CORRIGENDA

1. "The Development and Physical Structure of Muscle Collagen in Relation to Meat Toughness." Vol. 44, No. 4, p.354, last par., sub-paragraph 1 must read: 1. An enzyme, lysyloxidase, removes the **eta**-amino group from lysine or hydroxylysine . . ."

2. "Observations on the Ecology of *Schistosoma mattheei*, Veglia & le Roux, 1929, in portion of the Kruger National Park and Surrounding Area using a New Quantitative Technique for Egg Output." Vol. 44, No. 4, p.417, second paragraph, last sentence, must read: "in this case the wandering habits of the buffalo would tend to militate **for** the indefinite survival of the **S. mattheei** population" instead of ". . . militate **against** the indefinite survival of the **S. matthei** population."

The heading of Table 8, p.412, for S. *matheei* read S. *mattheei*.

Legend to Map on p.410. Areas surveyed **outside** Park – **horizontal** hatching. Areas surveyed **inside** Park – **vertical** hatching.

TYDSKRIF VAN DIE SUID-AFRIKAANSE VETERINÊRE VERENIGING

Die TYDSKRIF van die S.A.V.V. is die eiendom van en word gepubliseer deur die Suid-Afrikaanse Veterinêre Vereniging; dit is die offisiële mondstuk van die Vereniging. Dit verskyn kwartaalliks en word aan sake van algemene veeartsenykundige belang gewy. Bydraers tot hierdie Tydskrif maak hul stellings en lug hul menings slegs op eie verantwoordelikheid; sodanige stellings word nie noodwendig deur die Redaksiekomitee onderskryf nie en die menings gee nie noodwendig die Komitee se menings weer nie.

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ERKENNING

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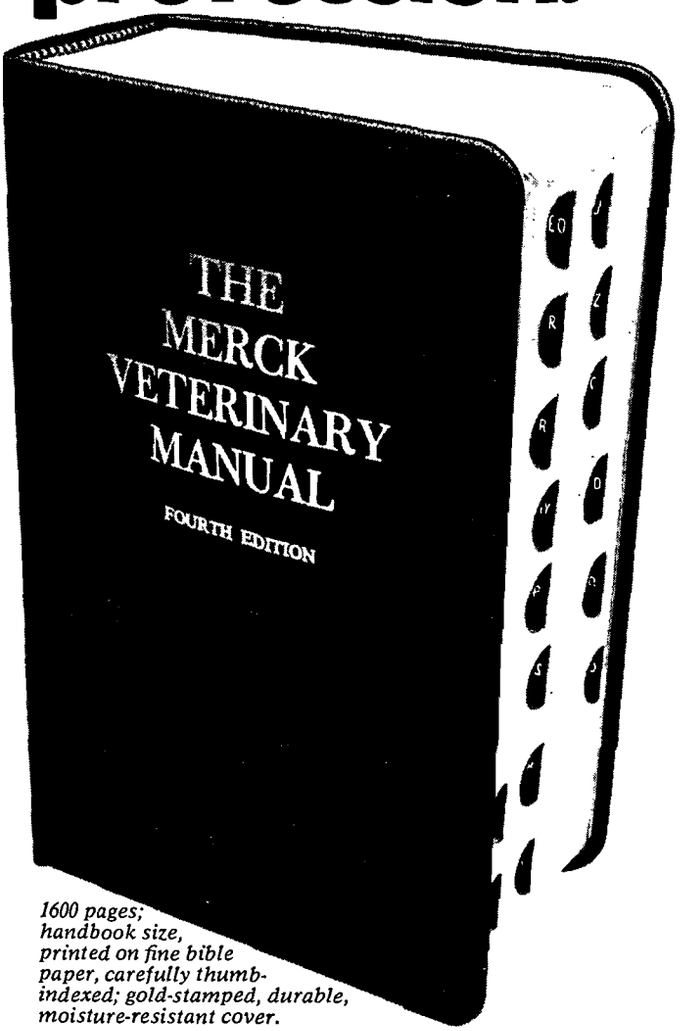

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REDAKSIONEEL

BESIGHEIDSBESTUUR

In die verlede het die onderskeie professies oor die algemeen die besigheidsaspekte van praktykbestuur links laat lê; in hierdie benadering is skynbaar langer volhard deur die Veterinêre Professie in Suid-Afrika. Die bevindings van die ondersoek deur die Raad op Geesteswetenskaplike Navorsing[1], dat die Veterinêre Professie die laagste rangorde tussen twaalf professies beklee t.o.v. beide werklike verdienste en rendement op belegging in opleiding, is simptomaties van die toestand.

Dat daar 'n behoefte aan en begeerte tot diepere kennis aangaande die besigheidsaspekte van praktykbestuur by veeartse bestaan, blyk uit die bywoning van die Bestuurskursus vir Veeartse, wat gesamentlik deur die Suid-Afrikaanse Veterinêre Stigting en die Nasionale Ontwikkelings- en Bestuurstigting aangebied was en waaroor daar 'n spesiale verslag in hierdie uitgawe verskyn, asook deur die insluiting van onderwerpe oor bestuur by die Jaarlikse Kongresse van Takke van die Suid-Afrikaanse Veterinêre Vereniging. Die organiseerders van sodanige kursusse, kongresse en simposia behoort die belangrikheid van aanbieding van 'n goed gebalanseerde program terdeë in die oog te hou, aangesien skewe beelde deur oorbeklemtoning van 'n bepaalde aspek probleme kan verwek ernstiger as dié wat volgens aanvanklike bedoelings opgelos moes word. Menslike verhoudings en organisasie, byvoorbeeld, is net so belangrik soos finansiële en belastingsaangeleenthede; dit is die totaliteit wat goeie bestuur skep.

Die behoefte aan deeglike kennis van besigheidsbestuur is nie tot die self-geëmplojeerde veearts beperk nie, dit is ewe-eens van belang vir die veearts in 'n betrekking, of dit nou navorsing, openbare diens of die industrie behels. Meeste veeartse strewe na of bereik gesagsposisies waar kennis van goeie bestuurspraktyke van onskatbare waarde kan wees. Sulke veeartse sal dan ook in 'n gunstige posisie wees om met nie-veeartse te kompeteer vir senior poste buite die Professie.

Voldoende en gepaste beloning is nóg immoreel, nóg onwenslik; dit is inderdaad noodsaaklik om die veearts sy regmatige plek te laat inneem om die gemeenskap en die land na behore te dien. Dit kan nie langer aan openbare mening of die Staat oorgelaat word om 'n gepaste peil van vergoeding te bepaal nie, aangesien aksie nie langer spontaan ontstaan nie maar slegs verkry word op sterk positiewe aansporing.

Die behoefte aan feitlike bewyse en gegewens waarop besluite gebaseer kan word, asook die behoefte aan advies en leiding met die neem van sodanige besluite, is deur die Raad van die Suid-Afrikaanse Veterinêre Vereniging besef by die verkryging van goedkeuring van lede van die Vereniging om opdrag te gee vir 'n opname van die verdienste van veeartse en die ekonomie van veeartsenykundige praktyk deur die Buro vir Finansiële Analise van die Universiteit van Pretoria onder direksie van Professor Zevenbergen. Die belangrikheid van hierdie opname vir die individuele veearts en die Professie as geheel behoort so vanselfsprekend te wees dat 'n ernstige beroep op alle lede om die vraagbriewe wat in die verband einde Junie individueel aan hulle gerig is volledig en korrek in te vul, feitlik onnodig mag blyk en dat die reaksie omvattend en spontaan sal wees.

1. BOSHOFF F. 1972 The Profitability of Twelve Professions. *Instituut vir Mannekragnavorsing. Verslag* Nr. MM35 Pretoria: Raad vir Geesteswetenskaplike Navorsing

EDITORIAL

BUSINESS MANAGEMENT

Historically, the professions have generally ignored the business aspects of managing a practice and this appears to have persisted longer in the Veterinary Profession in South Africa than amongst the other professions. The findings by the Human Sciences Research Council [1] that the Veterinary Profession ranks lowest amongst twelve professions in both earnings and return on investment in education, is symptomatic of the situation.

That there is a need and desire to be better informed on the business aspects of managing a practice amongst veterinarians is evident from the attendance at the Management Course for Veterinarians, which was presented jointly by the South African Veterinary Foundation and the National Development and Management Foundation and on which a special report appears in this issue, as is also the inclusion of management subjects at the Annual Congresses of Branches of the South African Veterinary Association. The organizers of such courses, congresses and symposia would do well to bear in mind the importance of presenting a balanced programme, as distortions resulting from over-emphasis of one specific aspect can produce problems more serious than those which were originally to be resolved. Human relations and organisation, for example, are as important as financial and tax matters; it is the whole which makes for good management.

The need for a sound knowledge of business management is not confined to the self-employed veterinarian but is of equal importance to veterinarians in employment, whether engaged in research, the public service or industry. Most veterinarians either aspire to or achieve positions of authority where knowledge of good management practices can be of inestimable value. Such veterinarians

will also then be in a favourable position to compete with members of other disciplines for senior positions outside the Profession.

To be adequately rewarded is neither immoral nor undesirable, indeed it is essential if the veterinarian is to fill his proper place and adequately serve the community and the country. It can no longer be left to the public or State to establish an adequate level of remuneration, since in to-day's society action is no longer spontaneous but response is only obtained to a strong, positive stimulus.

The need for factual evidence and data on which to base decisions, as well as the need for advice and guidance on reaching these decisions, was recognized by the Council of the South African Veterinary Association in obtaining the approval of members of the Association to commission a survey on the earnings of veterinarians and the economics of veterinary practice by the Bureau of Financial Analysis of the University of Pretoria under the direction of Professor Zevenbergen. The importance of this survey to the individual veterinarian and the Profession as a whole should be so self-evident that a serious appeal to all members to complete the questionnaires, sent to them in this respect individually at the end of June, fully and correctly should prove unnecessary and that the response should be total and spontaneous.

1. BOSHOFF F. 1972 The Profitability of Twelve Professions. *Institute for Manpower Research. Report* No. MM35 Pretoria: Human Sciences Research Council

REDAKSIONELE AANTEKENING

DIE NASIONALE ONTWIKKELING- EN BESTUURSTIGTING VAN SUID-AFRIKA*

Voortspruitende uit die wêreldwye besef gedurende die na-oorlogse tydperk van die belangrike bydrae wat doeltreffende bestuur tot menslike vooruitgang kan maak en die mate waartoe bestuur deur paslike studie ontwikkel en verbeter kan word, is die Nasionale Ontwikkelingstigting in November 1948 in Suid-Afrika gestig ten einde 'n gekoördineerde nasionale ekonomiese en opvoedkundige beweging te mobiliseer. In November 1961 is die naam verander na die Nasionale Ontwikkeling- en Bestuurstigting van Suid-Afrika, 'n nie-politieke vereniging sonder winsbejag, geregistreer ingevolge artikel 21 van die Maatskappywet.

Die volgende hoofdoelwit is in sy akte van oprigting gedefinieer:–

> ,,Om alle pogings, aktiwiteite en dienste wat gemik is op die verkryging van die grootste materiële welvaart en prestasie vir die inwoners van Suid-Afrika te bevorder en aan te moedig om sodoende hulle sosiale, ekonomiese en kulturele standaarde te verhoog."

Die volgende spesifieke doelwitte is geformuleer:–

1. Om deur middel van die bevordering van die kuns en die wetenskap van goeie bestuur oor die hele Suid-Afrika nasionale welvaart te verseker.
2. Om 'n diens te lewer ter verbetering van die kennis, vaardighede en doeltreffendheid van al diegene betrokke by bestuur oor die hele Republiek.
3. Om die opleiding en onderrig in bestuur aan te moedig.
4. Om groter koördinasie in die opleiding van studente te bevorder ten einde te voldoen aan die toekomstige bestuursbehoeftes van alle sektore van die ekonomie.
5. Om 'n brug te lê tussen bestuur en die sosiale en ekonomiese omgewing waarbinne die bedryfslewe werk.
6. Om vir die gepaste beoordeling van die grondliggende en langtermynfaktore, rakende die bedryfstruktuur en die sosiale en ekonomiese omgewing, voorsiening te maak.
7. Om nasionale en internasionale samewerking oor sake rakende bestuur te bevorder, en om NOBS se verpligtinge as lid van die Internasionale Komitee van Wetenskaplike Bestuur (CIOS) na te kom.
8. Om die bestuursontwikkelingsaktiwiteite na buurstate uit te brei ten einde die nasionale groei en welvaart van hierdie gebiede te bevorder.

Hierdie doelwitte word deur die organiseer van die volgende werksaamhede nagestreef:–

1. 'n Internasionale sprekersprogram, waardeur sprekers van internasionale faam Suid-Afrika besoek om topbestuur met nuwe ontwikkelings in voeling te hou, of om opleiding op 'n hoë vlak in nuwe konsepte en spesiale tegnieke te verskaf.
2. 'n Nasionale leierskapprogram, waardeur toonaangewende Suid-Afrikaanse bestuurders aangemoedig word om hulle kennis en ervaring te deel. Onder hierdie program vorm die jaarlikse ,,Konferensie oor Sakevooruitsigte" en die sessie vir ,,Voorligting aan die Bedryfslewe oor die Begroting" belangrike gereelde gebeurtenisse.
3. Streeksprogramme van kursusse, lesings, groepbesprekings, studiebesoeke, konferensies, seminare en skole word vir alle bestuursvlakke onder ses erkende hoofde aangebied: algemene leiding, kantoorbestuur, produksiebestuur, personeelbestuur, finansiële bestuur en bemarkingsbestuur.
4. 'n Omvattende reeks modulêre kursusse word aangebied waar 'n besondere vaardigheid of kennis benodig word. Hierdie standaardkursusse is spesiaal aangepas om verspilling in opleiding uit te skakel. In die behoeftes van beide klein en groot organisasies, van Blankes sowel as Nie-blankes, word op bestuurs- en toesighoudende vlakke voorsien deur aanbieding in die openbaar of binne die onderneming self.

Bepaalde dienste, naamlik biblioteek-, film- en inligtingsdienste, die uitreik van bulletins met oordrukke van artikels uit 'n wye reeks van tydskrifte oor bestuur, die publiseer van die verhandelinge van sekere belangrike NOBS-byeenkomste, en die reëling van bekendstellings word uitsluitlik aan lede verskaf.

Die opleiding en oordrag van bestuursvaardighede aan die opkomende volkere van Suid-Afrika vorm 'n belangrike doelwit van die NOBS. In hierdie opsig is

die Stigting genader om as katalisator op te tree by die stigting van die Korporasie vir Ekonomiese Ontwikkeling van Ekwatoriale en Suidelike Afrika (EDESA).

Die beleid van die NOBS word deur 'n Raad van Trustees bepaal, vir die huidige onder presidentskap van mnr. J.G. van der Horst, wat sy uitvoerende magte aan 'n Bestuursraad en die Direkteur van die Stigting delegeer. Die Hoofkantoor is in Management House, hoek van Stiemens- en Mellestraat, Posbus 31793, Braamfontein, Transvaal.

Daar is ses streekskantore**. Diegene wat in lidmaatskap belangstel moet hoofkantoor of hulle naaste streekkantoor skakel. Lidmaatskapgelde word bereken op 'n wisselskaal volgens die grootte van die personeel.

Met betrekking tot die menings in die redaksionele stuk in die vorige uitgawe van hierdie Tydskrif geopper, ontstaan die prikkelende vraag in hoeverre die NOBS die instrument kan wees om die werksaamhede van die veterinêre professie met die onderskeie Landboudepartemente, Beheerrade, Telersverenigings en Landbou-unies te koppel ten einde ons veeproduksiepotensiaal doeltreffender te ontwikkel.

* Gebaseer op en aangepas van die inligtingsbrosjure van die NOBS.

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EDITORIAL NOTE

THE NATIONAL DEVELOPMENT & MANAGEMENT FOUNDATION OF SOUTH AFRICA*

Arising from the world-wide realization during the post-war era of the major contribution which better management could make to human progress and of the degree to which the process of management could be developed and improved by appropriate study, the National Development Foundation of South Africa was established in November, 1948, to mobilize a co-ordinated national economic and educational movement. In November, 1961, its name was changed to the National Development and Management Foundation of South Africa, a non-profit, non-political association of companies, registered under section 21 of the Companies Act.

The following main objective is defined in the memorandum of association:

> 'To promote and encourage the development of all efforts, activities and services, calculated to advance the fullest attainment of material prosperity and achievement by the people of South Africa and to improve their social, economic and cultural standards.'

The following specific objectives have been formulated:–

1. To ensure national prosperity by promoting throughout South Africa the art and science of good management.
2. To provide a service to improve the knowledge, skills and efficiency of all those engaged in management throughout the Republic.
3. To encourage education and training in management.
4. To promote more co-ordination in the education of students, in order to meet the future management needs of all sectors of the economy.
5. To provide a bridge between management and the social and economic environment in which business functions.
6. To provide for appropriate review of the fundamental and long-range factors relating to the structure of business and the social and economic environment.
7. To promote national and international co-operation in matters affecting management, and to fulfil the obligations of NDMF's membership of the International Committee of Scientific Management (CIOS).
8. To extend management development activities to neighbouring territories, in order to promote the national growth and prosperity of these territories.

These objectives are pursued by organizing the following activities:–

1. An international speaker programme whereby speakers of international reputation visit South Africa to keep senior management in touch with new developments, or to provide top level instruction in new concepts and special techniques.
2. A national leadership programme whereby leading South African managers are encouraged to share their knowledge and experience. Under this programme the annual 'Business Outlook Conference' and 'Briefing Business on the Budget' session are important regular events.
3. Regional programmes of courses, lectures, group discussions, study visits, conferences, seminars and schools cater for all levels of management. Six main areas are recognized: general management, office management, production management, per-

sonnel management, financial management and marketing management.

4. A comprehensive series of modular courses is offered when a particular skill or knowledge is required. These standard courses have been specially tailored to take the waste out of training. They cater for both small and large organizations, for Europeans as well as non-Europeans, at managerial and supervisory leads, and are presented on a public or in-company basis.

Certain services, namely library, film and information services, the issuing of bulletins containing reprints from a wide range of management journals, the publication of proceedings of important NDMF events, and the arrangement of introductions are offered exclusively to members.

The training and transference of management skills to emergent peoples in Africa form an important objective of the NDMF. In this respect the Foundation has been requested to act as the catalyst in the formation of the corporation for Economic Development of Equatorial Southern Africa (EDESA).

The policy of NDMF is determined by a Board of Trustees, presently under the presidency of Mr J.G. van der Horst, which delegates its executive powers to a Management Board and the Director of the Foundation. The Head Office is located in Management House, Corner of Stiemens and Melle Streets, P.O. Box 31793, Braamfontein, Transvaal.

There are six regional offices** Those interested in membership should contact head office or the nearest regional office. The fee is based on a sliding scale calculated on the staff complement.

With reference to the opinion expressed in the Editorial in the previous issue of this Journal, the intriguing thought arises to what extent the NDMF might be instrumental in linking the activities of the veterinary profession with those of the various Departments of Agriculture, Control Boards, Breeders Associations and Agricultural Unions in order to promote our animal production potential more effectively.

* Based on and adapted from the information brochure of the NDMF.

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REDAKSIONELE AANTEKENING

BURO VIR FINANSIËLE ANALISE*

Die Buro vir Finansiële Analise is teen die einde van 1965 aan die Universiteit van Pretoria as 'n integrale deel van die Instituut vir Bedryfsadministrasie, wat vanjaar sy 25ste bestaansjaar vier, gestig.

Reeds sedert die begin van die Instituut se werksaamhede in 1949 het dit al aan die lig gekom dat daar in Suid-Afrika, in vergelyking met oorsese lande, 'n ernstige agterstand ten opsigte van die gebruik van sekere moderne bestuurshulpmiddels bestaan. Dit was veral opmerklik by die middelslag en klein onderneming, wat die grootste persentasie van die totale aantal ondernemings uitgemaak het. Hierdie tekortkoming het 'n nadelige uitwerking op die Suid-Afrikaanse ekonomie gehad, aangesien dit 'n beperkende invloed op die volle ontwikkeling van sy potensiaal gehad het. Groot getalle ondernemings wat na die oorlog ontstaan het kon na 'n paar jaar nie meer die mas opkom nie. As gevolg, onder andere, van 'n gebrek aan kennis van moderne bestuurstegnieke kon hulle nie die gevaartekens uitken nie en gevolglik ook nie betyds korrektiewe stappe neem nie.

Die mening het toe ontstaan dat die Universiteit van Pretoria 'n positiewe, praktiese bydrae tot die verbetering van die toestand kon, en behoort, te lewer, bo en behalwe sy taak om toekomstige bestuurders op te lei, wat in elk geval 'n langtermynuitwerking sal hê. Die probleem wat die hoof gebied moes word, was om die bestaande bestuurskorps op korttermyn in hul strewe na doeltreffender bestuur te hulp te kom. Dit sou die beste gedoen kon word deur 'n aparte organisasie binne die universiteitsverband en met die medewerking van die Instituut, sodat die kennis en ervaring van so 'n organisasie ook tot die beskikking van akademiese departemente gestel kon word. Hulp sou aangebied word in die vorm van bedryfsvergelykende ondersoeke en die verskaffing van bedryfsvergelykende statistiek. Bedryfsvergelyking kan omskryf word as die gebruik van statistiek oor die gemiddelde prestasie van verteenwoordigende groepe ondernemings in dieselfde bedryfstak met betrekking tot 'n reeks sleutelaktiwiteite, as maatstaf vir die beoordeling van 'n bepaalde onderneming se eie prestasie en dus ook van eie produktiwiteit. Hierdie statistiek vorm 'n baie belangrike bestuurshulpmiddel, aangesien die bestuur van sodanige onderneming daardeur 'n derde dimensie verkry, deurdat die resultate van die eie onderneming vergelyk kan word met die resultate van soortgelyke ondernemings soos in die

bedryfsvergelykende statistiek weergegee. So 'n vergelyking kan swakhede in die eie onderneming aan die lig bring waarvan die bestuur voorheen onbewus was. Die regstellende optrede wat hieruit kan voortspruit sal nie slegs die produktiwiteit van individuele ondernemings verhoog nie, maar ook in totaal 'n gunstige invloed op dié van die land as geheel hê.

Die vernaamste doelwit van die Buro is dus om die waarde van bedryfsvergelykende statistiek onder die aandag van bestuur in die algemeen te bring en om die gebruik daarvan aan te moedig deur die versameling, verwerking en publikasie daarvan. Die funksie van die Buro, met betrekking tot bedryfsvergelyking, bestaan dus uit drie komponente, naamlik, 'n navorsingsfunksie, 'n uitvoerende funksie en 'n opvoedkundige funksie. Benewens hierdie taak van die Buro is daar nog die suiwer akademiese funksie wat die Buro binne die universiteitsverband vervul, naamlik om basiese doelgerigte navorsing te onderneem waarin doserende personeel, nagraadse en voorgraadse studente betrek word. Die ondervinding wat doserende personeel in die uitvoering van navorsingsprojekte opdoen word weer met baie vrug aan hul studente oorgedra, terwyl nagraadse studente in staat gestel word om navorsingsprojekte deur middel van die Buro vir doeleindes van Magister- of doktorale studie aan te pak en voltydse voorgraadse studente waardevolle praktiese ondervinding opdoen deur deeltydse werk by die Buro.

Toe die Buro in 1966 met sy werksaamhede begin het, was bedryfsvergelyking in die Suid-Afrikaanse bedryfslewe feitlik geheel en al onbekend en was daar feitlik geen statistiek in dié verband beskikbaar nie. Bedryfsvergelyking was 'n vreemde tegniek vir ondernemers in die klein en middelslag ondernemings, en dit, tesame met die verskynsel dat sakemanne oor die algemeen 'n weersin teen die voltooiing van vraelyste gehad het en nie gretig was om hul finansiële state aan buitestaanders beskikbaar te stel nie, het baie probleme vir die Buro geskep.

Die Buro het egter geleidelik in 'n groot mate daarin geslaag om hierdie weerstand, wat eintlik uit onkunde voortgespruit het, af te breek. Die waarde van bedryfsvergelyking as 'n bestuurshulpmiddel word tans meer en meer besef en daar is 'n groeiende behoefte aan bedryfsvergelykende statistiek. Hierdie behoefte, en die gevolglike vraag na die dienste van die Buro, is nie slegs in die handelsektor waarneembaar nie. Professionele mense het begin insien dat bedryfsvergelyking ook vir hulle van groot waarde kan wees, en die Buro het gevolglik besluit om sy dienste ook aan die professies beskikbaar te stel. Ondersoeke is reeds vir tandartse, aptekers, prokureurs en ingenieurs gedoen, terwyl 'n bedryfsvergelykende ondersoek vir veeartse wat vir eie rekening praktiseer en 'n ondersoek na die verdienste van gesalarieerde veeartse tans van stapel gestuur word.

Gedurende die agt jaar van sy bestaan het die Buro reeds 37 verslae gepubliseer, terwyl 'n groot aantal *ad hoc*-ondersoeke voltooi is waarvan die resultate nie gepubliseer is nie maar aan die opdraggewers oorhandig was. Dit het daartoe gelei dat die Buro reeds deur handels- en professionele organisasies as gesaghebbend op die gebied van bedryfsvergelyking beskou word. As bewys daarvan dien die talle versoeke wat jaarliks tot die Buro gerig word vir die lewer van lesings en referate op kongresse en byeenkomste van sakemanne. As 'n onafskeidelike deel van die Bestuurskool word die Buro hoofsaaklik deur die Raad van die Universiteit gefinansier, terwyl donateurlede ook 'n belangrike bron van finansiering is.

