be some justification for omitting active immunization. But as treatment is expensive and tedious and more often than not without the desired effect, it is uneconomic to risk the life of an animal, often a very valuable one, for the sake of a few Rand and because the injections might "put it off".

Each horse entering the stud of the Serum Department of the South African Institute for Medical Research receives two intramuscular injections, six to eight weeks apart, of tetanus alum-precipitated toxoid (A.P.T.). Another dose is given six months later and thereafter one every six months. (This procedure is unnecessary in practice but is simple administratively; in addition, it ensures the presence of tetanus antitoxin in antivenoms and thus reduces the risk of tetanus developing after the bite of a snake). No case of "natural" tetanus has occurred in any of the hundreds of horses that have passed through our hands in the last twenty years.

A further indication of the efficacy of active immunization was given when each of two horses, in the course of being immunized against diphtheria toxin, received, in error, 50 ml of tetanus toxin. Nothing untoward occurred, a striking result in view of the extreme sensitivity of the horse to tetanus toxin. We have evidence that as little as twenty-five guinea-pig lethal doses can produce symptoms in the horse and, as the amount injected by mistake contained about twenty million guinea-pig fatal doses, the efficacy of immunization is clear.

It is almost an axiom that the injection of three spaced doses of A.P.T., one on day zero, one six to eight weeks later and one six months later will produce a satisfactory *basic immunity*, but to obtain this state, *the third of the three basic injections is absolutely necessary*. In the absence

of injury or surgery, all that is now called for is a booster dose every four or five years. A recall dose should be injected immediately after the infliction of an injury that could lead to tetanus, and a few days before an operation, but neither is necessary if a booster was given a few months before the incident.

There is evidence that the presence of 0.01 unit of anti-toxin per ml of serum will prevent tetanus occurring. The antitoxin titres of the sera taken from seven horses four weeks after the second injection of A.P.T. are recorded in table 1 and those of the sera of thirteen horses of another group taken seven days after the third basid dose in table 2.

TABLE 1

Serum antitoxin titres of seven horses, four weeks after the second injection of A.P.T.

Horse	1	2	3	4	5	6	7
Units/ml serum	0.5	2	3	3	10	12.5	$\geq$12.5

TABLE 2

Serum antitoxin titres of thirteen horses, seven days after the third basic immunizing dose of A.P.T.

Number of horses	4	5	4
Units/ml serum	20–40	40–80	$\geq$100

Dr. B. M. Horwitz, Director of the Municipal Abattoirs, Cape Town, has been good enough to give us the results of immunizing his stud of horses.

The animals received two doses of A.P.T., each of 10 ml, with an interval of six weeks between injections. A further dose of 10 ml was given six months later and thereafter yearly. The average number of animals in the stud was 240; in the seven years preceding immunization, there were 22 cases of tetanus; immunization began in 1954, since when, the disease has not been seen.

The dose, 10 ml, used by Dr. Horwitz was that originally recommended by one of us (J.H.M.) but could, we are certain, be reduced to 5 ml without detriment to the production of a satisfactory immunity. Probably Dr. Horwitz finds that the injection of a yearly dose of antigen is a simple routine procedure, which does away with the need for detailed record keeping and for booster doses after injury and before operations.

The evidence presented, which could be multiplied many times from the relevant literature is, we hope, enough to stimulate practitioners to advise active immunization. As the myth about the injection "putting the animal off" crops up frequently, the veterinarian should carry out

immunization at times when the horse is not racing. Foals from unimmunized dams may be immunized at any early age because they will be without maternally transmitted antitoxin. If the mother has been immunized, immunization should be delayed until the foal is between four and six months of age, to allow its circulating antibody to fall below an interfering level. The amount of A.P.T. to be injected will depend on the instructions of the laboratory producing it and, administered intramuscularly with sterile precautions through disinfected skin, it should produce no more than a transitory swelling.