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* Opgestel deur prof. A.P. Zevenbergen, Hoofnavorser van die Buro, op versoek van die Redakteur. 'n Uitvoeriger inligtingsbrosjure en diejongstejaarverslag met 'n lys van beskikbare publikasies is van die Buro vir Finansiële Analise, Posbus 486, Pretoria, 0001, verkrygbaar.

EDITORIAL NOTE

BUREAU OF FINANCIAL ANALYSIS*

The Bureau of Financial analysis was established at the University of Pretoria towards the end of 1965 as an integral part of the Institute of Business Administration, which celebrated its twenty-fifth anniversary this year.

Since the initiation of the Institute's activities in 1949, it became apparent that a serious backlog concerning the use of certain management aids existed in South Africa in comparison with overseas countries. This was particularly noticeable in medium and small concerns, which formed the major part of the total number of business undertakings. This shortcoming had an adverse effect on South African economy, as it inhibited the fulfilment of the country's potential growth. Within a few years a large number of concerns established during the post-war era no longer could make the grade. As result, *inter alia*, of lack of knowledge of modern management techniques they could not recognize the danger signs and consequently were unable to take timeous corrective steps.

The idea then arose that the University of Pretoria could and should make a positive, practical contribution towards improvement of the situation, over and above its task of training future managers, which in any case would only have a long term effect. The problem to be overcome was to render short term aid to the existing body of managers towards attainment of more effective management. This could best be done by a separate organization within the University frame-work and in co-operation with the Institute, so that the knowledge and experience gained by such an organization would also be available to the academic departments. Assistance could be offered in the form of inter-firm comparative studies and the rendering of inter-firm comparative statistics.

Inter-firm comparison may be defined as the use of statistics on average achievements of representative groups of undertakings in the same branch of industry with reference to a number of key activities, as a measure for assessment of a particular concern's own achievements and thus also of its own productivity.

These statistics form a very important aid to management, as the management of such a concern thereby obtains a third dimension, inasmuch as the results of that particular concern can then be compared with the results of similar undertakings as shown by comparative inter-firm statistics. The corrective action arising from such a comparison will not only enhance the productivity of the business concerned, but will have an over-all favourable effect on that of the country as a whole.

The main purpose of the Bureau is to bring inter-firm comparison to the attention of management in general and to encourage the use thereof by collection, processing and publication of such data. The function of the Bureau with respect to interfirm statistical comparison consists of three components, namely a research function, an executive function and an educational function. Besides this task of the Bureau, it is charged with a purely academic function to be fulfilled relative to the University itself, namely the undertaking of basic, directed research in which teaching personnel and post- and undergraduate students are involved. The experience gained by teaching personnel in carrying out research projects can be transferred fruitfully to their students, while post-graduate students are enabled to undertake research projects through the Bureau for the purpose of obtaining Doctor's and Master's degrees and undergraduates gain valuable practical experience by doing part-time work at the Bureau.

When the Bureau began its activities in 1966, inter-firm comparison was virtually unknown in the South African world of commerce and industry and there were almost no statistics available in this respect. Inter-firm comparative statistics constituted a tool foreign to undertakers in small and medium-sized concerns and this, coupled with the phenomenon that business men generally were averse to completing questionnaires and were not keen to divulge details of their financial status to outsiders, created many problems for the Bureau. Gradually the Bureau succeeded for the greater part in overcoming this resistance which really sprang from ignorance. The value of inter-firm comparisons as an aid to management now is becoming appreciated more and more and there is an ever-growing need for inter-firm comparative statistics. This need, and consequently the demand for the services of the Bureau, are not only observed in the sphere of commerce. Professional people started to realize that inter-firm comparative statistics could also be of great value to them; the Bureau therefore decided to make its services available to the Professions as well. Investigations have already been completed for dentists, pharmacists, attorneys and engineers, whilst a comparative survey for self-employed veterinarians and an investigation of the earnings of salaried veterinarians are now being launched.

During the eight years of its existence the Bureau has already published 37 reports; a large number of *ad hoc* investigations have been completed of which the results have not been published but have been handed to those who had commissioned them. Consequently the Bureau has come to be regarded as an authority in the field of inter-firm comparisons by commercial and professional organizations. As proof the numerous requests annually directed to the Bureau for the giving of lectures and papers at congresses and meetings of business men may be cited. Being part of the School of Business Administration, the Bureau is financed mainly by the Council of the University of Pretoria; donor members also form an important source of funds.

* Compiled by Prof. A.P. Zevenbergen, Chief Research Officer of the Bureau, at the request of the Editor. A more extensive information brochure and the latest annual report, together with a list of available publications, may be had from: The Bureau of Financial Analysis, P.O. Box 846, Pretoria, 0001

TO THE EDITOR — AAN DIE REDAKSIE

PROTEINS AND ECONOMICS

Sir,

Your editorial on page 349 of Volume 44, No. 4 of Dec. 1973 refers.

While you highlight a problem of many South African commodities, e.g., coal, as to whether they should be conserved or exported, the situation is not quite so simple.

Fish meal, even after stabilization, is an extremely unstable product and cannot be stored for long periods. In addition, the current total annual S.A. and S.W.A. production is more than twice that which can be utilized locally.

For monogastric species (avian and porcine), fish meal can only be replaced satisfactorily by soyabean oil cake meal. Annual S.A. production of soyabeans is very low mainly for three reasons:

1. Nutritionally it is only worth 60% of the value of fish meal. Thus with fish meal at R200/1 000 kg, 44% soyabean oil cake meal is only worth R120/1 000 kg.
2. The soyabean is unattractive to the vegetable oil industry as it contains only 20% oil compared to the 33% in sunflower seed and 50% in groundnuts. Thus the oil value of the bean is low in comparison to its competitors.
3. Its seasonal and climatic requirements correspond closely to those of the more traditional maize.

In fairness to the fishing industry, one must recognize that the operation of catching fish is highly speculative with an exceptionally high risk factor. If they are not compensated in good years, then little re-investment and expansion in the industry will take place.

Should one not look at equating the local fish meal prices with those of the world? This could well provide the economic stimulus needed to promote widespread soyabean cultivation.

Finally, fish meal in any form may not be exported even to neighbouring territories, except at export parity prices.

With respect to ruminants the picture is much more cheerful, as various forms of non-protein nitrogen combined with the proteins in grains and milling byproducts are often sufficient for excellent biological performance.

Yours faithfully,

Dr D.G. Mordant
Feeds Manager
Delmas Milling Co. Ltd
P.O. Box 21, Randfontein, Tvl. 1760

THE RÔLE OF THE VETERINARIAN IN THE MODERN WORLD*

PROFESSOR SIR ALEXANDER ROBERTSON**

In the first place let me say how much I appreciate the privilege of being asked to address this Association. I have had the pleasure of meeting some of your members occasionally in Britain or at International Conferences, but it is over twenty years since I last visited your country and I was naturally looking forward to renewing my acquaintance with it and to seeing something of the progress made. The task I accepted of addressing your Conference on the rôle of the veterinarian in the modern world is one which I approached with considerable diffidence and hesitation. The modern world is not only an increasingly complex world but it is also a rapidly changing one. Man's material powers to change the natural course of events have become immense, all too often with effects he had not anticipated. If, as has been said, a prophet has little honour in his own country, there is little reason to believe that he is likely to fare better in another hemisphere! He would be a brave, if not indeed a rash person, therefore, who would claim any degree of certainty in predicting the rôle of the veterinarian any distance into the future since there are already signs of considerable change of emphasis in many countries, and this may accelerate more rapidly than one would anticipate.

There are, of course, those who say that with the advent of meat analogues based on vegetable protein and of supplies of edible protein derived from microbiological breakdown of petroleum products, the day of the farm animal is drawing to its close and with that a large field of veterinary activity will gradually cease to be of importance; to these prophets of gloom can be added the voices of those who point to the increasing growth and urbanization of the human population in many countries with more and more people incarcerated in tower buildings or high-rise flats in which there is often little room to swing a cat, let alone keep one!

To such people even pet animal practice seems gradually doomed to go in a declining spiral through miniature poodles to budgerigars and eventually goldfish, till it also will cease to be of significance. I must confess that having heard more than once in my career how our profession was threatened with extinction, and having seen its continued growth and expansion despite those threats, I am not unduly moved by such utterances.

The complexity of the problem considered on a global basis stems from the fact that different countries are at different stages of development so far as demands on veterinary services are concerned. If we look beyond the accidents, dystokias, and sporadic ailments which are always with us and which still provide a considerable amount of work for our clinical colleagues, we can see the veterinary history of a country falling roughly into three main phases. First comes the problem of dealing with the devastating epidemic diseases which make it virtually impossible to develop a livestock industry of any consequence and of which some can threaten the life of man as well as that of animals. With the completion of that phase, considerable expansion of livestock production becomes possible; that in turn leads to demands on our services to deal with the less deadly and often more chronic microbiological infections and parasitic infestations. At this stage the increased value of animals results in the need to treat individuals and for a variety of reasons the prophylactic approach often gets submerged in a welter of clinical demands. But with the aid of a whole armoury of drugs and vaccines many of these more insidious conditions can be brought gradually under control.

At this stage, with the health of livestock reasonably assured, it becomes possible to embark on quite marked intensification of livestock production and this in turn modifies both the nature of the health problems and the requirements for tackling them. In place of the all-out attack on clear-cut epidemics or the treatment of specific individual disorders, the task becomes to an increasing extent one of mitigating and, if possible, preventing the ravages of frequently relatively mild and often largely subclinical conditions – often of multiple aetiology – on the production of flocks and herds numbering many hundreds or possibly even thousands of animals.

These phases are by no means clear-cut; the rate and order of development will vary from country to country and from time to time according to political and economic circumstances and the whims and fancies of those in authority. But they can serve as a rough guide to the likely changing nature of the demands on our profession with the passage of time.

Quite clearly we have, and will doubtless continue to have for many years yet, two quite distinct animal health problems to deal with. There are those parts of the world in Western Europe and North America, and doubtless in much of South Africa as well, where farm animal populations are already to a considerable extent free from the more serious epidemic diseases – areas which are both limited in extent when looked at on a global basis and areas which are all too often uncomfortably vulnerable to infection from elsewhere as the fairly recent appearance of swine vesicular disease in Europe has shown only too well, to say nothing of the potential threats of diseases like African swine fever and foot-and-mouth disease to the agricultural economy of your country. In such areas, however, veterinary interest tends to be increasingly concentrated on diseases consequent on animal production rather than on diseases of survival. By contrast, over large areas of the world major epizootics can and do still occur, sometimes with crippling effects on the survivability, to say nothing of the productivity of the animal population. And there are, of course, large areas in transition between these two extremes where even the less serious animal diseases, combined with bad management and faulty nutrition, can lead to un-

* Address delivered at the Biennial Scientific Congress of the South African Veterinary Association, Pretoria, 15 October, 1973.

** University of Edinburgh.

necessary mortality and morbidity to the great detriment of the livestock industry.

This situation becomes all the more serious when looked at in the light of the population explosion with something like 200 000 more mouths at the breakfast table every morning and little more, if not indeed sometimes less, food to give them. For, alas, in many countries very little progress is being made in improving animal productivity and even less in increasing animal production per head of the human population. Thus over large areas of the world which incidentally have, through a variety of circumstances considerable potential for expansion of livestock industries, and which have a crying need for such expansion, animal health measures must first involve an increasingly intensified struggle against serious epidemic diseases of livestock, while at the same time constant vigilance is necessary elsewhere to ensure that these epidemic diseases are contained. The task is, of course, formidable but the limiting factors are more financial and organizational than technical, since, with the possible exception of certain protozoal infections, we already have the technical expertise necessary for the control of most of these diseases. The cost of applying that expertise, though by no means negligible, is likely to be but a small fraction of the cost devoted to means of mass destruction or to putting a man on the moon! Much more intractable are the social and political obstacles, as these require education of the people and of their legislators, and that cannot be achieved overnight. Apart possibly from the provision of more extensive laboratory diagnostic facilities, the necessary control measures, so far as most epidemic diseases are concerned, should not make impossible demands on veterinary man-power; and while the essential control measures may, on occasion, arouse some undesirable short term political and even economic repercussions, taken over all they would undoubtedly be of immense value in the long run to the countries concerned. Certainly, if given the tools, the veterinarians of the world could get on rapidly with the job.

But essential though the eradication of epidemic disease is, if animal production is ever to develop adequately over much of the earth's surface, and if the geneticists, nutritionists and other animal scientists are to be enabled to deploy their skills effectively, it must be borne constantly in mind that by itself disease control is often not enough – and indeed may not even materially improve the situation. Carrying capacity, for example, is not necessarily increased by controlling epidemics. Thus, in many territories in the past – and indeed even in this more enlightened age as the disastrous effects of water shortage recently reported from Western Africa emphasizes only too clearly – the worst ravages of serious animal diseases can be brought under control at considerable trouble and expense, only to be replaced by drought or famine or the evil of overstocking, with large numbers of relatively worthless animals leading to soil erosion and eventual desolation – a state even worse than the first. Even at a less spectacular level, merely saving the lives of animals can increase numbers without necessarily increasing productivity, thereby actually decreasing the over-all efficiency of livestock production.

This does not, of course, imply that we should stop controlling and where possible eradicating serious epidemic diseases, for there is little hope of major progress in animal production in any country till these are effectively under control. But it does mean that if full benefit is to be obtained, steps must also be taken to help ensure that animals whose lives are saved by our intervention are given the chance to develop more fully the potential of which they are capable by attention to water supplies, feeding, management and the like.

Here again the veterinary surgeon can be of help. Through his ability to diagnose, treat and prevent disease he has a unique opportunity of gaining the trust and co-operation of the animal owner. If, in addition, he is enabled to apply his quite comprehensive knowledge of animals in health and disease to more general aspects of the whole production operation, he can play a valuable part as an effective general advisor, calling in experts – veterinary or otherwise – when a problem goes deeper than his general knowledge and experience can readily encompass.

In saying that, let me hasten to add that I am not advocating that our profession should try to do everything, or should claim omniscience in all aspects of livestock production – far from it. Indeed, it is quite clear that in embarking in the control of epidemic disease as an essential measure to improve the efficiency of the livestock industry, if the maximum benefits are to be obtained and the most rapid progress made there requires to be much more active collaboration between veterinarians on the one hand and agriculturalists, economists, marketing experts, and the like than has often been forthcoming in the past.

Nevertheless, eradication of major epidemics, vitally important though that is, only deals with the tip of the iceberg, a tip which, as I have said, constantly poses a highly dangerous threat to all around, a tip which must be removed or at least blunted if we are to get at the often unsuspected underlying mass, but a tip just the same. For, masked by the major epidemics, is a whole mass of morbidity – acute and chronic, clinical and subclinical – associated with microbial infections, parasitic infestations and the like, all of which impair in varying degree the efficiency of livestock production and all of which become exacerbated when, with the removal of the major threats, animal production begins to accelerate.

Here a somewhat different rôle awaits our profession as it becomes possible to select, feed and manage animals in such a way that they become increasingly productive and increasingly valuable. Bigger and more sophisticated veterinary services are usually required and many countries will in this phase have to increase both the quantity and the quality of their veterinary graduates to say nothing of the need for increased supplies of pharmaceutical and biological agents for the treatment and prevention of disease. At this stage also, the establishment of local veterinary diagnostic laboratories serving the field arm of the profession can play an increasingly important rôle in indicating the nature and significance of the problems that have to be tackled and the best methods of tackling them. Even in developed countries the importance of having a disease information service in which incidence is correlated with productivity and financial data is only being realized slowly as a result of increasing attention under financial pressure to the economics of livestock production in general and disease prevention in particular: we are slowly and

haltingly groping our way towards more effective systems for acquiring, analysing and applying the necessary information.

If experience elsewhere is anything to go by, as this phase progresses, as livestock enterprises become more intensified and more cost-conscious; and as communities become more environment- and more welfare-conscious, there comes an increasing demand for more 'herd medicine' and an increasing interest in the promotion of animal health and production by more than merely sporadic therapeutic and vaccination measures. It is, of course, possible that some countries, influenced either by political ideology or by the urgency of their population problem, may be tempted to accelerate the second phase or even try to by-pass it altogether by moving more or less directly from extensive, low-production regimes to the modern, highly sophisticated systems now in use in some developed countries, particularly in the case of poultry and pigs but possibly also into intensive beef production. If – and it is a big if – the necessary foodstuffs are available, the development of such aspects may well provide a superficially attractive proposition – but therewith danger lies. Such systems have, by their very nature, enough intrinsic health hazards of their own and to embark on them before the normal disease problems of the region are well under control would be tempting providence indeed. This was well exemplified by the ill-fated Gambia Poultry Scheme where an attempt to apply advanced poultry science technology in an unmodified way to a developing area cost the British taxpayer several million pounds, to say nothing of the dissemination in West Africa of some exotic poultry problems to add to the already considerable local hazards of which the poultry scientists concerned had chosen to ignore. Subsequent experiences with intensive production in every country all confirm that a high standard of animal health is essential if such enterprises are to be started with any reasonable hope of success.

Sooner or later, however, – and sooner probably than later – intensification of animal industries seems likely to spread and accentuate; and here again the problems the veterinarian has to deal with will also be accentuated. It is already clear that the larger the enterprise the more vulnerable it is likely to become; and that as more active management is introduced, as stocking densities increase, as more productive animals are developed by selection or crossing, as more sophisticated feeding systems are adopted and as our scientists keep tinkering with the anatomy and physiology of the animal body, disease problems tend to change both in nature and importance. Reproductive disorders tend to become more significant, internal and external parasites get more chance to debilitate their hosts, while environmental and other stresses modify both the pathogenicity of the attacking organisms and the metabolic and immunological efficiency of resistance mechanisms. Moreover, it is not only changes in the nature and development of disease in intensive systems that produce problems. Disease spread through the movement and marketing of animal products can also cause serious concern and pose a further challenge to our profession if serious disasters are to be avoided. The latter is, however, largely the conventional administration type of problem which need not be insuperable given the necessary man-power and given the necessary national and international co-operation. What is likely to prove a more serious challenge is the changing nature of the disease situation with the increasing development of industrialized animal production systems. An example was the surprisingly high prevalence of enzootic pneumonia encountered when it first became fashionable to feed calves intensively on barley. Here a new husbandry practice, which was theoretically highly advantageous – at least so long as the price of calves and of barley remained reasonable – resulted in the widespread occurrence of respiratory disease which could become so severe as to render the practice completely unprofitable. To meet such a situation the veterinarian has to deploy not only his already considerable clinical knowledge and his fundamental training in pathogenesis, epidemiology, therapy and prophylaxis; he has to apply also an increasing understanding of the ecology of disease, its inter-relationship with numerical and genetical changes in the animal population, with change in the environment in which animals are kept and with the changing stresses and strains imposed by changing management practices. For this, more information is obviously required and this is already being sought by many organizations in many countries. To be applied most effectively, however, this may also require some changes in our concept of the rôle of the veterinarian and even, on occasion, of the organizational framework within which he has to work.

It may be worth while recalling at this stage that the veterinarian's rôle is by no means confined to the field of animal production, vitally important though that is, particularly in the present world food situation. He has a wider responsibility to his fellow men in helping to ensure that human health is not only improved by improved supplies of essential protein but also that it is not adversely affected by contact with animals and their products; and, no less important, he has a responsibility to the animal population to ensure that its welfare is not overlooked, whether it be of companion or of food-producing species, or of the wild-life species, whose conservation we, as a profession, all too frequently have ignored or even on occasion possibly jeopardized. It is our responsibility to ensure, in so far as we can, that animals are protected, not only against the hazards of disease, malnutrition and mismanagement, but in addition that they are not subjected unnecessarily to destruction or even to discomfort – physical or psychological – produced, however inadvertently, in the supposed interests of financial gain.

There are thus many facets of applied biology in which our profession has an increasing rôle to play: in the care and management of laboratory animals for example; in the supervision of zoological collections and of wild-life parks; in the production, standardization and control of biological products; in fish and fur farming; in monitoring the biological use of toxic chemicals, and in the investigation of the comparative pathology of man and animals. But whatever the sphere of activity, the fundamental task of the veterinarian is to try to hold a balance between the interests and the needs of the animal on the one hand and the needs of man on the other, whatever the political and economic situation.

Within that general remit, the veterinarian in agricultural practice plays, and will continue to play,

a key rôle in advising the livestock owner on how best to minimize animal disease and improve animal health in such a way as to increase the efficiency and profitability of his enterprise. But to do this most effectively as the problems become more complex, he must, to my mind, seek to become less and less of an isolated one-man panjandrum and more and more a member of a team drawn from a variety of related disciplines of which he himself has often general rather than specialist knowledge. He would be an important, and indeed essential member of that team; because of his general knowledge and training in most, if not all, aspects of animal health and disease, he could be an effective co-ordinator of such a team; and because of the confidence he normally elicits from the farming community he could be a most valuable purveyor of its recommendation; and in many, if not indeed most, instances, with some specialized knowledge, probably on a species basis, grafted on to his basic training and experience, he could make, I would venture to hope, the most effective leader of that team. But as one of my more cynical colleagues remarked, that admirable situation seems unlikely to be achieved unless and until our veterinary educational establishments, at least the older established ones, succeed in divesting themselves of many of the shibboleths of the mid-nineteenth century and enter more fully and more wholeheartedly into the spirit of the second half of the twentieth.

The situation, however, is not so simple as that. While it is possible, no doubt, with centrally planned economies to make drastic changes in the agricultural pattern almost overnight, in many countries the change, though it is coming, is likely to evolve more slowly. Thus we shall have side by side for some considerable time yet, the traditional family farm with its traditional concept of the veterinarian's rôle as the physician of the farm animal and its traditional system of calling him in essentially for 'fire brigade' activities running cheek by jowl with complex, highly integrated industrial animal production units concerned only to a limited degree, if at all, with the fate of the individual animal but highly conscious of the balance sheet and of anything which threatens to impair efficiency and profitability.

For some considerable time to come, therefore, I can see the rôle of the veterinarian in agriculture being a dual one, while side by side with this, and often interwoven with it, will continue to grow a highly sophisticated form of practice dealing with the individual animal kept for sport, companionship or pleasure. A complex world indeed but a stimulating one and I would venture to hope a rewarding one. Moreover, such is the adaptability shown by our profession to changes in the past, such is the enthusiasm and understanding of the young men and women entering its ranks today, and such is the enlightened attitude shown by many of its leaders in education, administration and research in this country and many other combined with the persistent realism of its rank and file in every country that I have every confidence that whatever demands may be made on us in the future, animal health and welfare can be taken care of adequately, to the immense benefit of all concerned.

SOME ASPECTS OF EQUINE ELECTROCARDIOGRAPHY*

JOHANNA M. KRUGER AND W.L. JENKINS**

SUMMARY

In this review various aspects of equine electrocardiography as a diagnostic aid to cardiac abnormalities is presented. The recording and interpretation of the normal ECG of the horse are discussed and some of the most important cardiac abnormalities as detected by electrocardiography are reviewed.

INTRODUCTION

A number of clinical approaches may be used in the examination of the cardiovascular system of the horse. One of the methods which has become better known and more widely utilized during the last decade, is the investigation of the electrical activity of the heart by means of electrocardiography. Although the technique has limitations, it is of considerable value in detecting abnormalities such as disorders of the conduction system, arrhythmias, hypertrophy (if advanced), and changes in the position and axis of rotation of the heart. Electrocardiography does not provide information regarding the mechanical efficiency of the heart, the function of the heart valves, the presence of shunts, blood flow rates, or any pressure changes due to inefficient pumping.

It must be stressed that an electrocardiographic recording (known as an electrocardiogram or ECG), should never be used alone in the diagnosis of cardiac abnormalities. An electrocardiogram should only be interpreted in conjunction with a careful clinical examination of the cardiovascular system. Thus, the case history, observation of the superficial veins, examination of the pulse, determination of the region of maximal apical impulse, auscultation of the heart and percussion of the thorax are essential aspects to be evaluated in conjunction with an ECG. Other sophisticated techniques, such as phonocardiography, roentgenography and ultrasonic scanning are also valuable aids if available.

An important conventional method of investigating the cardiovascular system of the horse is an exercise test. In most cases this is confined to auscultation of the heart before and after exercise. Electrocardiography, however, provides an additional method of examination which should also be applied immediately before and after exercise, or, ideally, during exercise by radiotelemetry.

In contradistinction to man, little is known about the genesis of the ECG of the horse. Attempts have been made in the past to interpret electrocardiograms obtained from horses by using the configurations and values obtained from man for comparison. This extrapolation has proved to be spurious in many instances and should be avoided. Fortunately, a number of workers are at present investigating equine electrocardiography in some depth, and many of the unique features encountered in the equine ECG should soon be clarified.

* Based on a paper presented at the 4th annual General Meeting of the Equine Practitioners Group of the S A V A held in Johannesburg on 15th April, 1972.

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RECORDING AN ELECTROCARDIOGRAM

The electrocardiogram is generally recorded, with the horse standing, by means of electrodes placed on appropriate places on the surface of the skin. To prevent alternating current interference, the horse is earthed by means of an electrode via the machine and insulated from the surroundings by means of a rubber mat.

The potential changes which occur during each cardiac cycle are registered by the electrocardiograph, which is simply a specialized volt meter. A pair of recording electrodes is called a lead, and different lead systems can be used, depending on the purpose one has in mind. Standard bipolar limb leads, augmented unipolar limb leads and unipolar precordial leads have all been employed for clinical purposes in the horse.

The form of the electrocardiographic waves in the various leads depends on the direction and relative magnitude of electrical forces from moment to moment during the cardiac cycle with respect to the axis formed by the leads[2]. The direction of these electrical forces is determined by the anatomical position of the heart and the course taken by the spread of excitation throughout the myocardium [2].