Although the prevention of tetanus in man is not the immediate concern of the veterinary profession, we take this opportunity of stressing the advisability of active immunization for the veterinarian who, by the nature of his calling, is frequently exposed to the risk of infection.

REPORT ON THE BICENTENARY CELEBRATIONS OF THE NATIONAL VETERINARY SCHOOL, LYON, FRANCE, MAY, 1962

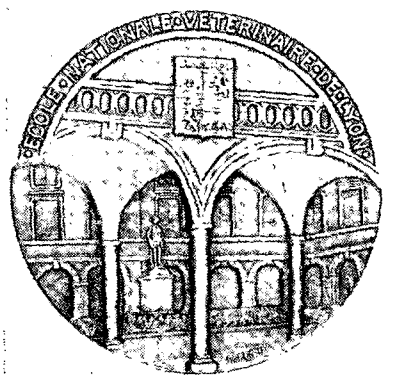
L. W. VAN DEN HEEVER — Section Food Hygiene Veterinary Research Institute, Onderstepoort

It was my privilege to attend these celebrations and to deliver a message of congratulations from the S.A.V.M.A. to the Director of the School.

Claude Bourgelat, Director of the Acadamy of Equitation, and keenly interested in agricultural matters, founded the school in 1762. It was built and staffed with the aid of funds granted by King Louis XVth on Bourgelat's recommendation and was the world's first formal training centre for veterinarians. From its graduates came the men who founded other early schools and colleges in France, Spain, Germany, England and elsewhere.

Lyon is truly the mother of all veterinary schools, *of which there are now about* 183 *throughout the world.* From a small beginning the profession has now grown to an estimated 100,000 members.

The National Veterinary School of Lyon is today housed in the original buildings on the banks of the Rhone River, and part of the celebrations consisted of the unveiling of a plaque in the courtyard, behind Bourgelat's statue, in the presence of guests of honour and representatives from most countries in the world. To me was presented a commemorative medallion (the obverse and reverse of which is reproduced below) with the request that it be presented to the S.A.V.M.A. as a token of appreciation for the congratulatory message presented to the WORLD'S FIRST VETERINARY SCHOOL, on its 200th Anniversary.



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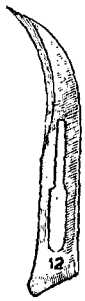

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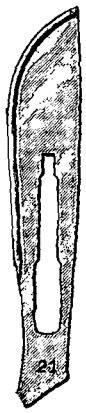

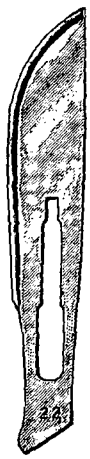

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A VISIT TO THE INTERNATIONAL CONFERENCE ON CATTLE DISEASES: VIENNA, 17TH TO 19TH MAY, 1962

J. R. FREAN — Publicity Section, Veterinary Research Institute, Onderstepoort

It was a very great privilege to have been asked to represent the S.A.V.M.A. at the Vienna Conference in May, 1962.

In arranging the trip to the Continent, care was taken to avoid the main tourist routes, and to travel to Vienna, via the Danube as far as possible. When it came to making final arrangements, however, it was found that no passenger vessel was available until the 13th May and, that the steamer did not travel from farther up the Danube than Passau, a small town on the Austro-Bavarian border. Railroad travel was undertaken to Passau, where a most interesting week was spent from where the first steamer of the season was boarded on the 13th of May. The journey upstream took a leisurely twenty-four hours, as against the ten-hour downstream trip.

The arrangements for the Conference were in the able hands of the genial Dr. Diernhofer, Professor of Cattle Diseases of the Veterinary High School.

Before leaving South Africa, permission had been granted by the D.V.S. (O.P.) to offer to Professor Diernhofer the projection of a selection of O.P. films on cattle diseases. This offer was avidly accepted, but, as it had come too late to be included in the original programme, it was included in the pre-Conference meeting of the Austrian Veterinary Association.