Usable tracings should be free of alternating current interference and myograms, and should have a fairly stable baseline. An electrocardiographic recording should always be calibrated. A commonly used calibration is 1 mV = 1 cm (Fig. 1). An ECG may be recorded in two or three dimensions. Tracings in which the magnitude of electrical activity is plotted on the vertical axis and time on the horizontal axis are known as scalar electrocardiographic recordings.

Vector cardiography is another graphic method of describing the electrical activity of the heart. In a vector cardiogram the magnitude and spatial direction of the cardiac vector is projected as visualized in the frontal, horizontal and sagittal planes of the body [14]. Vector cardiography is still in its infancy in veterinary medicine; the standard scalar electrocardiographic approach will be dealt with in this article.

THE FEATURES OF AN ELECTROCARDIOGRAM

An electrocardiogram is a graphic representation of the potential changes of the heart impulse traversing the heart, plotted against time. With each cardiac cycle, the same graphic representation is repeated. The electrocardiogram can be analysed into various waves, complexes, intervals and segments, each presenting a facet of the cardiac cycle (Fig. 1). The chief waves of the electrocardiogram are labelled P, Q, R, S and T. The P-wave represents the process of depolarization

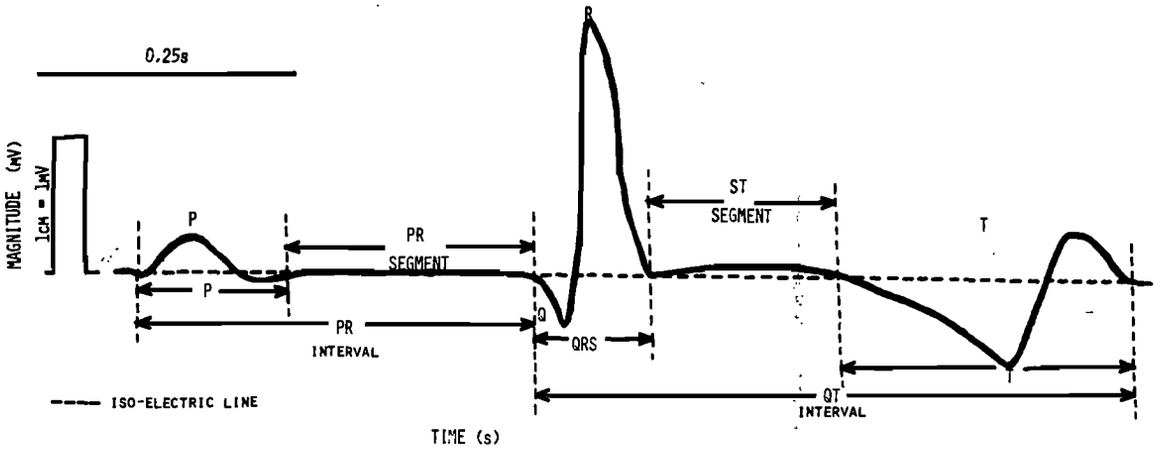


FIGURE 1 THE DIFFERENT COMPONENTS OF THE NORMAL ECG OF A HORSE, LEAD II

as it spreads from the sinoatrial node through both atria. The repolarization process of the atria is usually obscured by the QRS-complex. In the horse, however, because of the slow heart rate, it can sometimes be seen as deflection, opposite in direction from the P-wave. It is termed the Ta-wave. The PR-interval represents the time required for the excitatory process to reach the ventricular musculature. The QRS-complex is inscribed during the depolarization of the ventricular musculature. This complex may consist of one or more waves which are labelled in accordance to the direction and relative position. An upward deflection is labelled R, downward deflection is termed Q if it preceeds R, and S if it follows R. The ST-segment designates that part of the tracing between the end of the QRS-complex and the beginning of the T-wave. The T-wave represents ventricular repolarization.

MEASUREMENT AND INTERPRETATION OF AN ELECTROCARDIOGRAM

Amplitudes of upward deflections are measured as the maximum distance from the iso-electric baseline to the top of the wave, and downward deflections as the maximum distance from the iso-electric baseline to the bottom of the wave, expressed in mV. In measuring the amplitude of a notched, or double P-wave, the highest point of the wave is determined and used.

Time durations are measured from the first deviation of the wave from the iso-electric line till the wave returns to the iso-electric line. Depression or elevation of the PR- and ST- segments can be seen in their departure from the normal iso-electric baseline; changes in their contour should be noted.

The mean electrical axis of the heart, thus of the QRS-complex, is determined as follows [14]. Choose a complete electrocardiographic complex from any two limb leads recorded. Determine the positive and negative deflections for each lead above and below the iso-electric baseline. Add together the positive and negative values to determine a numerical value for each lead (Fig. 2). On the Bailey six-axis reference system, the point representing the positive or negative value in each lead is marked. From each point a perpendicular is drawn and extended till the perpendiculars intersect. The line drawn from the centre of the axis system to the point where the two lines intersect represents the electrical axis (Fig. 2). The same procedure is followed to determine the electrical axes of the P- and T-waves.

Diagnostic interpretation of ECG recordings consists of analysis of the recording for rhythm, heart rate, duration, amplitude and polarity of the P-wave, duration of the QRS-complex, amplitude and polarity of the components of the QRS-complex, duration of the PR-interval, duration of the QT-interval and amplitude, duration and polarity of the T-wave, and the contour of the PR- and ST-segments. The values of the electrical axes should also be determined.

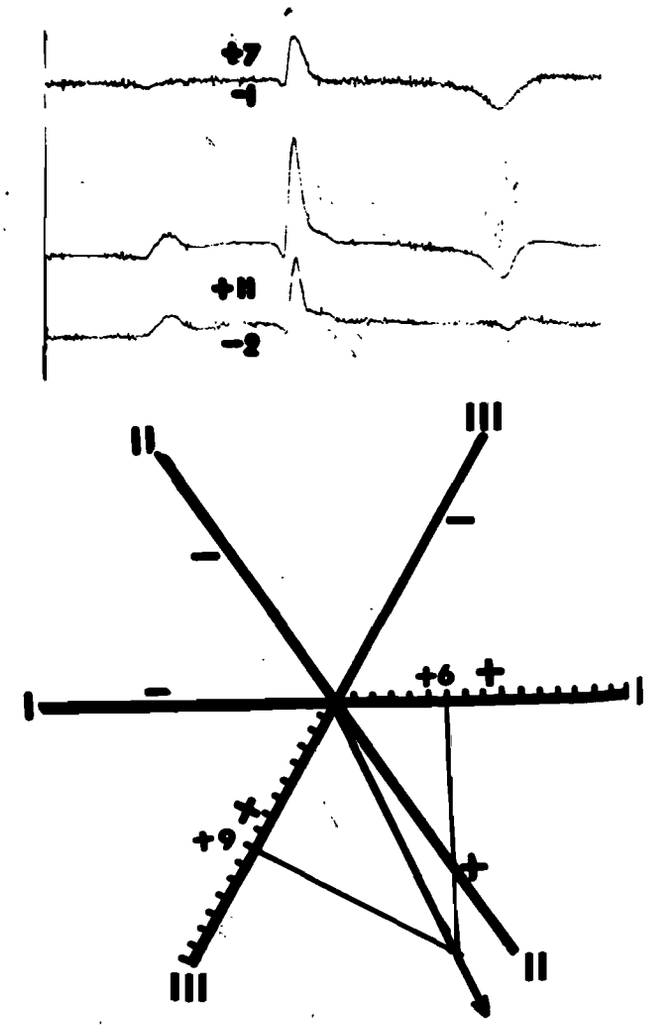


Fig. 2: Determination of the electrical axis: QRS, using leads I, III

Normal values and variations should be established by recording the ECG's of normal horses and analysing them. Deviations not falling within the normal limits are then attributed to diseased conditions of the

myocardium. Factors such as age, sex, weight, and heart rate influence the ECG and should be taken into account when interpreting the ECG.

THE NORMAL ELECTROCARDIOGRAM OF THE HORSE

The ECG of the horse differs in many respects from that of other animals. These differences include the configuration of the QRS-complex, the duration of the QRS-complex, heart rate and atrioventricular block that occurs in normal horses[2, 12]. Under usual conditions the heart rate of the horse is between 32 to 45 beats per minute[2]. Though the cardiac rhythm is approximately regular, slight sinus arrhythmia can be found in normal individuals.

Notching, slurring or splintering of the P-wave is a prominent feature of the equine electrocardiogram. It is considered a normal feature, and is attributed to the pathways of atrial activation. Wandering pacemaker is frequently observed in equine electrocardiography and originates from fluctuations in autonomic efferent activity which displaces the pacemaker from the sinoatrial node to some place in the caudal third of the right atrium[7].

The PR-interval varies with heart size rate, being shorter in smaller hearts or at faster heart rates[5]. Pathological shortening of this interval occurs in the Wolf-Parkinson-White syndrome. Abnormal prolongation of this interval is known as first-degree atrioventricular heart block, or incomplete block. A PR-interval of 0,42 s is considered the upper limit of normal when the heart rate is under 40 per min.[5].

The QRS-complex of the horse may appear in the form of a QRS-, QR- or QS-wave. The QRS-complex of the equine heart differs in configuration and duration from that of other animals. These differences are attributed to differences in the conduction system of the myocardium of the horse[12] and the anatomical position of the heart[2].

The ST-segment is directed either upwards or downwards, depending on the direction of the T-wave; it may also be influenced by respiration. Abnormal elevation or depression occurs when there is a current of injury generated by heart muscle which is suffering from ischaemia, as occurs in coronary insufficiency[5].

Because of the close relationship between the activation process and contraction, the QT-interval approximately equals the time span of ventricular contraction; it varies with the heart rate. The QT-interval increases with age, probably owing to acquisition of vagal tone and thus a slower heart rate[5].

The T-wave represents ventricular repolarization and is influenced by the preceding depolarization of the ventricles. Very little is known about the QRS-complex and T-wave in equine electrocardiography. The U-wave sometimes follows the T-wave. It is a small wave; its origin is obscure[5] and its significance unknown.

The normal values for the electrical axes in the H-plane, as found by Holmes & Alps in 670 equine subjects[6], are as follows:

QRS = −40° to +90°
P = +50° to +90°
T = +60° to −160°

Deviations from the normal direction of the electrical axes of the heart are indicative of changes in the size and shape of the heart, conduction disturbances and infarctions. Changes in the amplitude of the different waves, because of an increase or decrease in the mass of the myocardium, may also result in axis deviations.

Deviation in the electrical axis of the P-wave may be attributed to abnormal atrial conduction, whereas deviation in the electrical axis of the QRS-wave may be attributed to abnormal conduction of the impulse of the whole heart or the ventricles. Deviation in the electrical axis of the T-wave may be attributed to a variety of causes, e.g. inflammation of the myocardium[6].

EXAMPLES OF CARDIAC ABNORMALITIES DETECTED BY ELECTROCARDIOGRAPHY IN HORSES

A. CARDIAC ARRHYTHMIAS (Fig. 3A)

(a) *Sinus arrhythmia* (Fig. 3A). Sinus arrhythmia may be recognized in the electrocardiogram by a TP-interval that lengthens and shortens. It is often observed normally in the horse. It is due to alternate increase and decrease in vagal activity and is probably produced by a great number of cardiovascular reflexes. The arrhythmia may be abolished by exercise, parasympatholytic drugs, and some anaesthetic agents. If exercise does not abolish this form of arrhythmia, it is considered pathological in origin.

(b) *Sinoatrial block* (Fig. 3B). Sinoatrial block is a cardiac arrhythmia in which the auricles fail to respond to the sinus impulse or in which the response is delayed[10]. The block may be either partial or complete. In the electrocardiogram, sinoauricular block is characterized by the absence of a P-QRS-T-complex. The distance between the pre-block and post-block P-waves is twice the normal PP distance, or may be somewhat shorter than two short cycles together. It can be complicated by sinus arrhythmia, during which the normal PP distance can be longer than twice its distance.

(c) *Premature atrial beats* (Fig. 3C). Atrial premature beats are one of the causes of an intermittent heart rhythm and can only be diagnosed by electrocardiography[3]. The ECG features are premature P-waves which differ in configuration from that of the normal or dominant P-waves within the same lead. The premature P-wave may or may not be followed by a ventricular beat (QRS-T-complex) which in turn may be normal or bizarre.

(d) *Atrial fibrillation and flutter* (Fig. 3D). The electrocardiographic features of atrial fibrillation are absence of P-waves, which have been supplanted by fibrillation or 'f' waves, and irregularly spaced QRS-T-complexes[1]. Atrial fibrillation may occur in paroxysms or become established as a permanent condition. Flutter-waves ('F' waves) show some resemblance to fibrillation waves, except that they are regular in amplitude, configuration and duration. Usually they consist of a rapid upstroke and a more gradual downstroke. The QRS-complex always starts at the same point of an "F' wave, except where atrial flutter is associated with a disturbance in auriculoventricular conduction. The frequency of flutter waves is somewhat less than that of fibrillation waves. Atrial flutter and fibrillation are caused by the repetitive firing of ectopic foci. Isolated ectopic beats can usually be seen before the onset of the attack.

FIG. 3A SINUS ARRHYTHMIA

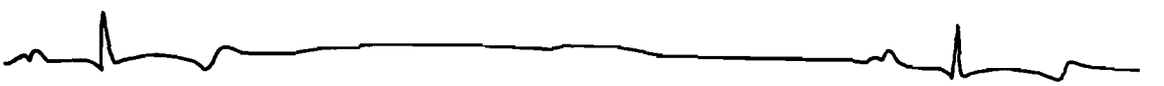


FIG. 3B SINO-ATRIAL BLOCK

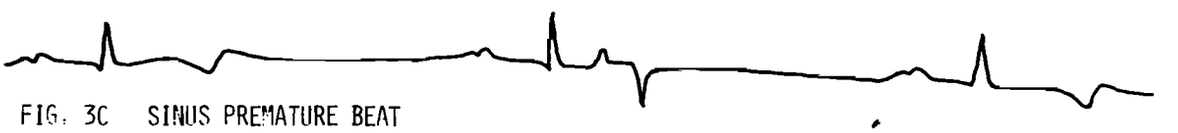


FIG. 3C SINUS PREMATURE BEAT

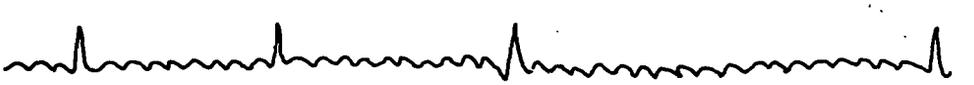


FIG. 3D ATRIAL FIBRILLATION

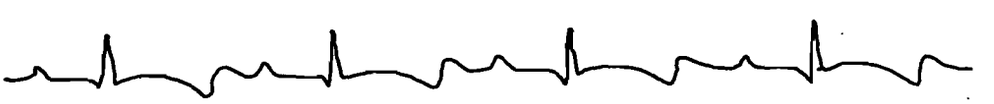


FIG 3E SINUS PAROXYSMAL TACHYCARDIA

FIGURE 3 EXAMPLES OF ARRHYTHMIAS OF ATRIAL ORIGIN, LEAD II
CALIBRATION: 1cm = 1mV
PAPER SPEED: 50 mm/s

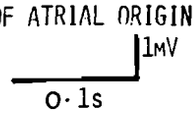


Fig. 3A: Original
Fig. 3B: After Nicholson, Glazier & Hofferman [10]*
Figs. 3C, D & E: After Brooijmans*

*Calibration modified to obtain uniformity.

(e) *Sinus tachycardia* (Fig. 3E). Sinus tachycardia is caused by impulse formation in the SA node at a high and, usually, regular rate. Clinically, little attention is paid to paroxysmal sinus tachycardia, unless cardiac failure or significant electrocardiographic findings are present [1].

(f) *Premature ventricular beats* (Fig. 4A). An isolated QRS-complex is one of the most easily recognized of all cardiac aberrations [1]. Ventricular premature beats are usually identified by a bizarre QRS-T-complex and the prolongation of the QRS-interval. In most cases the premature beat is followed by a compensatory pause. The reason for this pause is that as a result of the ectopic beat the ventricles are in a refractory state when the next atrial impulse arrives. Infectious diseases play an important rôle in the aetiology of this arrhythmia.

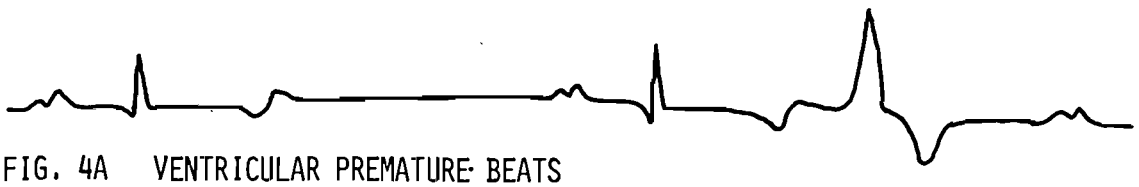


FIG. 4A VENTRICULAR PREMATURE BEATS

FIG. 4B VENTRICULAR FIBRILLATION

FIG. 4C VENTRICULAR PAROXYSMAL TACHYCARDIA

FIGURE 4 EXAMPLES OF ARRHYTHMIAS OF VENTRICULAR ORIGIN, LEAD II
CALIBRATION: 1cm = 1mV
PAPER SPEED: 50 mm/s

Figs. 4A, B & C: After Brooijmans[1]*

*Calibration modified to obtain uniformity.

(g) *Ventricular flutter and fibrillation* (Fig 4B). Ventricular flutter and fibrillation are the gravest disorders of the ventricles because the cardiac output is reduced to zero in these conditions [1]. Ventricular flutter and fibrillation are usually terminal events and electrocardiograms can be taken in rare instances only.

(h) *Ventricular paroxysmal tachycardia* (Fig. 4C). Ventricular tachycardia is an arrhythmia due to a number of ventricular extrasystoles occurring in succession [1]. Usually the paroxysms are preceded and followed by single extrasystoles, which are often of the same configuration as the paroxysmal beats. The duration of the paroxysms is variable: they may last from a few seconds to several days. The frequency of the attacks is also extremely variable. Ventricular paroxysmal tachycardia may occur in severe heart disease, e.g. recent myocardial infarction and inflammatory and toxic degenerative processes. Electrocardiographically it may be seen in runs of abnormally widened and slurred QRS-complexes alternating irregularly with sinus beats; the sinus rhythm is usually undisturbed.

B. CONDUCTION DISTURBANCES

1. *AV-nodal Conduction Disturbances* (Fig. 5).
Heart block is an abnormal condition in which there is a delay or absence of response to the sinus impulse. AV-block in the horse probably involves a neural mechanism and may represent a physiologic variant [11]. Different degrees of heart block are found. The following are generally recognized:

(a) *First degree partial block or prolonged auriculoventricular conduction time* (Fig. 5A). Electrocardiographically, first degree heart block may be seen in lengthened PR-interval durations. It is an unstable condition and is rarely found in the horse [1].

(b) *Second degree partial block (Type I)* (Fig. 5B). This type of block is also known as the Wenkebach block. It may be seen in a gradual increase in duration of the PR-interval in successive heart cycles, until one or more QRS-complexes are dropped. Sex, type and breed should be considered when interpreting this type of electrocardiogram [1].

(c) *Second degree partial block (Type II).* Second degree partial block (Type II) occurs very rarely in the horse [1]. In this type of block, two P-wave configurations are present.

(d) *Floating PR-interval* (Fig. 5C). This auriculoventricular conduction disturbance occurs only in the horse [1]. Electrocardiographically one sees an increase in the PR-interval which reaches a maximum and then a subsequent decrease to reach a minimum.

(e) *Complete heart block* (Fig. 5D). This condition is rarely encountered in the horse [1]. Complete heart block is characterized in the electrocardiogram by lack of correlation between the P- and QRS-waves. This is the result of total failure of auriculoventricular conduction. The ventricular rate is regular.

(f) *Premature AV-conduction (Wolf-Parkinson-White syndrome)* (Fig. 5E). This syndrome is caused by premature AV-conduction [1]. The atrial impulse reaches the ventricles ahead of the appointed time for excitation. Electrocardiographically, it can be recognized by a shortened PR-interval, an increased QRS-duration and susceptibility to bouts of atrial paroxysmal tachycardia and other arrhythmias.

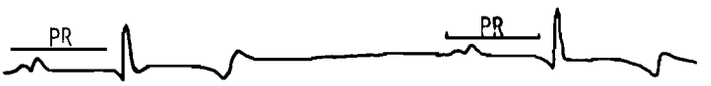


FIG. 5A FIRST DEGREE PARTIAL HEART BLOCK

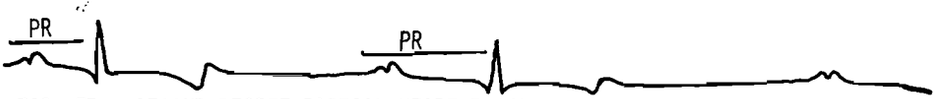


FIG. 5B SECOND DEGREE PARTIAL HEART BLOCK

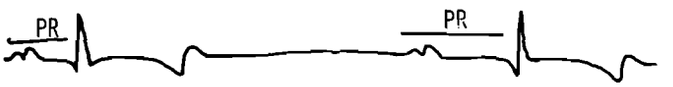


FIG. 5C FLOATING PR - INTERVAL

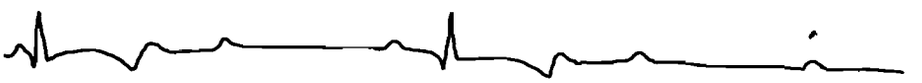


FIG. 5D COMPLETE HEART BLOCK

FIG. 5E WOLF-PARKINSON-WHITE SYNDROME

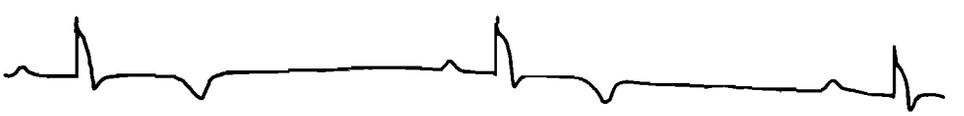
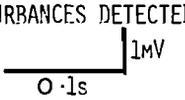


FIG. 5F BUNDLE BRANCH BLOCK

FIGURE 5 EXAMPLES OF CONDUCTION DISTURBANCES DETECTED BY ELECTROCARDIOGRAPHY. LEAD II
CALIBRATION: 1cm = 1mV
PAPER SPEED: 50 mm/s



Figs. 5A, C, D & E: After Brooijmans [1]*
Fig. 5B: After Smetzer & Senta [11]*
Fig. 5F: After van Zijl [13]*
*Calibration modified to obtain uniformity

2. *Intraventricular Conduction Disturbances*

Aberrant distribution of the supraventricular impulse in the ventricles is found in cases of disturbance in intraventricular conduction. Such disturbances can be either localized or due to a diffuse lesion of the ventricular conduction system. The former is known as bundle branch block –either left or right – and the latter is known as intraventricular conduction disturbance. Intraventricular conduction disturbances are usually not reflected in an electrocardiogram as the area involved is usually very small [1]. The electrocardiographic features of bundle branch block (Fig. 5F) include an increase in the duration and area of the QRS-complex, and large T-waves opposite in direction to the main ventricular deflection. Precordial leads form a useful adjunct to the diagnosis of bundle branch block [13].

C. MISCELLANEOUS CARDIAC CONDITIONS DETECTED BY ELECTROCARDIOGRAPHY (Fig. 6).

(a) *Pericarditis* (Fig. 6A). In the electrocardiogram of a case of pericarditis, the T-wave vector may be greatly changed and the QT-interval shortened. An increase in the amplitude of the R-wave may indicate a thickened myocardium [6].

(b) *Myocarditis* (Fig. 6B). Inflammatory lesions of the myocardium occur in various infectious diseases in

FIG. 6A PERICARDITIS

FIG. 6B MYOCARDITIS

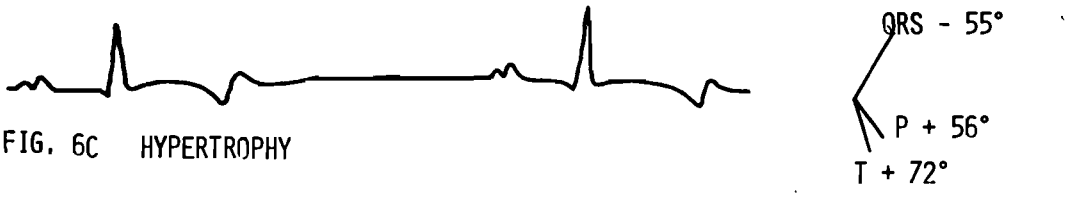
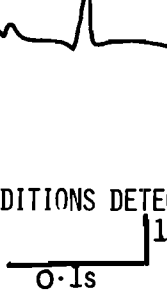


FIG. 6C HYPERTROPHY

FIGURE 6 MISCELLANEOUS CARDIAC CONDITIONS DETECTED BY ELECTROCARDIOGRAPHY, LEAD II
CALIBRATION: 1cm = 1mV
PAPER SPEED: 50 mm/s



Figs. 6A, B and C: After Gross [6]*

*Calibration modified to obtain uniformity.

Note:- Dr. Gross, in granting his permission to reproduce these figures, has made the important reservation that, in the light of his subsequent work at Ohio State University, these figures should not be regarded as diagnostic for the abnormalities mentioned. He concludes with the very significant statement: 'It is our feeling that there are still large gaps in the body of knowledge concerning equine electrocardiography.'

the horse. Myocarditis may be recognized by the rotation of both the QRS-complex and the P-wave axes [6].