This meeting had been called for the evening of the 16th May, mainly as entertainment for those delegates who arrived the day before the Conference commenced. Originally two of the three films available had been selected but, as it turned out, the third was seized upon to substitute for the scheduled address of a Professor from Esthonia and from whom at the last moment a telegram came advising of his inability to penetrate the Iron Curtain. It thus transpired that instead of being used as a "filler" to round off the evening's entertainment, these films became the sole feature of the meeting, apart from the business and social side.

The films were very well received and loudly applauded. The meeting was particularly impressed by the scale (not to mention the scenery) of the Operation Nagana. So, with the minimum of effort on the part of the writer, veterinary science in South Africa was impressively placed on the map before an audience of leading veterinarians from all parts of the Continent of Europe including quite a fair sprinkling from behind the Iron Curtain. But apart from three Americans, one Scot and the writer, representatives from other parts of the world were conspicuous by their absence.

The President of the Austrian Veterinary Association asked the writer to thank the D.V.S. (O.P.) for the loan of the films and also convey the

collegial greetings of the Austrian Association to its South African counterpart. The former was duly done by letter from Vienna and the latter to the 57th Annual General Meeting by word of mouth.

The Conference-proper occupied the next three days in the magnificent Auditorium Maximum of the University. There were about 600 delegates and the agenda comprised 57 papers. Each delegate was provided with a booklet containing a summary of each paper and the names of the authors. The subject matter was grouped. Each author introduced his paper briefly in succession until the group matter was concluded, and then only did discussion on the whole group's papers take place. This proved a great saving. One was particularly struck by the expeditious manner in which the proceedings were handled; so much so that no single session exceeded its scheduled time; on occasions an hiatus was filled by an appropriate film, which had been held in reserve against such contingencies.

The writer's booklet of the summaries is available on loan to anyone interested.

The Conference terminated with the usual courtesies of laudatory and valedictory messages which included the following:—

> "The President and Council of the S.A.V.M.A. send their best wishes to Professor Dr. K. Diernhofer and sincerely trust that the hard work which he has been obliged to undertake in arranging the Conference on Bovine Diseases has been rewarded to his entire satisfaction. The S.A.V.M.A. would be grateful for any facilities which allow it to obtain a copy of the papers which were presented".

MEMOIRS

WILLIAM PETRIE HAMLYN

eath occurred on March 2nd, 1962, at his home at Umkomaas
ı Petrie Hamlyn, a retired Veterinarian.
ıd Mrs. Hamlyn came to South Africa from England in 1913,
Hamlyn entered the service of the South African Government.
›sted to Cape Town and later transferred to East London.
ent much of his time in East Coast Fever Areas in the Eastern
ıg stationed at Umtata and Grahamstown.
amlyn was stationed at Johannesburg for many years and took an active part in controlling the outbreak of Foot and Mouth Disease at Germiston in 1933.

Dr. Hamlyn was among the Veterinarians encouraged to come to South Africa in succession to those who had remained after the Anglo-Boer War and who were largely concerned with horse practice.

He retired at the age of 60 years to Umkomaas where he set up a small Veterinary Practice and enjoyed his game of golf.

He re-visited England twice but decided to retire in South Africa.

A family re-union was arranged on New Years Day of this year. Dr. Hamlyn leaves a widow a son and two married daughters. To them we extend our deepest sympathy.

PHILIP RUDOLPH BOTHA SMITH

Philip Rudolph Botha Smith was born at Ficksburg, O.F.S. on April 11th, 1899.

He matriculated at Ficksburg High School and spent 3 years at Stellenbosch University studying Science.

He decided to study Veterinary Medicine and entered Cornell University at Ithaca, New York in September 1919, receiving his D.V.M. in June, 1923.

He returned to South Africa and entered Government Service as a G.V.O. He married Ruth L. Hardy on February 18th, 1924.

He was stationed in Richmond (Natal), Vryheid, Pretoria, Aliwal North, Umtata and at Allerton Laboratory, Pietermaritzburg where he remained for 10 years.