(c) *Hypertrophy* (Fig. 6C). Hypertrophy or dilatation of the heart is caused by altitude, stress or constant exercise. Hypertrophy may lead to an axis shift of the QRS-complex [6].

CONCLUSION

Equine electrocardiography is not as easy a task as it may seem to be at first sight. Many technical and morphological factors tend to complicate ECG interpretation. Thus a thorough knowledge of these factors and how they influence the ECG, complete clinical examination of the horse, and experience in both the recording technique and interpretation of the ECG, are of utmost importance in diagnosing cardiac abnormalities. Nevertheless, electrocardiography is a very useful adjunct in the investigation of cardiovascular disease in the horse and clinicians should make more use of this sophisticated diagnostic aid.

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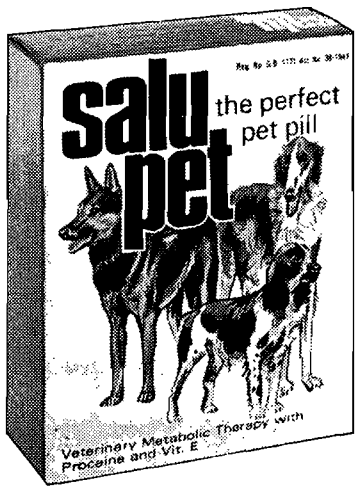

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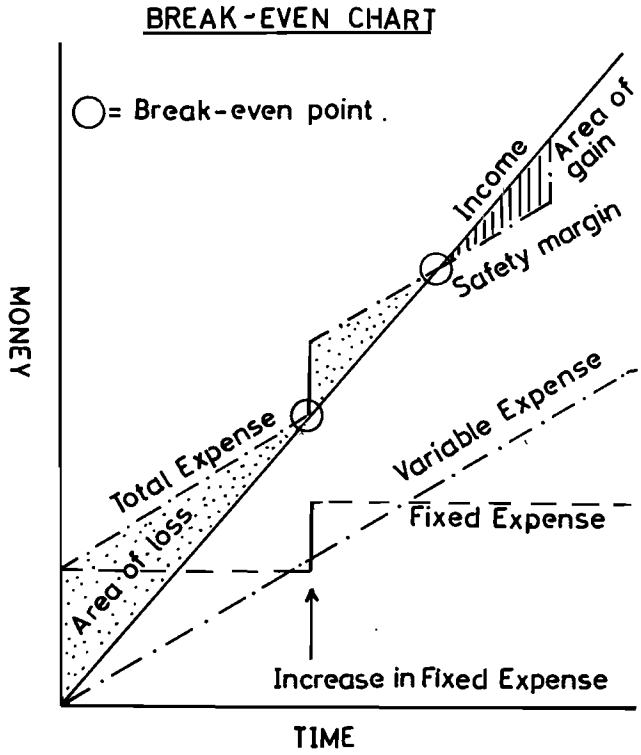
MANAGEMENT COURSE FOR VETERINARIANS

ZWARTKOPS COUNTRY CLUB, PRETORIA, 24 MARCH, 1973

In welcoming the 51 delegates from all parts of the Republic and Rhodesia and the five speakers to the Management Course for Veterinarians, organized jointly by the South African Veterinary Foundation and the National Development and Management Foundation of South Africa (Northern Transvaal Regional Branch), the President of the South African Veterinary Association, Dr. A.B. la Grange, as Chairman, stressed the unique nature of this particular course, the first of its nature in South Africa. The economic growth of a country is an excellent barometer of productivity of its people. South Africa's relatively low rate (2,25 percent for the years 1965 to 1970) calls for improvement, only to be attained by higher productivity and that in turn is a result of management ability and practice. The burning question is enhancement of our productivity and that of the masses constituting the various other ethnic groups inhabiting our country. Our final purpose as a Profession may never be self-centred: we must look to the wider circle of people and nations with which we are in contact. But first of all we must get our own house in order. Education is the first priority; in this continued education plays a prominent rôle. We are here today not so much to increase our veterinary knowledge as such, but how to use our knowledge more effectively in the application thereof and in increasing its availability; how to plan, develop and manage our practices more successfully; and, last but not least, to improve our relations with our fellow-men and render more effective aid to our animals. Despite the problems involved in imparting the tremendously increased body of knowledge to veterinary undergraduates, there remains the additional imperative of providing them with knowledge concerning the basic aspects of Management.

Mr. D. Mahony, Financial Manager of the National Development and Management Foundation, spoke on 'The importance of Scientific Management in running a Veterinary Practice'. The ultimate aim is to be able to achieve the most to the greatest effect, in minimum time. It is a duty the veterinarian owes to his creditors, those who finance him by allowing credit; his investors, those who financed his studies and his capital outlay; to his consumers, i.e. his clients, by rendering efficient service at minimum cost; to his employees, by offering them security and the prospect of financial advancement; and to his country, by contributing to its welfare.

In scientific management the first essential is to establish the 'break-even point'. i.e. the point at which income, plotted as a line on a money/time graph, intersects the line representing expenses. Fixed expense forms a base-line, parallel to the axis; stepwise upward movements in this line reflect specific events that increase fixed expenses: occupation of new buildings, taking in of an assistant, etc. From this base line upward variable expenses are charted. The area before the 'break-even' point represents the loss area, beyond it the profit area, in which a safety margin area should be allowed.



One method of increasing the profit area is to depress the expenses. To decide how this can be done most effectively, the relative proportions of gross income apportioned to the various components making up the total business activity have to be determined. These proportions may be represented graphically as a circle subdivided into sectors, the so-called 'pie chart'. In the average industry the sectors would be the cost of raw material, labour expenses, selling, delivery, administration and surplus. The latter, after deduction of tax, would constitute profit. Obviously, efforts should be made at bringing about a specific percentage reduction in that sector comprising the greatest component, as that would effect the greatest over-all reduction. As a rule the Materials sector is the most important one. 'Material well bought is profit half made'. In this respect the Economic Order Quantity provides a useful formula, as follows:

$$\sqrt{\frac{2 \times R \times P}{C \times I}}$$

where R = Annual requirements.
P = Ordering cost per order. (This includes time and labour involved in checking stock and stock-taking, keeping records of stock, telephoning and writing, receiving, unpacking, checking and stacking.)
C = Unit cost of item.
I = Carrying cost (i.e. the actual loss involved in having money frozen in stock and not earning interest) expressed as a percentage of the inventory. The latter is taken as half the full amount ordered over the year, because it

represents a diminishing quantity in terms of time and half represents the average between full stock and zero stock. Shelf life must also be taken into consideration.

Economic Order Quantity can also be expressed graphically or in tabular form. Involved formulae are available for various mixtures of materials, as are tables. When quantity discount is offered by the supplier of stocks, the most economical quantity for the particular consumer (in this case the practitioner) can be calculated.

Everything has to be planned and the best use must be made of every aspect. Cost involved in any development must always be related to the degree of augmentation of income. A fundamental principle is 'Management by Exception', i.e. diagnosing what is wrong and concentrating attention on its correction.

Prof. K. Adendorff of the Department of Mechanical and Industrial Engineering of the University of Pretoria delivered a formal paper on 'The Principles of Scientific Decision-making as applied to Veterinary Practice'. This paper appears in this issue of the Journal.

In reply to questions, Prof. Adendorff stated that it would be practically feasible to employ expert consultants to make a study of a group of more or less similar practices in order to develop scientific procedures, and so lessen the cost involved. This, however, is but a short-term procedure. The ultimate solution would be to introduce a course of Management into the undergraduate veterinary curriculum, whereby students could be exposed to the fundamental concepts of procedures involved. An estimate regarding the duration of such a course would be two teaching periods per week for one year. The Chairman strongly supported the suggestion. Although the present course is crammed to the hilt, extension of the course is bound to come; a course on Management would then merit most serious consideration.

Mr. Mahony informally discussed Accounting Methods, in which the following main principles were stressed, namely:

(a) simplicity and efficacy,
(b) that there is no field of accountancy that cannot be streamlined;
(c) the need for a system that can show the practitioner at a glance where he stands financial-wise, with
(d) the least possibility of errors; and
(e) without the need for compensating as so often occurs in balancing, and
(f) requiring minimum staff;
(g) the importance of reviewing procedures from time to time to simplify the system and render it more fool-proof;
(h) reducing the cost of control.

The average individual practitioner can hardly afford the services of a consultant, consequently he must himself look for systems that best suit him. He can only generate money, not his employees. Many traditional accounting practices are too complex and really unnecessary, e.g. debtor's ledger, creditor's ledger (no need to do auditing for the suppliers), cash book (which is kept more effectively by the bank), nor the conventional debit and credit system of entries. Priorities must be ordered correctly. The absolute requirements are:

a) Time Book in numbered sequence, in which appointments, consultations and fees are noted.
b) Invoices; by making carbon copies, which are kept alphabetically in a box file for a particular month and which are removed upon payment, or moved to the next box file when payment does not ensue, one obviates the need for a debtor's ledger and one has an immediate age analysis at hand.
c) Stock order book – on each order the quantity, unit price, total price, discount and nett amount due are shown, as well as the cheque number as soon as payment is effected. This serves as a creditor's ledger.
d) Cheque book – this takes the place of the cash book. By using blanks and carbon paper, a copy of each cheque is produced; the time required and the possibility of transposing errors in filling out counter-foils are obviated. The requisite copies may be pasted into the order book instead of entering the cheque number.

The following example of a simple combined diary and accounting system, as devised by the speaker, is shown, together with the previous month's balance sheet.

A, B & C. VETERINARY SURGEONS

BALANCE SHEET AT 28th FEBRUARY, 1973

Liabilities		**Assets**	
Creditors	1 000	Plant and equipment	1 000
		Motor vehicles	4 000
Current Accounts		Stock	2 000
A	3 000	Debtors	2 900
B	3 000	Bank	100
C	3 000		R10 000
	R10 000		

BALANCE SHEET AT 30th MARCH, 1973

Creditors	250	Plant	1 200
		Motor vehicles	4 000
Current Accounts		Stock	1 966
A	3 007	Debtors	1 400
B	3 007	Bank	705
C	3 007		R9 271
	R9 271		

COMBINED DIARY AND ACCOUNTING SYSTEM (D T MAHONY)

Date	Ref.	Details	Amount	Creditors	Current Accounts			Plant	Motor Vehicles	Bank	Debtors	Stock						Fixed Expense	Running Expense
					A	B	C					A	B	C	D	E	F		
												Code 10125	Code 10150	Code 10200	Code 10333	Code 10400	Code 10500		
1st March	BF			(1000)	(3000)	(3000)	(3000)	1000	4000	100	2900	500	500	400	300	200	100		
10th March	Mail	Sundry Debtors	1500							1600	1400								
15th March	Cheques 10-25	Creditors	950	nil						650									(50)
16th March	Time Book	Brown	5							655						197			(52)
17th March	Cheque 26	AECI	200					1200		455									
18th March	O/no 123	Cooper/Cooper	250	250													350		
25th March	Cheque 27	Salaries								155								300	
25th March	Cheque 28	Wages								105									(2)
30th March	Time Book	Consultations	600							705		419	450	300	250	197	350		(321)
				(250)	(3007)	(3007)	(3007)	1200	4000	705	1400	419	450	300	250	197	350		

Explanatory notes:-

1. The first entry is that brought forward from the previous month's sheet.
2. Entries between brackets denote a negative balance. A negative balance (in brackets) in the last column (Running Expense) is relative to the heading of the column, i.e. denotes a surplus.
3. Column 2 (Ref.) indicates source of the entry.
4. The current accounts are individualized, one for each partner A, B and C.
5. Capital equipment, e.g. Plant and Motor Vehicles, is entered at full replacement value and remains constant until replaced. There is no need to calculate depreciation and enter it. At replacement the old equipment is written off fully and a full charge made for replacement.
6. The stock columns and codes used can be fitted to suit the demands of the practice. In the codes used here, the last three figures denote percentage take-off to the nearest first decimal, i.e. 12,5%, 15%, 20%, 33,3% 40% and 50%.
7. The Fixed Expense Column is balanced with the Running Expense column at the end of the month, leaving in this case a surplus of R21. This column can be used for break-even charts as explained in the previous talk.
8. At every entry the necessary adjustment is made in every requisite column. For example, the second entry shows R950 paid to creditors, to whom R1 000 was owing; the R50 was taken as discount for payment within 30 days (5% in this case – at least 2,5% should be taken in any case). This R50 is shown as surplus under Running Expenses, i.e. R50 in brackets as adverse balance relative to the heading of the column. The R50 in wages paid (the second last entry) is deducted from the R52 surplus in the Running Expense column, leaving a surplus of R2. To that is added the profit of R319 obtained from the take-off from stocks used, giving R321. From this the R300 salaries (Fixed Expense) is deducted, leaving R21 surplus for sharing amongst the three partners.

Entries have to be made regularly and as soon as possible, preferably daily. Adequate use must be made of unavoidable waiting time (at traffic lights) and of receptionist's time: the practitioner cannot generate income by doing clerical work.

Prof. A.P. Zevenbergen of the Bureau of Financial Analysis of the University of Pretoria chose to give a broad introductory talk on the principles involved in his paper, 'The Interpretation of Financial Statements', published in this issue, rather than consider the details of the techniques concerned. The latter required much more study than was possible in the time allotted.

As a preamble he referred to the then recently published report on the 'Profitability of Twelve Professions' by the Institute for Man-Power Research of the Human Sciences Research Council, according to which the self-employed veterinarian occupied the lowest rank order; whether calculated on actual income basis, or on a weighted basis in terms of study investment, both before and after deduction of tax. The employed veterinarian was hardly better off. Clearly the matter required investigation, such as was done by the Bureau of Financial Analysis for the Dental Profession. Also to be propogated was the institution of a course on Practice Management, for at least two lectures per week for a full semester, in the undergraduate veterinary course. This was already done for students of Architecture, and, at post-graduate level, for students of Medicine. It could possibly be offered as an elective course.

In the paper a financial analysis is made of a medical practice, as no details of a veterinary practice were available: the problems are considered to b comparable.

For an analysis, information is necessary, and the only *relevant* information. It is useless to collec irrelevant facts. Secondly, it is important to have th facts so categorized that they can be utilized for usefu analysis. In a consultation there is the matter of fixe expense (cost of consulting rooms and facilities) an time required. In the ensuing therapy, if instituted b the practitioner, there are the factors of time an materials. The material factor must be treated as sale and falls into a totally different category. In keep ing an animal hospital, factors such as capital outlay attendant's wages, food, etc., must be considere before it can be decided whether a profit is made o not.

Before money is invested in expensive equipment, an analysis is required to decide whether the expected increase in returns justifies the step: a 15 to 20 per cent return is considered reasonable.

Mr. Mahony's bookkeeping system gives a daily record. Careful consideration must be given to which additional records are required in order to allow managerial decisions to be made on a scientific basis. Only expense and income items which have a definite relationship to one another can be used for analysis.

In an analysis numerous figures and ratios can be calculated. They are of no value unless they can be compared. A comparison of one year to the next may be made to indicate trends in the practice. Far more useful is a comparison to a norm; to establish such a norm figures from a number of comparable concerns are required. Hence an analysis of the veterinary profession would be imperative. Only when such norms are available can the question be answered: where can the practice be improved? The problem must be defined before corrective steps can be taken. Hence some training in interpretation of financial statements is essential. Until an interpretation of financial statements is made, the money spent on employing an accountant is a dead loss. Profit, despite the stigma attached to the word, is essential to keep the economy going.

In reply to questions Prof. Zevenbergen indicated all the factors to be considered before nett income per unit time for consultation can be calculated: this determines whether fees are sufficient and reasonable. What this nett income should be, could be indicated by a comparative analysis. On such basis the Veterinary Association could come to a definite ruling. In making calls, time spent in a motor vehicle cannot be calculated on the same basis as consultation time, as the effort factor is absent, yet a professional man should command a higher fee than an ordinary driver. But the Profession itself should come to express its opinion on such points.

Mr. Mahony supported Prof. Zevenbergen's emphasis on the fact that time is money and that time is the main commodity the veterinarian has to trade. He has to decide how he is going to apportion his time and allow for inevitable wastage. He then presented two case studies of firms producing medical products by mixing certain ingredients which are purchased. The calculations to obtain material variances and book entries for purchase, usage, completion and disposition in the first case and sales budget, production budget, direct materials requirements budget, and material purchases budget in the second case were presented.

CASE STUDY A

A company produces an antiseptic dusting powder which is sold in bulk. The product's mixture is tested at intervals during the production process. Materials are added as needed to give the mixture the desired drying and medicating properties.

The standard mixture with standard prices for a 100 kg batch is as follows:

A	10 kg	Hexachlorophene	@ 0.45 per kg
B	10 kg	Para-chlor-meta-xylenol	@ 0.30 per kg
C	30 kg	Bentonite	@ 0.08 per kg
D	20 kg	Kaolin	@ 0.10 per kg
E	50 kg	Talc	@ 0.05 per kg

During the month the following materials were purchased:-

1500 kg of A @ 0.47
1100 kg of B @ 0.33
4000 kg of C @ 0.07
2500 kg of D @ 0.11
6000 kg of E @ 0.05

Production for the month consisted of 10,500 kg of finished product. There were no beginning or ending inventories of work in process.

The following actual materials were put into production:-

1050 lb of A
1125 lb of B
3080 lb of C
2200 lb of D
5300 lb of E

Required:-

1) Calculation of all material variances.
2) Book entries for:
   - (i) purchase
   - (ii) usage
   - (iii) completion
   - (iv) Disposition of Variances (assuming that all completed units were sold).

SOLUTION TO CASE STUDY A

First calculate the cost of the standard mix

10 kg	A	at 0.45	= R	4-50
10 kg	B	0.30		3-00
30 kg	C	0.08		2-40
20 kg	D	0.10		2-00
50 kg	E	0.05		2-50
120 kg			R	14-40 ÷ 120
			=	0-12 per kg

100 kg of finished product at 0.144 per kg.

Purchase price variance

Item		Actual/kg	Standard/kg	Variance/kg	Total variance	
1500 kg	A	0.47	0.45	+ .02	30	U*
1100	B	0.33	0.30	+ .03	33	U
4000	C	0.07	0.08	− .01	40	F**
2500	D	0.11	0.10	+ .01	25	U
6000	E	0.04	0.05	− .01	60	F
				Purchase price nett variance	12	F

*U: Unfavourable **F: Favourable

	Actual quantity	x Standard prices	
	1050	0.45	R 472-50
	1125	0.30	R 337-50
	3080	0.08	R 246-40
	2200	0.10	R 220-00
	5300	0.05	R 265-00
A	12755		R1 541-40

	Actual quantity	x Standard cost (input)	
B	12755	0.12	R1 530-60

	Finished product	x Standard finished cost (output)	
C	10500	0.144	R1 512-00

Materials mix variances	A – B	=	R10-80	Unfavourable
Materials yield variance	B – C	=	R18-60	Unfavourable

	Dr	Cr
Materials	1 875-00	
To vouchers payable		1 863-00
purchase price variance		12-00
Work in process	1 530-60	
Materials mix variance	10-80	
To materials		1 541-40
Finished goods	1 512-00	
Material yield variance	18-60	
To work in process		1 530-60
Cost of goods sold	17-40	
Purchase price variance	12-00	
To mix variance		10-80
yield variance		18-60

CASE STUDY B

Vetservo Company Limited manufactures products X and Y. During April it expects to sell 5000 phials of X @ R2 and 2000 phials of Y @ R1.

Direct materials A, B, D are mixed in equal proportions to produce X and materials B, C, D are mixed in the proportion o 2 : 5 : 3 to produce Y.

The weight of both products is equal to the combined weight of their ingredients.

Material	Opening Stock Stock	Value per Unit	Total Value	Desired Closing Stock	Expected Cost
A	1500	.50	R 750	1000	.55
B	1000	.50	500	2000	.50
C	20000	.10	2 000	3000	.10
D	25000	.25	6 250	6000	.35
Product X	1000	1.50	1 500	500	
Y	5000	.75	3 750	6000	

Required:-

1. The Sales Budget.
2. The Production Budget.
3. The Direct Materials Requirements Budget.
4. The Material Purchases Budget for April.

SOLUTION TO CASE STUDY B

SALES BUDGET

		Anticipated Unit Sales	Anticipated Sales Price	Anticipated Income
Product	X	500	2.00	10000
	Y	20000	1.00	20000
				30000

PRODUCTION BUDGET

	Product X	Product Y
Sales	5 000	20 000
Closing Stock	500	6 000
	5 500	26 000
Less Opening Stock	1 000	5 000
Required Production	4 500	21 000

DIRECT MATERIALS REQUIRED

	Material A	Material B	Material C	Material D
Product X (1 : 1 : 1) 4 500 Units	1 500	1 500	–	1 500
Product Y (2 : 5 : 3) 21 000 Units	–	4 200	10 500	6 300
Total Requirements	1 500	5 700	10 500	7 800

MATERIAL PURCHASES

	Material A	Material B	Material C	Material D
Required for Production	1 500	5 700	10 500	7 800
Desired Closing Stock	1 000	2 000	3 000	6 000
	2 500	7 700	13 500	13 800
Beginning Stock	1 500	1 000	20 000	25 000
Units Required	1 000	6 700	(Excess 6 500)	(Excess 11 200)
Price	0.55	0.50		
Expenditure	R550	R3 350	NIL	NIL

The veterinarian could use similar calculations if he dispenses, but, more important, he can substitute his apportionment of time expenses in terms of his desired mode of practice in the same way as ingredients in the mixture in the case studies presented. In the ensuing discussion Mr. Mahony stressed the need to make projections for the future. Official figures are available for the rate of inflation and depreciation of money; these can be used as a guide when working out a budget. From estimates of cost structure and expected income, a decision can be made whether fees should be raised (with the danger of increased 'consumer resistance'), working hours lengthened, or work planned on a more selective basis. An analysis of how effectively time is spent is essential.

Good-will, the prestige value of certain items of equipment, and considering increasing staff salaries and wages ('buying loyalty') are some items to be considered in future planning.

A well-run concern should have no bad debts. Prof. Zevengerben stressed debt control. An average of 100 practices will give a good average of the level of bad debts. An analysis of a practice's cost structure will allow projections to be made.

Mr. Sydney Bam, attorney-at-law, reviewed the legal aspects of a veterinary practice (published in this issue), and Mr. W.A. Lindeque, Regional Manager for Northern Transvaal of the NMDF, in an informal talk, stressed the importance of human relationships. He concluded by equating the right attitude plus good human relationships to success.

Dr. D.K. Shone of the Veterinary Foundation summed up the procedings by indicating the absolute impossibility of covering the whole field adequately in a day, but that sufficient information had been put forward to stimulate interest and to cover the main weaknesses with regard to the business aspect of veterinary practice: the practitioner had to see himself as a manager of a business. The first requisite was accurate and relevant information, the second was to keep procedures simple. Basic legal responsibilities had to be accepted and catered for in the correct manner. Human relationships were as important as in medical practice.

The course ended by a wide range of questions being answered by the Panel of Speakers and a fitting vote of thanks proposed by Dr M.A.J. Azzie, Chairman of the Board of Trustees of the South African Veterinary Foundation.

INFORMATION

INLIGTING

CONTROLLING POULTRY DISEASES

Larynogotracheitis can now be successfully controlled with an aerosol re-vaccination but only after exposure to drinking water vaccination for four to eight weeks previously. This procedure employs a specific modified or attenuated L.T. vaccine strain. However, pullets must be *M. gallisepticum* clean. Coupled with good environmental conditions, the re-vaccination procedure has stimulated very high levels of respiratory tract protection. It is suitable in high risk exposure areas.

On the subject of water vaccination for respiratory diseases Dr Everett Bryant of the University of Connecticut stated that respiratory diseases, such as Newcastle and infectious bronchitis, will respond with better results if the vaccine gets into the respiratory tract. For this to occur, the birds must be thirsty enough so that they will dive into the drinking water and tilt or snap their heads back. In the process, they get some vaccine into their nostrils and windpipe. If a water type respiratory vaccine just goes down the throat and into the gut, the birds are not immunized.

John M. Casey, writing in *Georgia Poultry Tips* suggests using moth balls to keep away sparrows and other wild birds which often introduce diseases and parasites to poultry flocks. Field reports indicate that two or three moth balls (naphthalene crystals) in small baskets made from wire screen are effective in controlling wild birds when the baskets are placed at ceiling height every ten to twelve meters. This method, he stated, is quite inexpensive because of the low cost of moth balls; the wire baskets can be cut from scraps of screen wire.

Poultry Digest, Vol. 33, No. 383 (January 1974); P.O. Box 1220, Redlands, California. *Agricultural Report No. 116.* Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, N.W., Washington D.C. 20008, USA. Published by the Department of Agricultural Technical Services, Pretoria.

THE PRINCIPLES OF SCIENTIFIC DECISION-MAKING AS APPLIED TO VETERINARY PRACTICE*

DIE BEGINSELS VAN WETENSKAPLIKE BESLUITVORMING TOEGEPAS OP VETERINÊRE PRAKTYK*

K. ADENDORFF**

SUMMARY

In a bilingual (English/Afrikaans) presentation the author outlines the fundamental principles of scientific decision-making as he envisages it being applied to veterinary practice. He advises expert consultation to define and solve the problems likely to be encountered.

When attempting to make a contribution towards a subject such as 'The Principles of Scientific Decision-Making as applied to Veterinary Practice', it is helpful to commence with a survey which focusses on the general principles involved, rather than to occupy oneself with a mass of detail. The application of scientific decision-making to the veterinary profession is relatively new to me; nevertheless I shall endeavour to put forward my views in this regard, and these views will necessarily be biassed in the direction of the *science* of modern business management and scientific decision-making. This bias stems from the fact that I am an Industrial Engineer and consequently view the problem of management in any form of enterprise as one which can be solved most effectively by application of the techniques of Industrial Engineering, Operations Research and Scientific Decision-Making.

Modern developments make it readily apparent that we live in an era of very rapid and accelerating technological change. Moreover, most business executives are aware that this technological change has not been confined solely to materials, products and processes, but is taking place in management itself. For the purpose of this discussion I include professional veterinary pratitioners in the category of the business executive. Executives sense that a profound transformation is taking place in the art of management and that this transition from art to science will have an almost immeasurable effect on business enterprises and other forms of organization, and on business executives themselves. Business executives who can consistently make decisions of high quality in the local economic environment are capable of commanding large salaries. These executives are relatively scarce in South Africa; the condition of many local business enterprises bearing testimony to this fact. This statement could possibly be extended to embrace the field of the veterinary profession.

In die bedryf is daar dikwels meer as een oplossing vir 'n gegewe probleem. Dit is slegs by wyse van uitsondering dat 'n probleem een oplossing het. Probleme waarmee mens te doen kry besit elk gewoonlik 'n hele reeks oplossings, maar die oplossingsmoontlikhede is nie noodwendigerwys almal ewe goed nie. Wanneer 'n uitvoerende beampte van 'n onderneming dus 'n besluit moet vorm, moet hy in hoofsaak twee dinge doen. Ten eerste moet hy elk van die wyses van optrede wat verband hou met 'n ooreenstemmende oplossing skerp definieer. Daarna moet hy die beste oplossing selekteer uit die oplossingreeks. Hierdie optrede van die besluitvormer om 'n oplossing te selekteer uit 'n reeks van alternatiewe oplossings is die mees kenmerkende eienskap van besluitvorming.

Wanneer besluite in 'n bedryf gevorm moet word, is daar twee bykomende belangrike eienskappe van die proses wat oorweeg moet word: die uitvoerende beampte moet in staat wees om hom in die toekoms te kan projekteer, en om sodoende die element van onsekerheid te evalueer. Om hierdie stelling te illustreer, kan die geval van 'n uitvoerende beampte beskou word wat te staan kom voor die keuse van 'n beste oplossing uit 'n spektrum van probleemoplossings: watter werkwyse moet deur hom gevolg word?

Eerstens moet hy daartoe in staat wees om die beste oplossing te herken. Derhalwe is dit noodsaaklik dat hy die konsep van 'n ,,beste" oplossing vooraf moet defineer. So 'n ,,beste" oplossing moet derhalwe uiteraard beantwoord aan die besluitvormer se doelstellings. Vervolgens is dit vanselfsprekend dat die definisie van 'n ,,beste" oplossing gepaard moet gaan met 'n duidelike omskrywing van die doelwitte wat met die besluitvormingsproses bereik moet word. Nadat hierdie doelwitte volledig omskryf is, moet die besluitvormer die resultate van alternatiewe keuses van oplossing (en derhalwe optredes om die oplossing te implementeer) voorspel in terme van bereiking van die gestelde doelwitte. Na voltooiing van die voorafgaande optredes is hy gereed om die ,,beste" oplossingsmetode te kies.

Tweedens moet hy by die voorspellingsproses besef dat die resultate van sy besluite nie soseer afhang van teenswoordige en geskiedkundige gebeurtenisse wat plaasvind nadat die besluit geimplementeer is nie. Hierdie toekomsoriëntasie is van eerste belang wanneer 'n besluit in 'n bedryf gevorm word. 'n Besluitvormer van 'n bedryf kan allermins toekomstige gebeurtenisse met sekerheid voorspel en verkeer verder dikwels in die benarde posisie dat hy selfs nie oor volledige gegewens omtrent die verlede en hede beskik nie. Sy voorspellings oor die uitkoms van sy keuse uit die reeks van oplossingsmoontlikhede is derhalwe spekulatief van aard en deurspek met onsekerheid en risiko.

The main task of an executive thus is to make a choice between alternative courses of action in an environment of uncertainty and risk. It is therefore not surprising that the task of consistently making high quality decisions is difficult. Experience, intuition and rules of thumb must and do play an important rôle. The executive must make guesses and 'play'

* Lecture delivered at the Management Course for Veterinarians, Pretoria, March 24, 1973.

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hunches; these guesses may be 'wild' or informed, and may constitute the entire basis for a decision, or may only fill in where information is inadequate or not available.

Increasingly, executives concerned with business management in modern times have come to realize that extensive reliance on vague rules of the trade, 'feel' of the situation and intuition constitutes a dangerous practice in decision-making. This has largely come about as result of the growth in size and complexity of enterprises and the accelerated change of pace in the environment; the executive's problems have become so complex that only rarely can an executive comprehend the nature and essence of a problem completely. It also frequently occurs that an executive cannot even readily define a problem, much less the many critical factors that are involved and their inter-relationships, as well as the possible courses of actions, their outcomes and the probability of occurrence of any particular outcome. Under thesecircumstances decision-making becomes extraordinarily risky. To reduce their reliance on intuitive vision in making decisions many executives attempt to use a systematic and rational approach to problem solving. Implicit in this approach is the conscious and explicit definition of the problem and factors relevant to its solution. The objectives and conditions which a solution must satisfy consequently must be specified. Information concerning resources and the environment must be mobilized in an attempt to compare the costs, risks and benefits for each feasible solution. Finally, the executive must select a solution which embodies the *optimum balance of cost, benefit and* risk. Throughout this process, inspiration and judgement remain important, but the objective is to make them a contributory ingredient in decision-making rather than its entire foundation.

To some extent, this systematic and rational procedure has been rewarding and the quality of managerial decisions has often been improved. The decisions which have resulted have generally been superior to those based on intuition only. The procedure and its success, however, have been somewhat attenuated by certain factors. In order to apply the method described a large volume and wide diversity of information often have to be assembled, obscuring rather than revealing the executive's problems. Effects may have been described rather than their underlying causes. In addition, rapid and careful sifting of information to cull the significant and disregard the irrelevant has become enormously time consuming. The evaluation of alternative solutions in a methodical fashion has come to require more time and greater capability than the average executive has at his command. The upshot of this situation has been that the executive must revert to experience and intuition in making important decisions.

The advent of modern decision-making techniques have furnished the decision maker with advanced techniques of quantitative analysis with an integrated ability to isolate the critical variables of a problem situation and to relate events to them in a simple and cogent manner. To be more specific, these methods and techniques can ease the executive's difficulties in making decisions by contributing the following:

1. a better and more logical description of his objectives and of the assumptions on which they are based;
2. a more precise and illuminating definition of his problem and of the critical factors involved, the relative importance of each, and the relationships between them;
3. a clear indication of the information required to determine the best solution;
4. the ability to take into account a large number of relevant factors;
5. a precise description of all of the possible solutions to the problem, the assumptions underlying each, and the costs, benefits and risks involved in each;
6. the ability to compare many possible solutions and to locate the best amongst them rapidly, efficiently and with considerable confidence; and
7. a basis for predicting the consequences of changes in the enterprise's procedures or in the environment.

Opsommenderwys kan daar dus gestel word dat wetenskaplike besluitvorming die hoeksteen van moderne bedryfsbestuur is, en dat dit die belofte inhou van akkurater beskrywing van aannames, oorsaak- en gevolgverwantskappe en risikos, wat 'n deel vorm van die taak van daaglikse bedryfsvoering; trouens dit hou die belofte in om probleme wat te ingewikkeld, chaoties of te ongeordend voorkom, of met te groot risikos gepaard gaan om op enige ander wyse te behandel as deur gebruikmaking van intuïsie ondervinding en oordeel; te omskep tot ge-ordende patrone wat ontleed kan word met moderne bestuursbesluitvormingstegnieke. Dit hou dus die belofte in van 'n aansienlike verbetering in die kwaliteit van bestuursbesluite.

By hierdie punt wil ek afwyk van die algemene tema van wetenskaplike besluitvorming deur te benadruk dat besluitvorming in 'n onderneming ten nouste saamhang met die bestuur van die onderneming as 'n geheel; dit handel oor die ekonomiese aggregasie van faktore soos personeel en toerusting, die totstandkoming van bestellings vir diens en materiaal, die vloei van fondse en die doeltreffende gebruik van inligting.

Wanneer die implementering van wetenskaplike besluitvorming in 'n onderneming oorweeg word, moet die bestuurder besondere aandag skenk aan die ontleding van die bestuursisteem wat teenswoordig in gebruik is, aan die verameling van verbandhoudende feitlike inligting, aan die ontwerp van verbeterde sisteme, en aan die uitkenning van moontlike alternatiewe optredes wat saamhang met bestuursbesluitvorming. Om hierdie doelwit te bereik, moet die besluitvormende veeartsenypraktisyn verkieslik die dienste verkry van 'n persoon of persone wat die volgende take in sy onderneming of organisasie kan verrig:

1. Die ontleding, ontwerp en verbetering van werksisteme, werksentrums en werkmetodes.
2. Die daarstelling van werkstandaarde vir die bepaling van taak- en personeelbehoeftes personeelbesetting en koste.
3. Die ontwikkeling van taakbeskrywings taakwaarderingskemas, merietebepalings

prosedures en skemas vir die aansporing van werknemers.

4. Die ontwerp van ruimtes t.o.v. die uitleg en rangskikking van toerusting, doeltreffendheid van besetting, die vloei van materiaal en verkeerspatrone.
5. Die installering van kwantiteits- en kwaliteitsbeheersisteme vir die hantering, berging, prosessering en gebruik van materiaal en voorrade.
6. Die ekonomiese analise van alternatiewe kombinasies van personeel, materiaal en toerusting, en die ontwikkeling van modelle vir die optimisering van hierdie kombinasies.
7. Die vereenvoudiging van klerklike werk en die ontwerp van vorms.
8. Die verbetering van die organisasiestruktuur, verantwoordelikheid- en outoriteitsverwantskappe, en kommunikasiepatrone.
9. Die ontwikkeling van dataverwerkingsprosedures en die instelling van bestuursverslae vir die totstandkoming van bestuursbeheer op 'n kontinuë basis.
10. Die versameling van tegniese inligting, die voorspelling van toekomstige behoeftes en aanvraag, en die. omvorming van die verbandhoudende inligting tot 'n distillaat wat bruikbaar is vir besluitvorming.
11. Die behandeling van 'n verskeidenheid van aangeleenthede soos beleid, begrotings, geboubeplanning en eksterne betrekkings.
12. Die toepassing van wiskundige- en ander modeltipes op sekere fasette van die onderneming, en die integrasie van hierdie modelle ter bereiking van die organisasie se geheeldoelwit.

Ten spyte daarvan dat 'n veearts goed onderlê is in die praktiese aspekte van die voorafgenoemde aktiwiteite in soverre dit sy onderneming of organisasie direk raak, en dat hy in alle waarskynlikheid besonder baie aandag daaraan gee, is ek van mening dat hy daarby sou baat indien hy die dienste van 'n bestuursisteemkonsultant of bedryfsingenieur sou gebruik vir die oplossing van die heterogene probleemspektrum. 'n Uitvoerende veeartsenypraktisyn kan byvoorbeeld saam met 'n bedryfsingenieur met groot vrug 'n metodeverbeteringsprogram in 'n onderneming of organisasie ontwerp en implementeer. Hierdie stelling is vanselfsprekend gebaseer op die feit dat probleme in 'n onderneming bestaan en dat hulle opgelos moet word.

Important problem areas should be dealt with immediately, but this approach should not detract therefrom that the executive veterinary practitioner and industrial engineer should conceive and put into effect the orderly development of a total programme for the organization as a whole. Even after the total programme is well established and being carried out, periodic decisions will be required to implement 'remedial' and 'preventive' activities. In the same way that preventive medicine reduces the demand for remedial medicine, a systematic programme of methods improvement reduces the frequency and severity of acute problems in an organizational system.

A methods improvement programme which consists of several constituent projects should be subdivided into areas of activity of a shortterm and longterm nature. The time required to complete a programme depends on many factors, such as its scope and complexity, the accessibility of data sources, the importance of project results and the amount of resources which may be allocated to such a programme. It may prove to be of benefit to emphasize shortterm projects so that tangible results can be demonstrated at frequent intervals. As the programme matures and gains acceptance, however, the choice between shortterm and longterm projects should be determined by means of a systematic plan which forecasts future needs and which provides for deviations to cope with the exigencies of dynamic enterprise management.

Some of the efforts will of necessity be directed toward the improvement of operating methods and procedures, while others will deal with the development of administrative and managerial tools. Some projects will result in dramatic changes obvious to all concerned, others will have more subtle results, nevertheless providing information upon which administrative, managerial and even supervisory decisions can be made. Projects which result in physical changes, such as a new layout of consulting rooms, the redesign of a trolley or a simplified order form, can be useful as specific examples of the value of a programme and may be desirable choices for initial projects in a new programme. Such sub-system projects may solve what may be regarded as relatively unimportant problems requiring time and effort that might more logically be applied to major systems of the enterprise or the enterprise as a total-system. It may well be that the development of decision information is more important for a particular organization than the optimization of sub-systems thereof and in some cases more important than physical improvements in major systems of the enterprise.

One of the distinguishing characteristics of scientific decision-making is its emphasis on the 'systems' approach. Such a macroscopic approach reduces the likelihood of dealing with the wrong problem and gives priority to those aspects of the total system which contribute most to system improvement. In considering the assignment of projects it is natural to aim toward the optimization of major systems of an enterprise and these should be given high priorities, while studies of sub-systems should receive lower priorities.

The best way to achieve this result is for the manager of an enterprise to rely heavily on a professional adviser for the assignment of project priorities. In considering the matter of assignment, however, it is important for the manager or executive to bear in mind that such a programme is of his own creation, is therefore under his control, and should serve the institutional goals as defined by him. Thus, while the executive maintains ultimate control, he is in a position whereby he can utilize the programme as a 'consumer' in much the same way that he expects his associates and subordinates to use these managerial resources to achieve better performance in respect of their responsibilities. The practising veterinary executive together with his professional adviser on modern business management methods should maintain a 'problem' orientation, employ the 'systems' approach and utilize those techniques available which are appropriate for the solution of each particular problem.

Up to the present, organized methods improvement applied to veterinary practice has been relatively rare and has come about largely as a result of the initiative of either non-medical members of a veterinary team or of veterinarians in administrative or academic positions. By and large, emphasis has not been on the veterinarian's work *per se*, but rather on his participation in changes in the methods and procedures of others. From the early years of this century, when Frank Gilbreth applied his motion study principles to surgical procedures, up to the mid-1950's, industrial engineering analysis applied to the methods and procedures of medical doctors and veterinarians themselves were virtually non-existent.

Papers presented by physicians on engineering subjects at the annual conferences on "Engineering in Medicine", conducted since 1963 as events of the Engineering Foundation Research Conferences in Andover, New Hampshire, dealt with the direct application of several branches of engineering to physiology, anatomy, medicine and medical administration. The advent hereof testifies thereto that medical practitioners are beginning seriously to examine the applicability of industrial engineering techniques to medical practice. The techniques of Operations Research in relation to general clinical practice are also being examined.

'n Ondersoek is in die Verenigde State van Amerika in 1964 gehou en is hospitaalbedryfsingenieurs gevra om verslag te doen oor die frekwensie waarmee hulle gebruik gemaak het van die verskillende tegnieke van die Bedryfsingenieurswese. Die relatiewe frekwensie van gebruik was soos volg:

1. Tegnieke van *metodestudie, insluitende* proses- en *multi*-aktiwiteitstegnieke en die ontwerp van werksentrums – 30%
2. Werkmetingstegnieke waarby ingesluit word die tegnieke van tydstudie, standaardgegewens, voorafbepaalde bewegingstye en aktiwiteitsmonsterneming – 17%
3. Tegnieke vir die beplanning van fasiliteite, ruimtebenutting en materiaalhantering – 12%
4. Tegnieke van Operasionele Navorsing, waarby ingesluit word Lineêre Programmering, Simulasie, Spelteorie, Besluitkunde en Soekteorie – 8%
5. Bestuursbeheertegnieke waarby ingesluit word voorraadbeheer, produksiebeheer en kwaliteitsbeheer – 7%
6. Statistiese tegnieke – 7%
7. Tegnieke van die Ekonomie – 6%
8. Taakontledingstegnieke, waarby taakomskrywing, taakwaardering en merietebepaling ingesluit is – 4%
9. Ander tegnieke soos outomatiese dataverwerking, Organisasieteorie, voorstelskemas en Veiligheidsingenieurswese – 9%

Dit sal van waarde wees om 'n paar werklike probleme van beperkte omvang te behandel en te toon hoedat van die voorafgenoemde tegnieke gebruik is.

'n Onlangse opname van die aktiwiteite van Britse algemene mediese praktisyns het getoon dat die persone wat bestudeer is deel gevorm het van 'n duidelike patroon. Hulle was intense individue, besonder onafhanklik en ten volle bewus van hulle eie persoonlikheidsinvloed en siening op die bestuur van hul praktyke en pasiënte. Hulle het 'n gevoel van isolasie ondervind en was ooglopend onbewus van die wyses waarop praktyke buite hul eie praktyk ge-organiseer was. Hulle was sinies oor die huidige toestand van die algemene mediese praktyk maar het, eienaardig genoeg, vertroue in die toekoms daarvan gehad. Die verhouding tussen dokters en pasiënte was uitstekend; tussen die dokters en plaaslike hospitale redelik goed; maar in die geval van dokters en plaaslike owerheids-gesondheidsdienste eenvormig swak. 'n Verdere resultaat van die opname was dat beperking van die maksimum grootte van praktyk slegs deur 'n minderheid van die dokters voorgestaan word. Interessante bykomstige inligting is dat in alle gevalle wat ondersoek is, die dokters hul misnoë uitgespreek het oor die algemene praktisynsberoep en het geen spyt gevoel dat dit as professie agteruitgaan nie.

'n Groot hoeveelheid inligting oor die tipe, aard en omvang van die werk van die algemene praktisyn en die veldwydte van aktiwiteite van 'n reeks verskillende praktyke word ook deur Lees en Cooper („Journal of the College of General Practitioners" No. 6 van 1963) behandel. In voorafgenoemde verband kan daar bespiegel word oor die ooreenkoms tussen die mediese en veeartsenypraktyk. Ek is egter daarvan oortuig dat veeartse die volste vertroue in die vooruitgang van hul professie het en nie neerslagtig oor die toekomsverwagtinge is nie.

'n Studie van stedelike veeartsenypraktisyns gee 'n duidelike beeld van die ongesteldhede waarmee hulle te doen kry. Die studie toon dat 'n reeks alledaagse kwale soos babesiose, ekseem, spysverteringsongesteldhede en ook beserings te wyte aan verskeie oorsake behandel word. Hierdie en ander toestande kan geklassifiseer word as alledaags en verteenwoordig ongeveer 80 persent van die veearts se werk.

Die studie het ook getoon dat baie ernstige siektes in 'n enkele praktyk betreklik selde voorkom, maar dat ernstige siektes wel 15 persent van die dokter se tyd in beslag neem. Voorts het die studie ook die resultaat gelewer dat die aantal konsultasies per pasiënt per jaar vanaf 0,5 tot 11,2 gestrek het wat daarop dui dat die gewoontes van kliënte en dokters aansienlik varieer. 'n Vraag kan hier ook gestel word oor die terapiegewoontes van veeartse. Uiteenlopende resultate sal waarskynlik na ondersoek van die aangeleentheid verkry word.

Die teoretiese afleiding kan moontlik *a priori* gemaak word dat 'n veearts dikwels om persoonlike redes vaste terapiegewoontes ontwikkel en na ontwikkeling daarvan onwillig is om dit te verander, al is die metodes verouderd en oneffektief.

Bailey het gepoog om die probleem van beplanning van mediese dienste op te los deur die toepassing van die toustaanteorie, met die doelwit om te verseker dat die aanbod van mediese advies en behandeling by die vraag daarna sal aanpas en om tegelykertyd te verseker dat die vraag redelik snel bevredig sal word. Die algemene mediese en die veeartsenypraktyk bevat verskeie voorbeelde van situasies waarin 'n tou gevorm word, bv. kliënte wat wag op 'n spreekbeurt by 'n arts se kamers; of kliënte wat wag om 'n rekening te vereffen; of 'n arts wag dat kliënte hulle rekenings moet vereffen; of kliënte wat tuis wag op 'n besoek van die arts; ens. Alhoewel die algemene begrip van 'n tou 'n tou van mense is, bestaan daar 'n groot aantal ander prosesse wat gekenmerk word deur intermitterende vloei en derhalwe deur die toustaanteorie ontleed kan word. Voorbeelde hiervan is onder andere waar kliënte tuis wag op die besoek van 'n arts, al is geen tou werklik sigbaar nie, of die geval van 'n praktisyn wat wag op 'n patoloog se verslag.

By toustaansisteme ontstaan probleme wanneer daar te veel of te min aanvraag vir diens is. In eersgenoemde geval sal daar 'n te lang wagtyd op kliënte

afgedwing word, en in laasgenoemde geval sal die diensfasiliteite oormatig ledig wees. Derhalwe moet die bestuurder van 'n toustaansisteem die koste van kliëntwagtyd balanseer teen die koste van ledige dienstyd. Die vermoë of kapasiteit van die diensfasiliteit van 'n toustaansisteem kan verhoog word om die gemiddelde wagtyd per kliënt te verlaag, maar dit geskied ten koste van 'n verhoging in die ledige tyd van die diensfasiliteit, en *vice versa*. In die spesiale geval waar die presiese aankomstydstip van elke kliënt vooraf noukeurig bekend is, en die dienstyd vir elke kliënt of pasiënt ook akkuraat bekend is, kan 'n program ontwerp word om wagtyd en ledige tyd te minimiseer. So 'n ideale situasie kom selde of ooit in die praktyk voor. In die praktyk geskied dit meestal so dat beide aankomstye en dienstye betekenisvol beïnvloed word deur faktore buite die beheer van die kliënt en bediener.

Toustaanteorie word op die voorafgenoemde probleme toegepas, nie om die werklike bewegings van elke pasiënt deur die oorvol sisteem te registreer nie, maar om die statistiese eienskappe van die sisteem te kan voorspel, soos bv. gemiddelde aantal kliënte in die tou, gemiddelde kliëntewagtyd, en die kans dat kliëntewagtyd langer sal wees as 'n sekere waarde. Wanneer so 'n toustaansisteem geoptimiseer word, kan 'n bedryfsingenieur hierdie voorspellings aanwend om koste te minimiseer, produktiwiteit te maksimiseer, of om enige ander verbandhoudende doelwit te bereik. Van die optredes wat oorweeg kan word om die eienskappe van 'n toustaansisteem te wysig, is onder andere om die aantal dienskanale te verander; of om die gemiddelde kanaaldienstyd te verander; of deur die bedieningsprioriteit van eenhede of persone in die wagruimte te wysig; of deur 'n tou te splyt, of verskeie toue saam te voeg; of om reserwediensfasiliteite te gebruik.

A situation which often occurs in practice which may possibly be treated by the application of a queueing model is the problem which a veterinarian encounters in visiting clients at home. One may consider the realistic hypothetical example of a veterinary surgeon departing from his residence in the morning and doing his rounds before returning to his consulting rooms. As mentioned previously, this constitutes a problem which may be solved by means of the application of queueing theory, bearing in mind that the queue discipline would in all probability not be 'first come – first served', but would involve priorities to be treated, the distance to be travelled and personal characteristics of the clients and veterinarian. On the other hand the veterinarian could decide to minimize his travel distance and travelling time without considering the relative urgency of calls generated by patients for service. At this juncture it seems logical that a mathematical model be developed capable of giving an optimum route and which combines the minimization of distance and time with the maximization of service. In addition it should be relatively simple to interpret and should embody the facility for making multi-stage decisions as the route is being traversed. I am of the opinion that many veterinary practitioners perform this type of optimization in an instinctive fashion while rendering such a service.

This limited list of examples demonstrates the variety of problems facing the veterinary practitioner and by implication indicates which techniques may be applied to increase the productivity or systems and improve the quality of managerial decisions.

In conclusion, the future of Scientific Decision-Making, which in my opinion is the backbone of modern business management, appears to be bright at the present time. Successful applications are fulfilling the hopes of its supporters and the scepticism of businessmen is tending to break down as successful case histories become available for publication. The areas of potential application appear to be broad and undoubtedly include the field of general veterinary practice.

BOOK REVIEW — BOEKRESENSIE

VETERINARY PUBLIC HEALTH HAZARDS IN NEPAL

DWGA D. JOSHI

Kathmandu: O.H. Bhattarai 1973, pp V + 87, Figs: 11; Tables: 12. Publ. Price: 56 Rupees(?)

The author is Veterinary Epidemiologist at the Central Veterinary Laboratory in Kathmandu and possesses a Masters Degree in Preventive Veterinary Medicine from the University of California at Davis, U.S.A. He is to be commended for the first known effort to investigate and record the actual and potential veterinary public health hazards in Nepal and to suggest means of preventing or minimizing food-borne infection and infestations as well as zoonoses in man.

The work provides an alarming insight into the circumstances relevant to animal and public health in general, and to food hygiene in particular, in this part of the Indian continent. One cannot but help admire the enthusiasm and optimism which prevails in spite of the prevailing conditions in a country beset by ignorance and traditional, frequently religion-based, practices which must be altered before the benefits of public health knowledge and expertise can be realized effectively. The staggering socio-economic problems facing any organized effort at correcting these conditions are implied by simple, sober statements of fact.

The booklet contains a wealth of actual information relative to the occurrence of zoonoses in Nepal, with ample reference to the importance and significance thereof. As such it should go a long way towards informing governments and to educating the general population. One can but hope that the publication will be fully utilized for this purpose.