He resigned from the Government Service in 1944 to open a private practice in Durban, which he operated in spite of continuous serious ill health. He died on June 18th, 1962.

Dr. Smith was a very fine sportsman. While still at school he represented his province in soccer under 19. He played rugby for Stellenbosch under 19, and was to play for Western Province but broke his back and spent months in a wheel chair.

In the United States he was the first South African to be chosen for the all American soccer team. Dr. Smith played in the all American team in 1922, and in 1923 captained the team.

Determination was one of Dr. Smith's strongest characteristics. This was exemplified in the long courageous struggle against ill health in his later years.

He leaves a widow and a married son Dr. Barrie Smith both of Durban to mourn his loss. To them we extend our deepest sympathy.

WALTER HEINZ GERHARD SCHATZ

With the passing of Dr. Walter Schatz in Cape Town on the 16th September the Veterinary Profession lost one of its most highly respected and popular members, at an age when he could have been expected to render many more years of valuable service.

Walter Heinz Gerhard Schatz was born at Usakos, S.W.A., on March 8th, 1914.

He was educated at Ploen Schleswig Holstein, Germany, but returned to S.W.A. and matriculated at Swakopmund with distinction in 1934. He graduated as B.V.Sc. at Onderstepoort in 1939 and entered Government Service in March, 1940. He was first stationed at Allerton Laboratory where he stayed from March, 1940 to September, 1943. He then returned to South West Africa to take up a post with the Administration

of that Territory. His stay at Allerton gave considerable satisfaction and he was subsequently asked on various occasions whether he would return and continue his work there.

In South West Africa he was stationed in Windhoek from September, 1943, till August, 1947, when he was transferred to Omaruru. This station remained his headquarters until the end of October, 1956, when he was again transferred to Windhoek. In between time he served for shorter periods at Grootfontein, in Ovamboland, and at Walvis Bay.

Wherever he served he was greatly respected for his professional knowledge and experience, for his skill, and willingness to be of assistance, and his many other fine personal qualities.

When transferred from an area, petitions were received asking that his services be retained in that area and requests were often received from other districts asking that he should be allowed to render special services outside his own district.

He was stationed in Windhoek at a time when there were no private practitioners and in addition to the usual run of farm animals he had to deal with the not inconsiderable number of household pets and domestic animals in this town. His success in these fields was measured by the remarkable response from the public when he was recently transferred to Cape Town.

He had the gift, so valuable in any one, but particularly in a civil servant, of being able to get on well with everybody, and the knack of being able to carry out even unpleasant duties with a minimum of resentment on the part of the people concerned.

During 1959 he developed a serious illness which necessitated prolonged treatment in Germany and later again in Pretoria. This treatment appeared to have been successful and a transfer to the more congenial atmosphere and conditions of Cape Town was arranged to enable him to take full advantage of this improvement. In these circumstances, his sudden end came as a great shock and with a sense of personal loss to his colleagues and many friends throughout the country.

The esteem in which he was held may be measured by the many tributes of goodwill on the occasion of his departure from Windhoek. Colleagues throughout the Territory contributed generously to a farewell presentation, the Windhoek Farmers Association arranged a function and presented him with a handsome memento while the Karakul Exporters Association, together with all the various livestock agencies responded in similar generous manner. When news of his passing was received, the Windhoek Farmers Association immediately organised a fund for the bereaved family and received a remarkable response.

Dr. Schatz married Liselotte Scherer on the 30th of March 1944, and three daughters and one son were born to them. With these children all reaching the stage of higher education, the family welcomed the move to Cape Town, which seemed to hold out such bright prospects for them all. In according our sympathy with the bereaved family, we his colleagues, can only express the hope that they will be able to give effect to those ideas and that they will be strengthened and fortified in their efforts by these memories, and the knowledge that he was honoured and respected by all sections of the community.