The publication is printed on rather poor paper and the photographic illustrations are also inferior – a comment rarely made these days. In addition, there are numerous errors in the text which, unfortunately, cannot all be ascribed to the printer's devil. The following quotation is perhaps an example of the style of writing as well as the gist of its contents: 'There is a big danger for all meat consumers in Nepal because, (1.a.):– In the present condition of hygiene of the premises in which the animals are being killed, or of the people who process them, is so worst than there is a hundred percent of chance to get infection or to be contaminated'.

This does not detract materially from the undoubted value of the book, in fact it enhances the urgent, empathy-provoking appeal that the reader senses when reading between the lines.

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DIE INTERPRETASIE VAN FINANSIËLE STATE*

GEVALLESTUDIE: 'N KRITIESE BESPREKING VAN DIE FINANSIËLE TOESTAND VAN 'N MEDIESE PRAKTYK

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SUMMARY

A detailed financial analysis of an hypothetical medical practice is undertaken to serve as a demonstration of the pertinent questions the practitioner should set himself an how the answers thereto can be extracted from the financial statements and records.

INLEIDING

Alhoewel 'n lang en duur formele opleiding 'n voorvereiste vir die mediese professie is, het die suksesvolle mediese praktisyn meer nodig as dit. Juis as gevolg van die lang en duur opleiding en die feit dat dit aansienlike kapitaal vereis om 'n praktyk te begin, is dit vir die praktisyn noodsaaklik om oor kennis van die finansiële aspekte en implikasies van sy praktyk te beskik. 'n Mediese praktisyn is in die eerste plek 'n hoogs gekwalifiseerde deskundige op die werking van die menslike liggaam, maar tweedens is hy ook besturende direkteur en aandeelhouer van sy eie onderneming. In hierdie hoedanigheid is hy dan ook met 'n administratiewe en finansiële funksie belas, en die doel van hierdie bespreking is om hom op die hoogte te stel van die moderne metodes en tegnieke van finansiële bestuur. Uit hierdie bespreking sal dit duidelik blyk dat sekere administratiewe prosedures gevolg moet word wat hom in staat sal stel om beheer oor die finansiële verantwoordelikhede verbonde aan hierdie unieke posisie uit te oefen. In beginsel geld dieselfde vir die veterinêre praktisyn: slegs in sekere aspekte is aanpassing van besonderhede nodig.

Een van die belangrikste aspekte van die administratiewe prosedures is die instelling van 'n behoorlike statistiese stelsel en die beskikbaarstelling van die resultate aan die praktisyn op 'n gereelde basis. Dit dien om hom op die hoogte met die vordering van sy praktyk te hou; deur vergelyking met dieselfde periode in die vorige jaar is hy in staat om afwykings onmiddellik op te merk. In hierdie verband is dit belangrik om daarop te let dat statistiek alleenlik van waarde is wanneer dit met 'n ander stel vergelykbare syfers vergelyk word. Op sigself het dit geen betekenis nie. Daar moet dus op gelet word dat inkomste- en uitgawe-rekenings sowel as balansstate en ander statistiese inligting op 'n vergelykende basis met die vorige jaar saamgestel word. Met die doel om 'n betekenisvolle ontleding en waardering van die praktyk te maak, is dit belangrik dat slegs inkomste en uitgawes en bates en laste wat betrekking op die praktyk het in die finansiële state gereflekteer moet word. Alle private inkomste, uitgawes, bates en laste behoort uitgesluit te word. Daarbenewens word belasting ook van die state uitgesluit, omdat die praktyk nie as 'n belastingpligtige beskou word nie. Die surplus van inkomste oor uitgawe is die inkomste van die praktisyn en is op dieselfde wyse belasbaar as die inkomste van enige ander salaristrekker.

Die resultate van 'n analise kry veel groter betekenis as hulle met dié van ander, soortgelyke bedrywe vergelyk word.

Die ontledingsmetodiek sal aan die hand van 'n hipotetiese voorbeeld gedemonstreer word.

GEVALLESTUDIE: FEITE- EN STATISTIESE GEGEWENS

Dr X is 'n algemene geneesheer wat op 'n plattelandse dorp met 'n bevolking van ongeveer 2 000 Blankes en 14 000 nie-Blankes praktiseer. Die ekonomiese bedrywighede van die bevolking bestaan hoofsaaklik uit boerdery, handel en ligte industrieë. Daar is nog 'n algemene praktisyn, sowel as 'n apteek op die dorp, maar geen hospitaal nie. Die naaste hospitaal is ongeveer 60 kilometer ver.

Behalwe die gewone diagnostiese apparaat is die spreekkamer van dr X met die volgende toegerus: Elektrokardiograaf, Roentgen-apparaat, Unitestsisteem, terwyl urine- en bloedtoetse, asook bakteriologiese toetse, daar uitgevoer word. Operasies word in die hospitaal 60 km ver gedoen, waar 'n ooreenkoms vir die nasorg van pasiënte bestaan. Geen kraamgevalle word onderneem nie. Daar is uitstekende geriewe vir die nie-Blankes in die opleidingshospitaal in die nabygeleë stad.

Dr X het 'n kritiese ontleding van sy praktyk gemaak, gebaseer op die werklike syfers vir die jaar eindigende 28 Februarie 1970, waaronder hy onder andere tot die volgende gevolgtrekkings geraak het:

(a) Dit sal vir hom moeilik wees om sy praktykuitgawes verder te besnoei.
(b) Daar is moontlikhede vir verhoogde inkomste, maar dit sal meer aandag vereis.
(c) Dit is slegs moontlik om die getal nie-Blanke pasiënte in sy praktyk te vergroot;
(d) Winste uit die voorsiening van medisyne is onontbeerlik.

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Tabel 1:

INKOMSTE- EN UITGAWEREKENING VIR DIE JAAR GEËINDIG 28 FEBRUARIE 1971

1970	INKOMSTE		1971	
R		R	R	R
20311	Blanke privaat-pasiënte			17 298
7651	Blanke mediese fonds-pasiënte			6 664
8911	Nie-Blanke praktyk			8 700
3078	Ander praktyk-inkomste			2 743
39951	TOTALE INKOMSTE			35 405
22673	MIN: TOTALE UITGAWES			22 558
7264	VASTE UITGAWES		8283	
600	Huur: spreekkamer	900		
27	Versekering: spreekkamer	32		
27	Kranse en blomme	36		
26	Tydskrifte vir spreekkamer	30		
167	Telefoon- en posbushuur	184		
52	Ledegelde	52		
507	Professionele voorsiening en bydraes aan verenigings	558		
161	Mediese handboeke en tydskrifte	75		
110	Motorlisensies en versekering	126		
128	Water en krag	140		
190	Huisversekering en rente (10%)	210		
1320	Salaris: ontvangsdame	1700		
192	Lone: Bantoe	240		
1260	Salaris: plaasvervanger	1500		
1172	Waardevermindering	980		
375	Bankkoste en rente	450		
45	Rekenmeestersfooie	60		
412	Slegte skulde afgeskryf	450		
300	Onthaalkoste en donasies	360		
193	Diverse vaste uitgawes	200		
15409	Veranderlike uitgawes		14275	
10035	Medisyne: Blankes	9500		
1790	Medisyne: Nie-Blankes	1900		
39	Suurstof en ander gasse	45		
48	X-straalbenodigdhede	60		
54	Verbande en hegmateriaal	60		
511	Laboratoriumreageermiddels en -toebehore	550		
46	Assisteerfooie	50		
90	Wasgoed	95		
623	Brandstof en olie	700		
533	Instandhouding van motorvoertuie	625		
391	Asiatiese griep-entstof	250		
24	S.A.I.M.A.	25		
10	S.A.M.A. vir aflospersoneel	10		
112	Vervoer van pakkette	115		
79	Seëls	90		
224	Drukwerk en skryfbehoeftes	200		
17278	PRAKTYKWINS			R12 847

HANDELSREKENING VIR MEDISYNE

	1970	1971		1970	1971
Openingsvoorraad	3847	5104	Verkope:		
Plus: Aankope	12092	10000	Blanke privaat-pasiënte	12329	10482
	15939	15104			
Min: Sluitingsvoorraad	5104	5604	Blanke mediese fonds-pasiënte	3956	3768
Koste van verkope	10835	9500			
Brutowins	5450	4750			
	R16285	R14250		R16285	R14250

Tabel 2:

BALANSSTAAT SOOS OP 28 FEBRUARIE 1971

1969	1970	BATES		1971	
6936	7049	VASTE BATES			6070
2536	3304	INSTRUMENTE		2974	
		-Saldo soos op 1/3/71	3304		
		Min: Waardevermindering (10 persent)	330		
550	665	MEUBELS		632	
		-Saldo soos op 1/3/71	665		
		Min: Waardevermindering (5 persent)	33		
3850	3080	MOTORS		2464	
		-Saldo soos op 1/3/71	3080		
		Min: Waardevermindering (20 persent)	616		
19371	21406	VLOTTENDE BATES			22106
14588	15702	-Praktyk-debiteure		16502	
3847	5105	-Medisynevoorraad		5604	
936	599	-Kontant en bank		—	
R26307	R28455	TOTALE BATES			R28176
18405	21744	KAPITAAL			17591
	18405	-Saldo soos op 1/3/71		21744	
	17278	Plus: Winste		12847	
	35683			34591	
	13939	Min: Onttrekkings		17000	
7902	6711	VLOTTENDE LASTE			10585
7902	6711	-Krediteure		7311	
—	—	-Oortrokke bank		3274	
R26307	R28455	TOTALE LASTE			R28176

Tabel 3: BLANKE PRIVAAT-PASIËNTE

Diens	1970				1971			
	Getal	Gem.	Bedrag	%	Getal	Gem.	Bedrag	%
		R	R			R	R	
Konsultasies	1 183	2,52	2 978	14,66	894	2,75	2 459	14,21
Besoeke	379	9,78	3 705	18,24	300	9,84	2 952	17,07
Medisyne met diens	1 254	4,40	5 523	27,19	1 149	4,70	5 400	31,22
Medisyne sonder diens . . .	1 608	4,23	6 806	33,51	1 271	4,00	5 082	29,38
Prosedures	198	4,01	795	3,91	180	4,50	810	4,68
Operasies	15	33,60	504	2,49	17	35,00	595	3,44
			R20 311	100,00			R17 298	100,00

Tabel 4: BLANKE MEDIESE FONDS-PASIËNTE

Diens	1970				1971			
Konsultasies	629	2,39	1 502	19,63	550	2,50	1 144	17,17
Besoeke	275	3,95	1 087	14,20	250	4,25	883	13,25
Medisyne met diens	653	3,49	2 282	29,83	600	3,50	1 930	28,96
Medisyne sonder diens	515	3,25	1 674	21,88	666	3,00	1 838	27,58
Prosedures	147	3,02	444	5,80	130	2,75	357	5,36
Operasies	21	31,52	662	8,66	16	32,00	512	7,68
			R 7 651	100,00			R 6 664	100,00

Tabel 5: ANDER PRAKTYK-INKOMSTE

Bron	1970			1971		
	Getal	Gem.	Bedrag	Getal	Gem.	Bedrag
		R	R		R	R
X-Strale	45	4,67	210	47	5,00	235
B.O.D.	21	10,03	211	18	10,00	180
Salaris M.G.B.			240			240
Inenting – Asiatiese griep	726	2,50	1 815	464	2,50	1 160
E.K.G.	49	4,00	196	80	4,70	376
Urine-toetse	97	4,18	406	130	4,25	552
			R3 078			R2 743
Nie-Blanke-praktyk						
Kontant ontvang	6 505	1,18	7 677	6 000	1,25	7 500
Vir rekening van Blankes	451	2,74	1 234	400	3,00	1 200
			R8 911			R8 700

Tabel 6: SAMESTELLING VAN TOTALE INKOMSTE

Bron	1970		1971	
	R	%	R	%
Blanke privaat-pasiënte	20 311	50,84	17 298	48,86
Blanke mediese fonds-pasiënte	7 651	19,15	6 664	18,82
Nie-Blanke-praktyk	8 911	22,31	8 700	24,57
Ander praktyk-inkomste	3 078	7,70	2 743	7,75
	R39 951	100,00	R35 405	100,00

Tabel 7: KREDIET- EN KONTANT-TERME

Diens	1970	1971
Blanke kredietdiens	30 052	26 177
Nie-Blanke kredietdiens	1 234	1 200
Totale kredietdiens	R31 286	R27 377
Blanke kontantdiens	986	528
Nie-Blanke kontantdiens	7 679	7 500
TOTAAL	R39 951	R35 405

Tabel 8: WERKSURE

1970	Gemiddelde werksure per week	= 43
1971	Gemiddelde werksure per week	= 40

BESPREKING

Die volgende vrae kan gestel word:

- Wat is die verduideliking vir die afname in winste van R17 278 in 1970 tot R12 847 in 1971?
- Waarom toon die balansstaat op 28 Februarie 1971 'n oortrokke bankrekening van R3 274, terwyl die praktyk in werklikheid 'n wins van R12 847 vir die jaar toon?
- Raak die praktyk-debiteure al hoe verder agterstallig in hul betalings?
- Hoe kan hierdie neiging teengewerk word?

ALGEMEEN

Met die oog op die feit dat die balansstaat van 'n onderneming die bates en laste van 'n onderneming op 'n spesifieke datum weerspieël, en deur die resultate van die voorafgaande periode beinvloed word, is dit verkieslik om die resultate van die inkomste- en uitgawerekening eerste te ontleed en te bespreek. Die inkomste- en uitgawerekening toon in watter mate die eienaar van 'n onderneming suksesvol was in die bereiking van sy hoofdoelstelling, naamlik om 'n wins te realiseer, of om 'n surplus inkomste oor uitgawes te toon.

INKOMSTE- EN UITGAWEREKENING

Watter inligting benodig 'n praktisyn uit sy inkomste- en uitgawerekening en bygaande statistiek wat vir hom tot hulp in die bestuur van sy praktyk kan wees? Indien sy state volledig is, behoort hy in staat te wees om die antwoorde op die volgende vrae daaruit te verkry:

(a) Wat was my wins en in watter rigting beweeg dit? Vermeerder dit of verminder dit?
(b) Was enige verandering die gevolg van 'n verandering in:
i) inkomste, of ii) uitgawe?
(c) Wat was die samestelling van my inkomste? Watter van die inkomste-elemente was onderworpe aan verandering en watter faktore beïnvloed hierdie veranderlike elemente? Wat kan gedoen word om hierdie invloede te beheer?
(d) Wat is die koste-elemente en watter poste is veranderlik? Watter faktore beïnvloed die veranderlike poste en wat kan gedoen word om hierdie faktore te beheer?

Die eerste vraag kan beantwoord word deur na die wins te verwys, soos dit in die inkomste- en uitgawerekening aangetoon word en dit met die wins van die vorige jaar te vergelyk. In verband met die tweede vraag is dit onmiddellik uit vergelykende inkomste- en uitgawerekening duidelik dat inkomste met R4 546 of 11,38 persent afgeneem het, en dat uitgawes met R115 of 0,51 persent gedaal het. Die hoofoorsaak vir die vermindering van die wins blyk dus die afname in die inkomste te wees.

Inkomste

In tabel 9 word die inkomste met dié van die vorige jaar ontleed en vergelyk.

kan word deur na die ooreenstemmende syfers van vorige jare te verwys. Indien dit 'n bepaalde tendens verteenwoordig, sal 'n poging aangewend moet word om die rede daarvoor te bepaal met die oog op toekomstige beplanning. Verwysing na tabel 3 bring aan die lig dat inkomste uit prosedure en operasies ten opsigte van Blanke privaat-pasiënte toegeneem het, maar dat konsultasies, besoeke en medisyne met diens sowel as sonder diens in waarde sowel as getalle afgeneem het.

Die belangrikste afname het in die voorsiening van medisyne voorgekom, naamlik R1 847, waarvan R1 724 ten opsigte van medisyne sonder dienste was. Besoeke het met R753 en konsultasies met R519 verminder. Hierdie verminderings kan 'n aanduiding wees van die toenemende populariteit van die ander mediese praktisyn in die gebied en van die plaaslike apteker. As die gemiddelde bedrag per geval dieselfde as in die vorige jaar gebly het, sou die totale afname in inkomste nog groter gewees het, aangesien die aantal gevalle ook gedaal het.

'n Interessante voorbeeld van die praktiese gebruik van statistiek sou wees om vas te stel of daar enige korrelasie tussen inkomste en ure gewerk bestaan. In 1971 het dr X gemiddeld 40 uur per week gewerk, vergeleke met 43 uur per week gedurende 1970. Hy is die mening toegedaan dat daar geen rede is waarom 'n mediese praktisyn langer ure moet werk as ander persone nie. Die ander praktisyn in die gebied het waarskynlik meer ure as dr X gewerk en het gevolglik daar-

Tabel 9: ONTLEDING VAN INKOMSTE VOLGENS TIPE PASIËNTE

Hoofbron van inkomste	1970		1971		Afwyking		% van totale afwyking
	R	%	R	%	R	% van vorige jaar	
Blanke privaat-pasiënte	20 311	50,84	17 298	48,86	−3 013	−14,84	66,28
Blanke mediese fonds-pasiënte	7 651	19,15	6 664	18,82	− 987	−12,90	21,71
Nie-blanke praktyk	8 911	22,31	8 700	24,57	− 211	− 2,37	4,64
Ander praktyk-inkomste	3 078	7,70	2 743	7,75	− 335	−10,88	7,37
TOTAAL	39 951	100,00	35 405	100,00	−4 546	−11,38	100,00

Hierdie tabel toon dat die belangrikste relatiewe afname, vergeleke met die vorige jaar, in die inkomste uit Blanke privaat-pasiënte voorgekom het, naamlik 14,84 persent, terwyl Blanke mediese fonds-pasiënte 'n daling van 12,90 persent getoon het. In absolute terme was die daling in inkomste uit die Blanke privaat-pasiënte, naamlik R3 013, egter die belangrikste. Hierdie daling in inkomste het nie minder as 66,28 persent van die totale daling van R4 546 bedra nie.

Die inkomste uit Blanke privaat-pasiënte was die belangrikste bron van inkomste, naamlik net minder as 50 persent, gevolg deur die inkomste uit die nie-Blanke praktyk en die Blanke mediese fondspasiënte.

Die syfers in die bostaande tabel toon dat die inkomste uit die nie-Blanke praktyk en die ander praktykinkomste in belangrikheid toegeneem het. Daarenteen het die relatiewe belangrikheid van die inkomste uit die Blanke privaat-pasiënte en die mediese fonds-pasiënte afgeneem. Of hierdie variasie, wat eintlik maar gering is, bloot toevallig is, en of dit 'n voortsetting van 'n tendens is, sal slegs vasgestel in geslaag om die omvang van dr X se praktyk te beperk. Daar moet ook op gelet word dat dr X se inkomste per uur van R17,87 in 1970 tot R17,02 in 1971 gedaal het. Ten opsigte van totale inkomste moet dit gemeld word dat dit waarskynlik verhoog kan word deur 'n meer effektiewe benutting van die beskikbare tyd en nie noodwendig deur meer ure te werk nie. Deur verbeterde kommunikasie met die spreekkamer, beter beplanning van konsultasies en behandeling in die spreekkamer en, waar moontlik, vooraf beplande besoeke met die doel om reistyd te verminder, kan 'n hoër inkomste per uur verkry word.

Tabel 3 toon verder dat dr X in 1971 60,60 persent van sy inkomste uit Blanke privaat-pasiënte van die voorsiening van medisyne gekry het, vergeleke met 60,70 persent in 1970. Medisyne speel ook 'n belangrike rol ten opsigte van inkomste uit Blanke mediese fonds-pasiënte, naamlik 56,54 persent in 1971 en 51,71 persent gedurende die vorige jaar. Hierdie syfers bevestig dr X se mening dat die verskaffing van medisyne onontbeerlik vir sy praktyk is, veral as dit in gedagte gehou word dat medisyne in 1971 nie minder nie as 40,25 persent en in die vorige jaar 40,76

persent tot sy totale inkomste bygedra het. Die verskaffing van medisyne aan Blanke pasiënte het egter in 1971 met R2 035 gedaal in vergelyking met die inkomste uit hierdie bron in 1970.

Die medisyne-handelsrekening, wat as deel van die inkomste- en uitgawe-rekening getoon word, dui aan dat die brutowins op medisyne met R700 in 1971 verminder het as gevolg van die daling van R2 035 in omset. Die persentasie brutowins op koste het slegs van 50,3 persent tot 50,0 persent gedaal en op omset van 33,5 persent tot 33,3 persent.

In tabel 10 word die inkomste ontleed volgens die tipe diens verskaf.

like koste word dan van elke rand bruto inkomste afgetrek om 'n bydrae (genoem marginale inkomste) tot delging van die vaste koste en wins te lewer. Die bepaalde bruto inkomste wat, ná aftrekking van die veranderlike koste, 'n voldoende bydrae lewer om slegs die vaste koste te dek sonder om 'n wins te laat, word die gelykbrekingspunt ('breakeven point') genoem.

In 1970 het die vaste koste in dr X se praktyk R7 264 bedra en in 1971 het dit tot R8 283 toegeneem, dit wil sê 'n toename van R1 019. Die gelykbrekingspunt kan gevolglik bereken word soos in tabel 11 aangedui.

Tabel 10: INKOMSTE VOLGENS TIPE DIENS

Diens verskaf	1970		1971		Variasies	
	Getal	R	Getal	R	R	%
Konsultasies (blankes)	1 812	4 480	1 444	3 603	– 877	–19,58
Besoeke (blankes)	654	4 792	550	3 835	– 957	–19,97
Medisyne (blankes)	4 030	16 285	3 686	14 250	–2 035	–12,50
Prosedure (blankes)	345	1 239	310	1 167	– 72	– 5,81
Operasies (blankes)	36	1 166	33	1 107	– 59	– 5,06
X-straal fotos	45	210	47	235	+ 25	+11,90
B.O.D.-gevalle	21	211	18	180	– 31	–14,69
Asiatiese griep-inspuitings	726	1 815	464	1 160	– 655	–36,09
E.K.G.	49	196	80	376	+ 180	+91,84
Urine-toetse	97	406	130	552	+ 146	+35,96
Nie-blanke praktyk	6 956	8 911	6 400	8 700	– 211	– 2,37
Salaris MGB	–	240	–	240	–	–
TOTAAL	14 771	39 951	13 162	35 405	–4 546	–11,38

Dit is duidelik dat die verminderde inkomste uit medisyne, besoeke (Blankes), konsultasies (Blankes) en Asiatiese griep-inspuitings hoofsaaklik vir die afname in totale inkomste verantwoordelik was. Die totale getal gevalle het met 1 609, dit wil sê met 10,89 persent, gedaal.

Uitgawes

Die uitgawe-poste is in vaste en veranderlike uitgawes verdeel. Vaste koste is daardie uitgawes wat relatief konstant bly afgesien van die volume werk wat gedoen word. In die geval van 'n mediese praktyk sal dit alle uitgawes van 'n herhalende aard insluit, wat konstant bly afgesien van die getal pasiënte. Uitgawes soos die salarisse van die ontvangsdame, huur van spreekkamers, ens., is voorbeelde van vaste koste.

Veranderlike koste daareenteen neig om te varieer in ooreenstemming met veranderings in die hoeveelheid werk gedoen. Reiskoste en voorraad is voorbeelde van hierdie soort uitgawes. Die veranderlike koste kan gewoonlik as 'n persentasie van inkomste uitgedruk word. Hierdie verhouding van veranderDit beteken dus dat 29,60 persent van die totale inkomste, of die inkomste van 108 dae, in 1970 nodig was om die vaste koste te dek voordat 'n wins getoon kon word. Dit beteken verder dat uit elke rand ontvang, 38,57 sent vir veranderlike koste uitbetaal was en dat 61,43 sent beskikbaar was om die vaste koste te dek en 'n wins te lewer nadat alle vaste koste gedek is.

As gevolg van 'n toename in spreekkamerhuur, telefoonuitgawes, water en elektriese krag, versekering, rentekoerse, salarisse en lone het die vaste koste in 1971 met R1 019 toegeneem. Dit het ten gevolg gehad dat die gelykbrekingspunt met R2 054 toegeneem het en dat in 1971 dus 39,20 persent van die totale omset, of ongeveer 143 dae se inkomste, nodig was om die vaste koste te dek. Elke rand ontvang het uit 40,32 sent veranderlike koste en 'n bydrae van 59,68 sent tot vaste koste en wins bestaan. Hoewel die veranderlike koste in 1971 met R1 134 gedaal het, het dit as 'n persentasie van die totale inkomste van 38,57 persent tot 40,32 persent toegeneem en tesame met die verhoogde vaste koste dui dit 'n verhoogde kostestruk-

Tabel 11: BEREKENING VAN GELYKBREKINGSPUNT

	1970		1971	
Totale inkomste	R39 951	100,00%	R35 405	100,00%
Min: Veranderlike koste	15 409	38,57	14 275	40,32
Marginale inkomste (bydrae om vaste koste en wins te dek)	24 542	61,43	21 130	59,68
Vaste koste	7 264		8 283	
Wins	R17 278		R12 847	
Gelykbrekingspunt d.w.s. die minimum wat hy moet verdien om nie 'n verlies te ly nie	7 264 ÷ 0,6143 =		8 283 ÷ 0,5968 =	
	R11 825	29,60%	R13 879	39,20%

tuur aan. Om dus dieselfde wins as in 1970 te behaal, dit wil sê R17 278, was dit nodig dat die totale inkomste in 1971 met R7424 moes toeneem (R4 431 = benodigde wins x $\frac{100}{59,68}$). Die totale inkomste sou dan R42 829 in plaas van R35 405 gewees het, en as die inkomste van die getal ure gewerk afhanklik is, sou dr X ongeveer 48 uur per week in plaas van 40 uur per week moes gewerk het. So nie, sou hy die moontlikhede om sy tyd meer effektief te benut, soos vroeër bespreek, moes ondersoek.

Veral ten opsigte van die veranderlike koste, kan die individuele uitgaweposte gekontroleer word deur elke pos as 'n persentasie van die totale inkomste uit te druk en dit met die persentasies van die vorige jaar te vergelyk.

BALANSSTAAT

Die balansstaat toon die finansiële struktuur van die onderneming op die laaste dag van die finansiële jaar. Aan die een kant toon dit die waarde van die belegging in die verskillende bates en aan die ander kant die bronne waaruit dit gefinansier is. Op 28 Februarie 1971 was R28 176 in die praktyk se bates belê, waarvan R6 070 in vaste bates, dit wil sê bates met 'n ekonomiese lewe van meer as 'n jaar, en R22 106 in vlottende bates, naamlik kontant en ander bates soos debiteure en voorraad, wat relatief maklik in kontant omskep kan word, gewoonlik binne 'n jaar. Van die R28 176 wat in bates belê is, het dr X R17 591 self voorsien, terwyl krediteure R10 585 bygedra het, waarvan R3 274 deur 'n bankoortrekking verkry was.

Inligting verskaf deur die Balansstaat

1. *Die balansstaat toon die belegging in bates.* Bates skep inkomste. Die belangrikste bate van 'n mediese praktyk verskyn ongelukkig nie in die balansstaat nie – die praktisyn self! As ons egter die ander bates oorweeg blyk dit dat meubels en toerusting nodig is om 'n inkomste te verdien en dat debiteure 'n noodsaaklike euwel is. Die vraag ontstaan nou hoe groot die belegging in bates behoort te wees?

Eerstens oorweeg ons vaste bates. In die algemeen kan gesê word dat, uit 'n besigheidsoogpunt gesien, beleggings in bates slegs die moeite werd is as dit 'n redelike inkomste skep. Moderne spreekkamers byvoorbeeld, lok meer pasiënte, of gespesialiseerde toerusting kan 'n toename in inkomste meebring. Die praktisyn kan sy beleid ten opsigte van belegging in bates evalueer deur die verhouding van totale inkomste tot totale bates te oorweeg. 'n Afnemende verhouding met 'n toename in inkomste dui 'n neiging tot oorkapitalisasie in bates aan.

In dr X se geval was die verhouding woos volg:

	1970	1971
Gelde	R39 951	R35 405
Bates	28 455	28 176
Verhouding	1,43	1,26

(L.W. Vaste bates alleen kan ook gebruik word).

In hierdie geval egter beteken die dalende verhouding nie noodwendig oorkapitalisasie nie, maar weerspieël slegs die effek van 'n dalende inkomste. Hierdie verhouding is slegs 'n aanduiding van wat in die verlede plaasgevind het.

Ten einde 'n redelike bate/omset-verhouding te handhaaf behoort die praktisyn sy beleggings in vaste bates vooruit te beplan.

Daar is twee soorte beleggings in vaste bates:

(i) Beleggings in toerusting wat noodsaaklik is vir die funksionering van die praktyk waarsonder die praktyk inkomste sou moes prysgee, en
(ii) beleggings in gespesialiseerde toerusting wat moontlikhede vir verhoogde inkomste skep.

Daar is verskeie benaderings tot hierdie soorte beleggings:

Gelykbrekingspuntontleding

Die doel van hierdie ontleding is om te bepaal of die toerusting op so 'n wyse benut kan word dat die gevolglike inkomste voldoende sal wees om die vaste koste te dek. Veronderstel die praktyk oorweeg die aankoop van toerusting vir 'n bedrag van R500. Die reagense benodig vir elke toets kos R1-00 en die praktisyn se fooi is R2-50 vir elke toets.

Inkomste per toets	R2-50
Koste per toets	R1-00
Bydrae per toets	R1-50

Die vaste koste van die toerusting per jaar (gebaseer op 'n gebruikstydperk van 5 jaar) is:

Afskrywing: $\frac{R500}{5 \text{ jaar}}$ = R100 per jaar.

Om hierdie jaarlikse afskrywingslas te dek is 'n totaal van $\frac{R100}{1,50}$ = ± 70 toetse per jaar nodig.

Indien daar egter slegs 70 toetse per jaar uitgevoer word, sal daar geen wins wees nie: totale inkomste sal gelyk wees aan totale koste. Om 'n redelike opbrengs op die belegging te verdien sal dus meer as 70 toetse per jaar uitgevoer moet word. As die praktisyn sê 20 persent op die belegging wil verdien, kan die berekening soos volg gedoen word:

Kapitale beleggings in die bate R500
Elke toets moet tot die delging van die belegging bydra.
Gemiddelde kapitaal in die toerusting belê = ½R250
Verlangde wins teen 20 persent = R 50 per jaar
Dus die jaarlikse bydrae uit die toetse moet voldoende wees om:

(a) 20 persent wins ..... = R 50, en
(b) Vaste koste van ..... = R100, d.w.s. 'n totaal van R150 per jaar te dek. Teen 'n bydrae van R1,50 per toets beteken dit $\frac{R150}{1,50}$ = 100 toetse per jaar.

Vlottende Bates

Die praktisyn het minder kontrole oor die beplanning van vlottende bates, waarvan die debiteure die belangrikste item is. Hy kan in 'n sekere mate besluit wat die bedrag is wat hy in vaste bates wil belê, maar hy kan nie die belegging in debiteure in dieselfde mate beplan nie. Hy het egter wel 'n mate van kontrole oor debiteure. Hy kan byvoorbeeld veranderings in die uitstaande bedrae bepaal deur die gemiddelde ouderdom van sy debiteure te bereken, d.w.s. die gemiddelde tyd wat sy debiteure neem om hul rekenings te betaal. Dit word deur gebruik van die volgende formule gedoen:

$$\frac{\text{Totale debiteure uitstaande}}{\text{Totale krediet vir jaar}} \times 365 \text{ dae}$$

In dr X se geval was hierdie syfers soos volg:

1970	1971
$\frac{15\,702}{31\,286} \times 365 = 183$ dae	$\frac{16\,502}{27\,377} \times 365 = 220$ dae

(Die kredietgelde is uit tabel 7 verkry).

Die gemiddelde ouderdom van sy debiteure het dus toegeneem, en dit beteken dat meer fondse in debiteure belê was en nie vir die praktisyn beskikbaar was nie.

Die feit dat die gemiddelde ouderdom toegeneem het dui daarop dat meer aandag aan kredietkontrole gegee moet word. Die gemiddelde ouderdom van die debiteure behoort op 'n maandelikse basis bepaal te word, aangesien dit die praktisyn in staat sal stel om enige ongunstige neiging vroegtydig raak te sien. Meer doeltreffende kontrole kan uitgeoefen word as debiteure in groepe verdeel word, byvoorbeeld privaat-pasiënte, mediese fonds-pasiënte, ens. Elke groep sal sy eie probleme hê, en deur elke groep individueel te kontroleer kan korrektiewe maatreëls effektief en betyds beplan word.

'n Nog meer doeltreffender metode bestaan daarin dat debiteure maandeliks in verskillende tydsgroepe verdeel word en die persentasie van die totale debiteure in elke groep bepaal word. So 'n ontleding sal 'n verandering in die betalingspatroon dadelik aantoon sodra dit voorkom. Hierdie debietsouderdomsontleding kan soos volg daar uitsien:

Blanke Privaat-pasiënte	Januarie		Februarie		Maart	
	Bedrag	%	Bedrag	%	Bedrag	%
Meer as 90 dae	*2 000*	*17*	*2 340*	*18*	*2 700*	*18*
60 – 90 dae	*6 000*	*50*	*6 760*	*52*	*8 100*	*54*
Minder as 60 dae	*4 000*	*33*	*3 900*	*30*	*4 200*	*28*
	12 000	*100*	*13 000*	*100*	*15 000*	*100*

Hierdie tabel toon 'n verskuiwing na 'n langer betalingstermyn aan. Die rede kan wees dat rekenings nie maandeliks uitgestuur word nie, of dat debiteure nie hul rekenings voor die einde van die maand ontvang nie. Debiteure wat 'n rekening ontvang nadat hulle reeds hul ander rekenings betaal het, laat gewoonlik so 'n rekening tot die end van die volgende maand oorstaan. 'n Ander rede kan wees dat daar nie 'n bepaalde prosedure bestaan vir die opvolging van onbetaalde rekenings nie.

2. *Die balansstaat dui ook die onderlinge verband tussen die bates en die bronne van finansiering aan.* Enige toename in dr X se bates kan slegs uit een van die volgende bronne gefinansier word:

(i) Die praktisyn se eie fondse:

  (a) Fondse deur hom uit sy privaat bronne inbetaal, d.w.s. kapitale bydrae deur homself; en
  (b) surplus wat in die praktyk bly nadat vir persoonlike trekkings voorsiening gemaak is.

(ii) Fondse deur krediteure voorsien:

  (a) Algemene krediteure.
  (b) Bankoortrekkings.

Indien hierdie onderlinge verband begryp word, is die antwoord op die vraag wat dikwels gestel word duidelik, naamlik: die inkomste-staat toon 'n wins, maar daar is 'n tekort aan kontant; wat het van die wins geword? Die inkomstestaat van dr X toon 'n wins van R12 847 in 1971. Daarbenewens toon sy balansstaat 'n batige banksaldo van R599 aan die begin van die jaar en 'n bankoortrekking van R3 274 aan die end van die jaar. Hoekom? Met 'n kennis van die onderlinge verband tussen bates en bronne van finansiering kan die posisie soos in tabel 12 ontleed word.

Tabel 12: BRONNE EN AANWENDING VAN FONDSE IN 1971
(Kontantvloeistaat)

Bronne van Fondse		
Wins	R12 847	
Plus afskrywing*	979	R13 826
Toename in krediteure (7311-6711)		600
Bank (afname in kontant en toename in bankoortrekking)		3 873
		R18 299
*Op instrumente	R330	
op meubels	33	
op motorvoertuig	616	
	R979	
Aanwending van Fondse		
Toename in debiteure van R15 702 tot R16 502		R 800
Toename in voorraad medisyne (R5 604 – R5 105)		R 499
Trekkings		R17 000
		R18 299

In hierdie geval kan die tekort toegeskryf word aan die feit dat dr X meer uit die praktyk getrek het as die wins. As hy dieselfde bedrag as sy wins getrek het sou hy 'n batige banksaldo van R879 gehad het, nieteenstaande die feit dat die voorraad medisyne en debiteure R1 299 van die ontvange fondse geabsorbeer het. Hierdie onderlinge verband moet dus altyd by finansiële beplanning in gedagte gehou word.

3. *Die balansstaat toon ook die verhouding van eie kapitaal tot laste aan.* 'n Goeie finansiële toestand veronderstel 'n redelike verhouding tussen die fondse deur die eienaar voorsien en die fondse deur die krediteure voorsien. 'n Buitestaander, soos 'n bankbestuurder, sal nie bereid wees om krediet aan 'n onderneming te verleen waarin ander krediteure reeds meer fondse belê het as die eienaar self nie. Die risiko verbonde aan 'n lening word deur voornemende krediteure ge-evalueer, deur die verhouding van eie kapitaal tot bestaande leningskapitaal te oorweeg.

Beskou die volgende twee situasies:

PRAKTYK A

Kapitaal dr. Y	R20 000	Vaste bates	R 5 000
		Vlottende bates:	
Bankoortrekking	R10 000	– Debiteure	R25 000
	R30 000		R30 000

PRAKTYK B			
Kapitaal Z	R 5 000	Vaste bates	R 5 000
		Vlottende bates:	
Bankoortrekking	R25 000	– Debiteure	R25 000
	R30 000		R30 000

SLOT

Deur analises van bostaande aard korrek deur te voer kan die vinger op die pols van die praktyk gehou word en die nodige voorkomende en korrektiewe maatreëls betyds getref word.

Veronderstel dat, as gevolg van 'n ernstige droogte, R10 000 van die debiteure nie ingevorder word nie. In praktyk A verminder die bates dan met R10 000 tot R20 000, en die kapitaal van dr Y tot R10 000, aangesien die eienaar die verlies eerste dra. Die bank dra geen verlies nie. In praktyk B kan dr Z slegs die helfte van die verlies dra en die bank moet die ander helfte dra as die praktyk tot niet gaan.

THE LAW RELATING TO THE VETERINARY PROFESSION*

S.G.M. BAM**

SUMMARY

The status of the Veterinary Board relative to professional conduct and the laws and regulations, pertaining to animals, under Common and Statute Law in South Africa are outlined.

The law relating to the practice of any learned profession cannot possibly be known by any one. No one knows the whole law: it is too extensive for any one to know. What a legal practitioner of experience can say is that, because his work has related to certain branches of the law, he has specialized – to an extent at any rate – in that field. Practising law is similar to that of growing a tree, one's system becomes imbibed – saturated perhaps – in the subject in which the lawyer practises. The greater the degree of concentration and repetition, the more certain is the lawyer of the correctness of his opinion. Dealing with legal opinions, one of the truest sayings which I have heard is that a legal opinion is worth what you pay for it. Any 'off the cuff' statement of the law is highly dangerous to accept.

The practice of veterinary science is governed by the Veterinary Act, No. 16 of 1933, which Act has been amended twice, namely, by the Veterinary Amendment Act, No. 49 of 1963, and by the Veterinary Act, no. 19 of 1972. To a large extent the provisions of the Act were based on those of the Medical, Dental and Pharmacy Act, no. 13 of 1928, as amended.

Disciplinary powers are vested in the Veterinary Board, which has the power under section 14 to enquire, with the approval of the Minister†, into any complaint, charge or allegation of improper or disgraceful conduct. The penalties are prescribed by section 15. On the question of the powers of the Veterinary Board, I quote from the leading case of *Groenewald vs the South African Medical Council,* 1934 T.P.D. 404, which, after almost 40 years, has not been departed from in our law –

> '. . . They are the custodians of the honour and rectitude of the profession, it is left to them to say to what standard of honour the members of the profession should conform, and much depends upon their opinion whether the standard of personal and professional honour of its members is a high one or not. Where, therefore, in their opinion, the conduct of a member is a fit subject for inquiry and punishment, a court of law should be slow indeed to substitute its opinion for that of the Council. On the contrary, where it is found that the Council have inquired into and inflicted punishment for conduct which, in their collective opinion, they deem to be improper or disgraceful, and there is nothing to suggest that their opinion was come to unreasonably, and there is nothing moreover to show that in coming to a conclusion they acted capriciously or *mala fide,* the Court should not interfere.'

I know of no case which has come before our Courts relating to the administration of its powers by the Veterinary Board. This says a great deal for either the Board or its members or both.

The Board has issued a pamphlet, which you all have, called 'Guide to Professional Etiquette'. The guiding principles on which a veterinarian should base his personal and professional conduct are set out in the preamble to the code. Its contents, its principles, apply to any noble profession. Mention might be made of item (b), i.e. all veterinarians should endeavour to make themselves fully conversant with the various laws affecting themselves and their work as veterinarians and should, as far as lies in their power, assist in carrying out those laws. There are numerous laws directly affecting veterinarians, as I shall mention later. The latter part simply means that a veterinarian is expected to be loyal in the widest sense.

Advertising naturally plays a big part in the Rules. Any professional man knows that he is not allowed to advertise. How many understand the basic reason? I quote from an old publication by two English barristers, Sanderson and Rayner: 'An Introduction to the Law and Tradition of Medical Practice,' p. 26.

> 'In medicine, as in the other honourable professions, advertising is strictly forbidden. The objection to advertising is based on a principle of ancient application, embalmed in the proverb "Good wine needs no bush." To advertise is "to attempt to get practice by other than the legitimate means of proficiency in his profession and skill or success in dealing with patients." It is vicious because it is an appeal to the ignorance of public opinion, which has no access to any standard of judgment in specialities. The reputation which a scientist may get by writing in papers with a circulation among non-scientific readers is built upon a false foundation, which differs fundamentally from the basis of a reputation among the learned which is gained by thorough workmanship. Thus it is considered advertisement for a medical man to write signed articles in lay papers, or to have his books advertised or reviewed in lay papers, or to have his portrait published in them. It is an entirely different matter if these things are done in a medical journal, such as The Lancet. Probably the principal objection of the honourable professions to advertisement is neither the fact that it misleads the ignorant nor that it is an unfair method of competition, but the indication it affords of a character who is more concerned with exploiting the profession for his own personal advantage than with the service to be rendered

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** Reprint requests to the SAVA, P.O. Box 2460, Pretoria, 0001.

†This clause will be repealed in the proposed further amendment to the Act (see page 234 of this issue).

to society. The last is the reason why all honourable men set their faces against advertisement, knowing that the professional man has many times to risk losing his reputation in the conscientious service of patients.'

In dealing with the subject of advertising in the medical profession, one's mind quite understandably goes to Christian Barnard. After performing a feat which was unparalleled in the history of medicine, he got, no doubt quite innocently on his part, publicity in the lay press which was quite out of keeping with the status of a scientist of his calibre. This publicity snowballed to such an extent that it has rebounded to his discredit. Instead of people hailing him, as they did at the outset, as a hero, the general comment to-day by the public is rather one of discredit. The Barnard case may be unique, nevertheless it illustrates only too well the fickleness of public opinion.

What is veterinary science? It deals with the anatomy, physiology and pathology of animals other than man. There is no time available on which to expand. Basically, then, before a person takes up the profession of veterinarian, he must have a love for animals. His motivation is essentially of a very high order of public service in its widest sense. Profit-making and material gain is an aspect of the life of a veterinarian which must be set aside. It is not surprising, therefore, to find that veterinarians are usually persons of the highest moral character, persons who are prepared to devote their entire lives to their subject. A bare living in an inflationary age is all that is asked and obtained. The character of veterinarians is evidenced by the few disciplinary matters which have to be dealt with by the Veterinary Board. And what is more, I know of no single instance in which a decision of the Board has been challenged in the Supreme Court.

Research plays a tremendous part in the activities of veterinarians. It is indeed gratifying to know the world-wide status of Onderstepoort.

To understand the law relating to veterinary practice, one must go into the history of animal doctors from the ealiest times. Veterinary science flourished in ancient India, where separate treatises on the diseases of horses and elephants were written. There were hospitals for various species of animals. The legal code of the Babylonian king Hammurabi (c. 1800 B.C.) prescribed the fees for 'doctors of asses and oxen', and the Egyptian papyrus of Kahun (c. 1900 B.C.) gave prescriptions for diseases of dogs and cattle. The ancient Greeks had a class of *hippiatroi* (literally, 'horse-doctors') and a number of writers such as Hippocrates, Xenophon and Aristotle gave consideration to the treatment of animal diseases. The word *veterinary* comes from the Latin *veterinarius*, 'pertaining to beasts of burden'. The armies of the later Roman empire had a veterinarium or 'hospital for sick and wounded horses.' Chief among the Byzantine veterinarians was Apsyrtus (A.D. 330) whose writings mark him as the father of veterinary medicine. It was not until the 18th and 19th centuries that veterinary schools were established. The profession rapidly regained its lost status and its development closely paralleled that of medicine. Human and animal medicine came to be regarded as complementary. And from the legal aspect, we find that the same principles which apply to the medical profession apply to the veterinary profession.

Preventative veterinary medicine and control measures are of great economic importance to animal breeders, farmers and the general public. Methods of control to prevent the spread of diseases amongst animals have to be available. For this reason, there are a large number of Acts of Parliament, with accompanying regulations, which have been passed to enable control to be enforced; these are dealt with later.

Public health aspects require the discipline and attention of many veterinarians, medical practitioners, research workers and administrators. There are diseases transmissible between animal and man; there are more than 80. This fact by itself requires legislation to control the spread of disease between animal and man.

Dealing with animals, our common law, i.e. our law other than Statute Law, contains, as is to be expected, a great deal relating to animals. To mention a few:–

The *actio de pauperie.* This back to Roman Law. The action was maintainable only in respect of harm done by an animal acting contrary to the nature of its class – *contra naturam sui generis* – that is to say, under excitement or (from) vice which was contrary to the nature of such animals. The basis of liability was ownership.

The *actio de pastu.* In Roman Law a person could recover compensation by a special action – the *actio de pastu* – for damage done to his land by a domesticated animal trespassing thereon.

Action based on the *Aediles' Edict.* The aediles' edict prohibited the keeping of wild beasts or other animals dangerous to mankind in the vicinity of a public place or thoroughfare, either loose or so chained as not to prevent their doing harm.

Action under the *lex aquilia* is the appropriate remedy for (1) harm done by a domesticated animal falling outside the scope of the pauperien action and the *actio de pastu,* and (2) harm done by a wild animal falling outside the scope of the aedilitian action.

Unattended cattle or other livestock straying on to the highway. In our law, farmers or other persons in control of domestic animals are under a duty to take reasonable precautions to ensure that their animals do not wander off their land on to a public road and thus become a source of danger to motorists or other persons using the road.

Our Statute Law relating to *animals* deals mainly with the protection of animals and the preservation of the fauna of the Republic, as well as with animals generally.

To itemize, I mention:–

Angora Goat Export Prohibition (Repealing) Act, No. 17 of 1922. – This Act repealed Act No. 34 of 1908 (Cape); Act No. 29 of 1908 (Natal); Act No. 6 of 1908 (Orange Free State) and Act No. 24 of 1908 (Transvaal), all of which probibited the export of angora goats beyond the limits of the respective Provinces.

Livestock and Meat Industries Act, No. 48 of 1934, as amended by Acts No. 49 of 1946, No. 74 of 1963 and No. 52 of 1969. – This Act established a Livestock and Meat Industries Control Board and provided for a levy on slaughtered stock.

Many of the original provisions of the Act are superseded by the provisions of the Livestock Improvement Act, No. 74 of 1963.

By section 22(3) of the Marketing Act, No. 26 of 1937, if a scheme is published under that Act relating to any product under the control of the Livestock and Meat Industries Control Board, the State President may, by Proclamation in the Gazette, suspend any provisions of Act No. 48 of 1934 which, in his opinion, are inconsistent with the provisions of the scheme, during the period the scheme is in operation.

Performing Animals Protection Act, No. 24 of 1935, as amended by Acts No. 62 of 1955 and No. 7 of 1972. – This Act prevents the exhibition or the training of any animal unless a licence is first obtained.

Dongola Wild Life Sanctuary Repeal Act, No. 29 of 1949. – This Act repealed the Dongola Wild Life Sanctuary Act, No. 6 of 1947 which had established a native sanctuary in the valley of the Crocodile or Limpopo River in the Transvaal.

Artificial Insemination of Animals Act, No. 23 of 1954, as amended by Acts No. 26 of 1957, No. 70 of 1959, No. 56 of 1962 and No. 36 of 1969. – This Act provides for the control of the artificial insemination of animals which include cattle, sheep, goats, horses, pigs and any other class of animals to which the State President, by proclamation, may apply the Act.

Animal Diseases and Parasites Act, No. 13 of 1956, as amended by Acts No. 18 of 1967, No. 70 of 1968, No 51 of 1969 and No. 46 of 1970. – This Act consolidates the law relating to animal diseases and parasites. It repealed the Diseases of Stock Act, No. 14 of 1911, and amendments to that Act and also repealed the Cape Province Cattle Cleansing Act, No. 11 of 1910.

Registration of Pedigree Livestock Act, No. 28 of 1957, as amended by Act No. 27 of 1962 and Act No. 1 of 1967. – This Act consolidated the laws relating to the incorporation of the South African Stud Book Association and of societies affiliated thereto. It also deals with the registration and the publication of records of the pedigrees of farm livestock. It repealed the Registration of Pedigree Livestock Act, No. 22 of 1920, and amendments to the Act.

Animals Protection Act, No. 71 of 1962, as amended by Acts No. 7 of 1972 and No. 102 of 1972. – This Act consolidated and amended the laws relating to the prevention of cruelty to animals. It repealed the Prevention of Cruelty to Animals Act, No. 8 of 1914 and the amendments to that Act.

Livestock Brands Act, No. 87 of 1962. – This Act consolidated and amended the law relating to the branding of livestock.

The Act repealed a number of pre-Union Acts which had previously dealt with this subject.

Prohibition of Export of Ostriches Act, No. 18 of 1963. – This Act prohibits the export of any ostrich from the Republic without the authority of a permit.

The Act repealed the pre-Union statutes which previously dealt with this subject.

Livestock Improvement Act, No. 74 of 1963. – This Act provides for the improvement of livestock and for the regulation of the import and export of breeding stock.

Wild Birds Protection and Export Prohibition Laws Repeal Act, No. 6 of 1967. – This Act repealed the Wild Birds Protection Act, No. 22 of 1934, and The Wild Birds Export Probibition Act, No. 18 of 1959.

The Abattoir Commission Act, no. 86 of 1967. – This Act provides for the establishment of a commission to deal with and exercise control over all matters in connection with abattoirs.

Animal Slaughter, Meat and Animal Products Hygiene Act, No. 87 of 1967, as amended by Act No. 36 of 1972. – This Act provides for the maintenance of proper standards of hygiene in the slaughtering of animals and the handling of meat and animal products. It also makes provision for the prevention of the transmission of diseases to humans and animals by diseased or infected animals, meat or animal products and also for the prevention of cruelty in the slaughtering of animals at abattoirs. The Act also controls the importation of certain meat. This Act repeals the Slaughter of Animals Act, No. 26 of 1934, and the Slaughter of Animals Amendment Act, No. 4 of 1956.