BOOK REVIEWS

TEXT BOOK OF MEAT INSPECTION — 4TH EDITION PP. IX–594. FIGS. 237 (4 FULL SIZE COLOUR). TABLES III — By H. THORNTON, 1962. BAILLAIRE, TINDALL AND COX, LONDON

This is the 4th edition of a book first published in 1949, and represents a completely revised and improved version of a text book which is already accepted as a standard work in veterinary food hygiene.

The text authoritatively and readably covers the whole field of meat hygiene from handling, slaughter, inspection, storage and preservation to the treatment and utilisation of by-products. Separate chapters. Specific chapters deal with comparative anatomy, organ utilisation as food, pathology and specific affections, bacterial and parasitological diseases, the bacteriology of meat, food poisoning and the inspection of poultry, eggs, rabbits and hares.

Specific attention is given to topical problems and Salmonella developments such as transport stress, salmonella transfer, antibiotics, radiation, tests for incipient decomposition, oedema disease. Emergency slaughter and its bacteriological implications is well covered, except for the regrettable absence of some details of media and technique used in the examination of tissue specimens.

The illustrations are numerous and good and constitute a special feature of the book, which continues to be probably the most useful of its kind in the English language.

L. W. van den H.

A CONTRIBUTION TO THE STUDY OF MASTITIS OF COWS IN NORTHERN GREECE

DR. E. PARISIS

(Published in Greek by the Aristotelian University of Tessaloniki in 1961 in a monograph of 214 pages)

The results and conclusions are published in English at the end of the work.

It was found that the Negretti test gives better values corresponding with the degree of inflammation in the udder, than does the Whiteside test.

Mastitis due to acid-fast bacilli, brucella organisms, streptococci, micrococci coli bacilli, corynebacterium pyogenes, and fungi of a variety of types was found.

Treatment was carried out on a number of cases of mastitis caused by micrococci using penicillin-containing preparations, as well as aureomycin and terramycin, with satisfactory results in a fairly large number of cases, provided the dosage level was sufficiently high and applied for more than 1–2 days.

Treatment was also carried out on a number of cases of mastitis caused by haemolytic streptococci and by coli bacilli, with satisfactory results.

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PUBLIC RELATIONS SERVICES

Dr. W. D. Malherbe has returned from a two year appointment as visiting professor in Clinical Pathology in the School of Veterinary Medicine of the University of Pennsylvania, in Philadelphia. Dr. Malherbe is now starting a similar section at Onderstepoort.

Seven Professors of Veterinary Medicine of the Free University of Berlin, arrived at Onderstepoort to study various techniques which will assist them in adjusting their curricula to train Veterinarians for service in Africa.

Dr. Smith of Queensland and Dr. Clay of Adelaide, Australia, visited Onderstepoort and spent some time with State Veterinarians in the Field Services. They were on their way back to Australia from the Commonwealth Veterinary Conference in London.

Dr. D. K. Stone of the Southern Rhodesia State Veterinary Department has joined the staff of Messrs S.K.F. Laboratories, Isando, Transvaal.

Dr. A. J. Snyders of Messrs Merck Sharp and Dohme, Johannesburg, has been invited to attend the Fourth Pan-American Congress of Veterinary Medicine and Zootechnics in Mexico City from November 11–17. He left Jan Smuts by air in November 6th.

We congratulate Dr. Snyders on being given the opportunity to attend this very important Congress and hope he will return with lots of knowledge for transmission to the profession.

NEW PREPARATIONS AND APPLIANCES

Pfizer Laboratories S.A. (Pty.) Ltd.

Pfizer International, the world's largest manufacturers of antibiotics, have announced a further investment in Southern Africa with the acquisition of African Chemical Corporation (Pty.) Ltd., a chemical manufacturing concern registered in the Federation. This follows close on the acquisition by Pfizers' South African subsidiary of Choat's Pharmaceuticals (Pty.) Ltd.

The African Chemicals acquisition is a joint venture by Central African Pfizer (Pvt.) Ltd. and Pfizer Laboratories South Africa (Pty.) Ltd. As a result of this, Central African Pfizer acquires control of the Rhodesian Subsidiaries Rhodesia Chemical Corporation Ltd. and Combines Sales Ltd., while Pfizer Laboratories in South Africa takes over the Durban companies Lush Products (Pty.) Ltd. and Lush Aviation (Pty.) Ltd. The effect of this transfer of the African Chemicals share capital to Pfizer is to strengthen further their already strong position in both veterinary agricultural chemicals, and also industrial and proprietary domestic products. Rhodesia Chemicals and Lush Products manufacture a wide range of stock dips, agricultural insecticides, industrial and domestic detergents, chemicals and horticultural products. Lush Aviation is active in the field of crop spraying.

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VETERINARY HEALTH CERTIFICATES

Printed and offered for sale by the Association in both languages and obtainable from the Secretary, P.O. Box 2460, Pretoria.

Books of 50 Veterinary Health Certificates bearing the crest of the South African Veterinary Medical Association and printed in Afrikaans and English are available at the following prices.

Members desiring these books of certificates should remit the necessary amount to the Secretary, P.O. Box 2460, Pretoria.

Certificates for Small Animals	50c.
Certificates for Cow or Heifer	75c.
Certificates for Bull	75c.
Certificates for Horse	75c.
Certificate for Ram	R1.00

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LISTS OF VETERINARIANS

The S.A.V.M.A. compiles and offers for sale the following list of Veterinarians residing within and beyond the Republic.

1. FULL LIST of Members of the S.A.V.M.A. indicating their places of residence. R2.10 *per list.*
2. PROVINCIAL LIST of Members of the S.A.V.M.A. indicating their places of residence. R1.50 *per Provincial list.*
3. CITY LIST of Members of the S.A.V.M.A. indicating the Veterinarians residing in the cities of Johannesburg, Pretoria, Cape Town, Port Elizabeth, East London, Durban, Pietermaritzburg, Bloemfontein, Windhoek.

CIRCULATION OF INFORMATION TO MEMBERS

The S.A.V.M.A. undertakes on requestk to circularise its members on all urgent and important matters, at R5.00 *per intimation for members and* R10.00 *per intimation for non-members.*

The circuiar letters are usually dispatched to members every 14–21 days.

ATTENTION TO THE S.A. GUIDE-DOGS ASSOCIATION FOR THE BLIND

P.O. BOX 10896, JOHANNESBURG.

At a meeting of Council held on 22nd. October, 1962, it was decided to relay the following suggestions to members:—

(*a*) That this Council considers it to be the duty and privilege of members to render all professional attention to dogs registered under the Guide Dog Association, *gratis.*

(*b*) The Guide Dog Association be officially notified of this and be supplied with a list of veterinarians in the Republic so that they can notify blind owners of guide dogs as to where they can most conveniently obtain veterinary assistance.

(*c*) All members be notified of the action taken with an explanatory note pointing out that we have no doubt that they would have rendered such service *gratis* spontaneously but that we wished to make the fact known to the Guide Dog Association in order to relieve any doubt or undue anxiety in the minds of blind persons of limited means.

A copy of a list of Veterinarians has been supplied to the S.A. Guide-Dogs Association for the Blind.

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THE DEGREE M. MED. VET. UNIVERSITY OF PRETORIA
A LETTER OF INTIMATION FROM THE FACULTY OF VETERINARY SCIENCE.

21st September, 1962.

The Secretary,
S.A.V.M.A.,
P.O. Box 2460,
PRETORIA.

Dear Sir,

I have pleasure in informing you that the University of Pretoria, on representation from the Faculty of Veterinary Science, has instituted a series of M. Med. Vet. degrees. I hope that this communication will be of interest to South African and foreign readers of your Journal. The general details are as follows:—

1. The degree M.Med.Vet. is awarded in the undermentioned subjects after the candidate has satisfied the University that he is in possession of the B.V.Sc. (Pret.) degree, or other qualifications regarded as equal to this degree.

   Admission to the M.Med.Vet course depends on the lapse of a variable period after achievement of the basic degree as indicated below, provided that the applicant has had applicable experience for at least the period stated in the general field of the subject in which he wishes to specialize;

   (*a*) *Physiology and Biochemistry*:
   M.Med.Vet. (Phys.) Immediately after B.V.Sc. or exemption.

   (*b*) *Pharmacology and Toxicology*:
   M.Med.Vet. (Pharm. et Tox.) 2 years after B.V.Sc. or exemption.

   (*d*) *State Veterinary Medicine and Veterinary Jurisprudence*:
   M.Med.Vet. (S.V.M. et Jur.) 3 years after B.V.Sc. or exemption.

   (*e*) *Genesiology and Artificial Insemination* (*i.e. Gynaecology*, Obstetrics, Andrology and Artificial Insemination):
   M. Med. Vet. (Gyn.) 3 years after B.V.Sc. or exemption.

   (*f*) *Surgery*:
   M. Med. Vet. (Chir.) 3 years after B.V.Sc. or exemption.

   (*g*) *Medicine*:
   M. Med. Vet. (Med.) 3 years after B.V.Sc. or exemption.

2. *Duration*:
   The course is to be of at least two years' duration. Each candidate must satisfy Faculty that he is working in an approved institution where he can conduct his studies. (This means that the Faculty may decide that a state veterinary office, municipal abattoir or a private practice, etc. may be approved.

Faculty will decide in each individual case the period of attendance at the Faculty.

3. *Exemption*:

Where applicants have done applicable post-graduate work in a suitable institution, the Senate of the University of Pretoria may, on representation by Faculty, grant the candidate partial or complete exemption from one or more subjects.

4. *Curriculum*:

(*a*) *Physiology and Biochemistry*:

Major Subjects:	Physiology and Biochemistry.
Ancillary Subjects:	(i) Histology
	(ii) Anatomy
	(iii) Dietetics.

(*b*) *Pharmacology and Toxicology*:

Major Subjects:	(i) Pharmacology
	(ii) Toxicology.
Ancillary Subjects:	(i) Physiology
	(ii) Biochemistry.
	(iii) Medicine.

(*c*) *Food Hygiene and Public Health*:

Major Subjects:	Food Hygiene and Public Health.
Ancillary Subjects:	(i) Biochemistry
	(ii) Infectious Diseases (with Bacteriology, Virology and Protozoölogy).
	(iii) Pathology.

(d) *State Veterinary Medicine and Veterinary Jurisprudence*:

Major Subject:	State Veterinary Medicine and Veterinary Jurisprudence.
Ancillary Subjects:	(i) Pathology
	(ii) Infectious Diseases
	(iii) Poultry Diseases.

(*e*) *Genesiology* (Obstetrics, Gynaecology, Andrology and Artificial Insemination).

Major Subject:	Genesiology.
Ancillary Subjects:	(i) Physiology
	(ii) Pathology
	(iii) Zoötechnics.

(*f*) *Surgery*

Major Subject:	Surgery.
Ancillary Subjects:	(i) Anatomy.
	(ii) Physiology
	(iii) Pathology.

(g) *Medicine*:

Major Subject:	Medicine.
Ancillary Subjects:	(i) Pharmacology and Toxicology
	(ii) Physiology
	(iii) Pathology.

5. *Examinations.*

The nature and duration of examinations are determined on consultation with the head of the department of the major subject.

Further details may be obtained from the undersigned or from the Registrar, University of Pretoria, Pretoria.

These degree courses will be available from the beginning of the academic year in 1963. *That means that application will have to be made before the beginning of February*, 1963.

Yours sincerely,

Prof. C. F. B. Hofmeyr.

Secretary: Faculty of Veterinary Science.

JOURNAL OF THE SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

VOLUME XXXIII

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