Control of the Meat Trade in South-West Africa Amendment Act, No. 69 of 1972. – This Act amends Ordinance No. 20 of 1962 of South-West Africa which deals with the control of the meat trade in that territory.

In conclusion I must make a few generalizations on the life of a scientist as seen through the eyes of a lawyer. May I ask you all to remember you are scientists: your mental horizon is far higher than that of the average go-getting businessman. Leave the get-rich-quick methods to the businessman. If you have to enter into any contracts, get a reliable lawyer to look after your interests. Take out a policy of insurance to protect you against any claims which might be made against you, based or allegedly based on negligence. Do not sign guarantees for your friends or for any other people. By all means assist your fellow man: send him money, give it to him; but do not sign as surety; if you do so, you may be called upon to pay when you are least able to do so. Invest your savings wisely: bear in mind the erosion of money which is taking place continuously. If you invest in shares, do not act on 'tips'; get the best advice from the best people and, last but not least, do *not* leave your scrip in the hands of a broker.

May I pay homage to the great scientists who have given our country a world reputation in the field of veterinary science, to mention a few names known to me: Theiler, P.J. du Toit, de Kock, Alexander, Jansen and many others, some of whom are present here today.

INFORMATION – PRODUCTS

INLIGTING – MIDDELS

HABAN

A new preparation launched by Dales Pharmaceuticals Ltd., is described as a deterrent controlling a very wide number of indications ranging from feather-pecking in poultry to the damage by rodents to bags of farm feed. Also quoted as examples of its use are crib-biting in horses, navel-sucking in calves, tail-biting in pigs, dustbin scavenging by dogs and furniture damage by cats.

The product, Haban, claimed to be the only one of its kind, is available in aerosol form. It is planned to produce it as as a micronized powder, and a long-acting powder of use as a paste after mixing with water. Haban is a clear, colourless, non-staining and non-toxic powder.

Other uses have already been found for the product. One application has been the treatment of young fir trees in England and Scotland to prevent attacking by deer. Among the trials by the makers was a test on sacks in a street where rats normally gnawed open sacks containing household refuse. The Haban treated sacks were said to be the only ones not damaged in one week, where all other repellents tried proved inneffective.

Further details can be obtained from Dales Pharmaceuticals Ltd., Steeton, Keighley, Yorkshire.

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FLUCTUATIONS IN PITUITARY FSH AND LH IN THE NORMALLY CYCLING AND IN THE ANOESTROUS ANGORA GOAT*

P.S. PRETORIUS**

SUMMARY

Pituitary FSH and LH activity increased continuously during the luteal period (Day 1 to Day 18) in the cycling female goat. FSH levels attained a maximum value during early oestrus (Day 0), while LH activity had already reached its highest level at pro-oestrus (Day -1). Following these high pre-ovulatory levels, a sharp drop in both FSH and LH in the pituitary occurred towards late oestrus (Day 1). During the period of anoestrus, gonadotrophin levels equalled those recorded during the mid- and late luteal periods in the cycling female. Gonodotrophin hormone activity is discussed in relation to ovarian follicular activity in the doe.

INTRODUCTION

Studies by Van Heerden [21] and Van Rensburg [23] revealed an apparent weakness in the endocrine mechanisms of the Angora goat which culminated in various aberrations from the normal reproductive pattern. Apart from the abnormal periodicity and duration of oestrus, embryonic resorption and foetal abortion were the more serious reproductive problems encountered in this species. These dysfunctions seemed to have an hormonal basis which could be traced back to the pituitary gland. Nevertheless, the pituitary-endocrine relationships in this breed of goat have been subjected to speculation only. Generalizations on the chronological and cyclical production and release of pituitary gonadotrophins and their effect on the target organs cannot be extrapolated to apply to the reproductive disorders experienced in the Angora goat with any certainty. Species differences do occur and the normal pattern of a particular species must be investigated before the deviation therefrom in individuals of lowered reproductive efficiency can be evaluated and understood.

As no comparable data are available on the pituitary gonadotrophin levels in the Angora goat with normal reproductive function, and owing to the special fertility problems experienced in this goat breed, an investigation on the pituitary gonadotrophic hormone activity during different reproductive phases in the normal animal was undertaken. The object of this paper is to report on the pituitary FSH and LH activity in the cycling animal, as well as during anoestrus.

PROCEDURE

Animals and Reproductive Stages

Angora goats displaying normal periodicity of oestrus [13] were slaughtered, six each at the following reproductive stages: pro-oestrus (Day -1); early oestrus (Day 0; 4 h following onset of behavioural oestrus); late oestrus (Day 1: 36 h following onset of oestrus); early luteal stage (Day 6); mid-luteal (Day 12); and late luteal stage (Day 18). Five animals were slaughtered during the early and middle stages of anoestrus, and six during late anoestrus, the date of slaughter being determined by the onset, exact mid-period and end of the previous anoestrus period. Oestrus was detected with the aid of vasectomized teaser Angora rams. The does were slaughtered at the local abattoir, situated some 320 km away from the feeding pens. Care was taken not to subject the animals to any conditions of stress prior to slaughter.

Collection of Pituitary Glands

Pituitary glands were removed intact from the cranial cavity within 10 minutes of death and deep-frozen. After thawing and cleaning of the gland, the posterior part was removed. The anterior pituitary was subsequently weighed and preserved in cold acetone according to the method described by Melampy, Henricks, Anderson, Chen & Schultz[6]. The acetone-dried anterior pituitary glands were ground to a fine powder and stored in a desiccator at approximately 4°C. Before bio-assay, the pituitary powder was homogenized in cold 0,9 per cent saline and diluted to the desired concentration. Pituitaries of animals in the same reproductive stage were pooled in order to provide sufficient material for repeated bio-assay.

BIO-ASSAY

(i) Follicle Stimulating Hormone (FSH)

Pituitary FSH activity was determined by the HCG-augmentation assay of Steelman & Pohley[20]. Intact immature female Sprague-Dawley rats, 21 to 22 days of age, received pituitary homogenate subcutaneously, twice daily, over a period of three days. A total dose of 16 mg pituitary material in 3 m*l* 0,9 per cent saline (6x0,5 m*l*) was administered to each rat. The augmentation dose was 25 IU HCG (Lutormone, Buroughs Wellcome & Co.) per rat, which was added *in vitro*. Control rats received HCG alone. Five rats were employed in each group. At necropsy on the fourth day, 72 h after the first injection, the extirpated ovaries were cleaned and weighed. FSH activity was expressed as the percentage increase in ovarian mass over that of the HCG control animals.

(ii) Luteinizing Hormone (LH)

LH activity was determined by the ovarian ascorbic acid depletion method of Parlow [9,10]. Some minor modifications in the standard pre-treatment procedure for the rats were adopted. Younger rats were used at the start of the assay, and two PMS injections, instead of one, were given during the pre-treatment of the rats.

Intact, immature female Sprague-Dawley rats, 23 to 24 days of age, each received subcutaneous injections of 30 IU pregnant mare serum (PMS) (Burroughs Wellcome & Co). A second PMS injection

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(30 IU) was administered 45 h later. Sixty-five hours after the last PMS injection, 25 IU HCG (Lutormone, Burroughs Wellcome & Co.) were administered to each rat. The rats were used for assay eight full days following HCG administration. At the time of assay the rats were lightly anaesthetized and the test solutions (pituitary homogenate) injected intraperitoneally[8] in a single 0,5 m*l* dose. Pituitary material was administered at a dose of 0,8 mg per rat.

The rats were killed three hours after the intraperitoneal injection and both ovaries were removed, cleaned and weighed. Ovaries weighing less than 70 mg each were discarded. Both ovaries were homogenized in a mortar and pestle in 10 m*l* ice cold 2,5 per cent freshly prepared metaphosphoric acid and filtered. Ascorbic acid concentration was determined in the clear metaphosphoric acid filtrates by the method of Mindlin & Butler . Pituitary LH activity was expressed as per cent ovarian ascorbic acid depletion over that of control animals.

Statistical Analysis

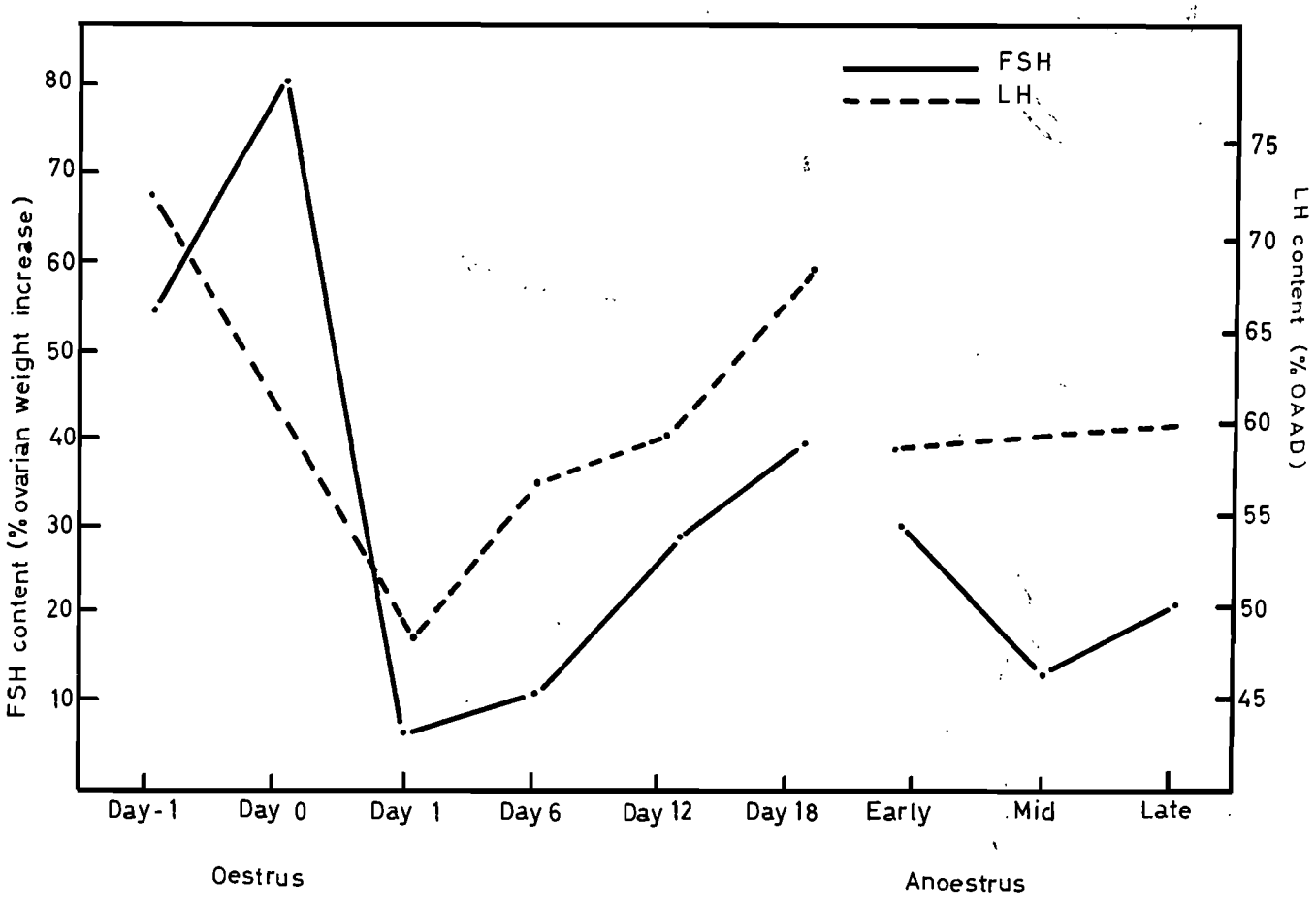
Standard statistical procedures [19] were employed in analysing the experimental results. In dose-response assays, lambda values were calculated according to the method of Bliss[1] and compared with the values of Loraine[4] for acceptability.

RESULTS

Follicle Stimulating Hormone

According to the figure, a considerable and statistically significant ($P \leq 0,05$) increase in pituitary FSH content ocurred from pro-oestrus (Day -1) to early oestrus (Day 0). Maximum FSH activity was recorded 4 h following the onset of oestrus (Day 0). From the pre- to the immediately post-ovulatory stage of the cycle (Day 0 to Day 1), which constituted a period of only some 32 h, a large and highly significant ($P \leq 0,01$) drop in FSH activity of the anterior pituitary occurred. A low, minimum level for the oestrus cycle was recorded at the late oestrus stage (Day 1). Following this post-ovulatory level, a small but non-significant increase in FSH activity was recorded during the first six days of the luteal period (Day 1 to Day 6). From Day 6 to Day 8 of the cycle, FSH activity increased more rapidly to attain a highly significant ($P < 0,01$) higher value at Day 18 than on Day 1. This rise in pituitary FSH activity continued through pro-oestrus of the next cycle (Day -1) until early oestrus (Day 0).

Relatively low values for pituitary FSH activity were observed in females slaughtered during the period of anoestrus (Fig.). From early to mid-anoestrus a decline in FSH activity was recorded, to be followed by a slight increase towards the end of anoestrus. The mean value for FSH activity of anoestrus was considerably lower ($P < 0,01$) than the mean value recorded for the oestrous cycle. The levels of pituitary FSH activity during anoestrus resembled those of the second half of the luteal period, but were considerably lower than the levels recorded around the occurrence of oestrus (Fig.).



Luteinizing Hormone Activity

Following maximum activity during pro-oestrus (Day -1), a sharp drop ($P<0,01$) in pituitary LH level was recorded (Fig.). This decrease continued through early oestrus (Day 0) to attain a minimum level for the cycle during late oestrus (Day 1). Following this low level during the immediately post-ovulatory stage of the cycle, a continuous and highly significant increase ($P< 0,01$) in LHactivity was recorded during the whole luteal period (Day 1 to Day 18). This increase was more rapid during the first (Day 1 to Day 6) and last third (Day 12 to Day 18) of the luteal period than during the middle period (Day 6 to Day 12). From the late luteal phase of the cycle (Day 18) until pro-oestrus of the subsequent cycle (Day -1) a further increase in pituitary LH activity was evident to attain a maximum level for the cycle (Fig.).

The figure also indicates that pituitary LH activity was maintained at a nearly constant level during the period of anoestrus. Although small differences in value were found between the levels at various phases of anoestrus, a slight tendency to increase on the part of LH activity was noticed as anoestrus advanced. Pituitary LH levels during anoestrus were comparable to those of cycling females during the mid-luteal phase (Day 12).

DISCUSSION

The rapid decrease in both FSH and LH activity of the anterior pituitary some time immediately prior to the onset and end of behavioural oestrus seemed to indicate that FSH as well as LH played an active part in the induction of oestrus and ovulation in the cycling Angora goat. These rapid changes in gonadotrophin levels presumably indicated a massive release of both these hormones from the pituitary during a period of only a few hours. It did not, however, exclude the possibility that these sudden changes in pituitary gonadotrophin activity might be superimposed on a background of a steady release of one or of both these hormones during the cycle, as a continuous increase in both FSH and LH activity was recorded during the inter-oestrous period of the cycle.

The cyclic changes in the ovarian follicular system of the Angora goat reported earlier on by Pretorius [12] fit in well with the presently recorded changes in pituitary gonadotrophin activity. The increase in pituitary gonadotrophin activity during the luteal period was accompanied by considerable ovarian follicular growth, which reached a maximum towards pro-oestrus, to be followed by ovulation. These observations in the Angora goat concur with the fairly well-established cyclic variation in pituitary gonadotrophin content in other species of domestic animals. Some differences in the time sequence of release, however, do seem to occur [2 11 15 16 18].

The release of FSH and LH from the pituitary did not seem to be synchronous in the Angora goat. A decline in LH was evident some time before that recorded for FSH. A decrease in LH activity was already noticed at pro-oestrus, whilst an increase in FSH activity still occurred at that stage. A dramatic release of FSH did not seem to occur until commencement of oestrus. Differences in the times at which pituitary gonadotrophins are released were also reported in sheep by Robertson & Hutchinson [16] and by Robertson & Rakha [17]. In these studies, FSH was released a few hours before LH. The difference in results of the present study and the accepted time sequence in release of FSH and LH in other animal species could be explained on the basis that some of our experimental goats might have experienced a relatively short period of pro-oestrus and that they were very close to, or actually in oestrus, when killed. According to Marincowitz [5], pro-oestrus lasts for an average period of 1,6 h in the Angora goat, but may vary from 0 to 8 hours. If this were the case, it might be inferred that the release of both FSH and LH occurred approximately simultaneously. Nevertheless, the possibility that an early release of LH from the pituitary might be a normal feature in the Angora goat cannot be excluded and could possibly be related to the phenomenon of cystic ovarian follicles in the doe reported by Van Rensburg [22] and by Pretorius & Van der Westhuizen [14]. Luteinization seemed to have commenced before ovulation occurred.

Pituitary gonadotrophin levels in the anoestrous goat equalled those recorded during the second half of the luteal period in the cycling female. Ovarian follicular activity, however, was considerably less during anoestrus than during the late luteal stages of the oestrous cycle [12]. Nevertheless, large individual follicles were present in the ovaries of anoestrous females. It appears that only enough gonadotrophin is released by the pituitary to maintain the size of the larger follicles, while the smaller ones undergo atresia. These observations are in agreement with those of Robertson & Hutchinson [16] in sheep. On the other hand, Warwick [24] and Lamond, Radford & Wallace [3] did not observe differences in pituitary gonadotrophin content between the breeding and non-breeding season in sheep. Kammlade *et al*[2] reported even higher pituitary gonadotrophin values in sheep during the anoestrous period compared to the breeding season.

It thus appears that the synergistic action of both FSH and LH from the pituitary is responsible for the cyclic ovarian changes in the Angora doe and ultimately leads to oestrus and ovulation.

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INFORMATION — INLIGTING

VACCINE AGAINST ELEPHANT SKIN DISEASE (BESNOITIOSIS)

The Director of the Veterinary Research Institute, Onderstepoort, announced the release of the abovementioned vaccine as from 18.2.1974.

It is a live vaccine which consists of a strain of *Besnoitia besnoiti* of blue wildebeest origin grown in tissue culture. The dose is 2 m*l* administered by the subcutaneous route. A localized transitory swelling may occur at the inoculation site and the regional lymph node may enlarge temporarily. A mild febrile reaction sometimes occurs 7 to 10 days after vaccination.

Cattle may be vaccinated at any age. Since the disease rarely occurs in young calves, it is recommended that calves be vaccinated at weaning age. Pregnant cows and bulls may be vaccinated. The best time to vaccinate is in winter, when few cases of elephant skin disease occur.

Immunity develops approximately 4 weeks after vaccination and lasts at least 2 years, possibly life-long. Field observations on the duration of immunity extend over 2 years and no indication of a reduction in the protective effect has been observed. In most cases a single injection will therefore probably convey life-long protection. Particularly valuable animals, such as bulls, however, may be vaccinated annually. The vaccine has no protective effect if given during the incubation period of the disease. In this respect it should also be borne in mind that it may take as long as 8 weeks before an animal with elephant skin disease develops the typical symptoms.

Vaccine is only manufactured on order. Because it is technically difficult to make the vaccine, orders must be placed well in advance of the date of requirement. Vaccine is manufactured weekly on Monday, (or Tuesday, if Monday is a public holiday) and orders must reach Onderstepoort at least 3 weeks before the Monday of the week in which the vaccine is required. The vaccine is issued the day after manufacture. Telephone numbers must be supplied with orders to enable notification of clients when the vaccine is ready. It is absolutely essential that the vaccine be kept at 4°C in melting ice or in a refrigerator. Therefore the vaccine cannot be forwarded, but most be collected at Onderstepoort. *Under no circumstances must the vaccine be frozen.* It must be used within a week of manufacture.

The price of the vaccine is 10 cents and it is available in bottles of 5, 25 and 50 doses.

INFORMATION — PHARMACEUTICAL — INLIGTING — FARMASEUTIKA

FINE CHEMICAL NOW MANUFACTURED LOCALLY

The Noristan Organisation announces the development of a new process which has led to the local manufacture of dicyclomine hydrochloride, a fine chemical widely used in the pharmaceutical industry.

Dicyclomine hydrochloride is an antispasmodic and anticholinergic substance generally used in the treatment of gastrointestinal disorders. It is often included in antacid preparations used, for instance, in the treatment of peptic ulcers.

To date, this material has been imported and local manufacture represents an achievement for South African industry. The new process was developed over a period of two years in the Central Research and Development Laboratory of the Noristan Group. Normally, the manufacture of dicyclomine hydrochloride involves five steps, which the Laboratory has reduced to two, resulting in cost savings and a competitive price. In the course of development in a special pilot plant, extensive use was made of computer-aided optimization techniques. Full-scale manufacture is under way and the dicyclomine hydrochloride will be an addition to the well-known range of fine chemicals already produced by Norichem-Waltloo (Pty) Ltd., one of the Companies in the Noristan Group.

Norichem-Waltloo already manufactures, among others, acetylsalicylic acid (aspirin), paracetamol, methyl salicylate (oil of wintergreen) and magnesium trisilicate – all used extensively in the pharmaceutical industry. Export possibilities for locally made dicyclomine hydrochloride are also being investigated.

DIE PERINATALE PERIODE BY HONDE*

ASPEKTE VAN FUNKSIE EN WEERBAARHEID

A.P. SCHUTTE**, R.I. COUBROUGH**, K.J. KÜHNE† EN R.J. MAPLETOFT††

SUMMARY

In this paper on the perinatal period in dogs the following aspects of function and defence mechanisms of the newborn pup are presented as a condensation of current knowledge: degree of development of the brain and its vulnerability; the glycogen reserves in liver, cardiac and skeletal muscle, and various other tissues, with reference to metabolic requirements; respiratory adaptation following birth; the resuscitation of asphyxiating puppies; temperature control; and immunological mechanisms.

A. BREINONTWIKKELING EN KWESBAARHEID

As inleiding tot hierdie bespreking is dit wenslik om te beklemtoon dat die pasgebore hondjie nie as 'n „mini-hond" of as 'n „beknopte uitgawe" beskou moet word nie. Hy is 'n onvolwasse organisme met anatomiese, fisiologiese en gedragseienskappe eie aan sy ontwikkeling en ouderdom. Die gedrag wat hulle openbaar wanneer hulle aan honger of abnormale temperature blootgestel word, en wat as toeval of sonder berekening mag voorkom, is in werklikheid opgebou uit presiese reflekse en tropistiese reaksies. Indien die pasgebore met die volwasse vergelyk word, moet dit in gedagte gehou word dat hy gekortwiek word deur 'n onderontwikkelde sensoriese en neuromotoriese sisteem. Eweso, dat hy van sy omgewing afgesny is omrede sintuie vir visie, gehoor en reuk onderontwikkel is.

In die pasgebore hondjie is die brein morfologies, nog onvolledig gedifferensieerd[22,25]. Groot gedeeltes van die sentrale senubane en veral van die sensoriese stelsel is nog onvolledig gemiëlieniseer [25]. Breinontwikkeling geskied met doelgerigte stappe, en histologies word 'n stadium van sellulêre proliferasie onderskei, wat opgevolg word deur 'n stadium van groei en vermenigvuldiging. Hierop volg 'n stadium waar aksons en dendriete uitgroei en ontwikkel. Miëlienisasie is die laaste morfologiese stap in die ontogenese van die brein. Die proses van miëlienneerlegging geskied gedurende verskillende stadia van ontwikkeling en dit verskil van deel tot deel in die brein [22]. Met geboorte is breinontwikkeling van die hond (gesien as funksionele entiteit) in 'n meer gevorderde stadium as dié van byvoorbeeld die rot en die mens, maar swakker ontwikkel as dié van die vark[14]. Ongeveer 'n week voor partus ondergaan die breinweefsel van die hond 'n merkwaardig snelle ontwikkeling en hierdie besondere ontwikkelingstempo word gehandhaaf gedurende die eerste twee weke *post partum*. Die ontwikkeling gedurende die daaropvolgende drie weke is weer besonder traag [25]. Die hond word dus gebore gedurende 'n stadium wanneer sy brein nog aktiewe ontwikkeling ondergaan.

Die gedrag van die pasgebore hondjie is met die stadium van breinontwikkeling korreleerbaar en meer spesifiek met neerlegging van miëlien in die brein [14,34]. So, byvoorbeeld, is die optiese senuwee ten volle gemiëlieniseer wanneer die oë oopgaan. Gedurende hierdie periode reageer die hondjie dan ook meer op sy omgewing, die meeste van die neonatale reflekse het verdwyn en sy temperatuurreguleringmeganisme funksioneer goed. Gedurende hierdie oorgangstadium begin die vorming van 'n sosiale verwantskap met sy omgewing [44].

Voor en gedurende die periode van miëlienisasie is die brein besonder kwesbaar deur troumatiese invloede [14]. Troumatiese invloede op die brein kan nie baie akkuraat klinies in die pasgebore waargeneem word nie. Indien dit wel waargeneem kan word, beteken dit nie noodwendig dat dit permanent van aard gaan wees nie. Letsels a.g.v. kwashiorkor in babas sal alleenlik 'n permanente demper op latere intellektuele ontwikkeling plaas indien hulle binne die eerste 6 maande na geboorte tot stand gekom het [14]. Ondervoeding gedurende latere fases lei nie tot permanente beskadiging nie. Dit is ook nie noodwendig dat neurologiese tekens soos abnormale spierbewegings, wat na blootstelling aan suurstofnood opgemerk mag word, permanent van aard moet wees nie. Daarom is dit raadsaam om nie te veel peil op abnormale spiertonus, refleksreaksies, en pynsimptome, wat gedurende die neonatale periode mag voorkom, te trek nie. Indien asfiksie egter vir langdurige periodes volgehou word, vind permanente beskadiging bilateraal simmetries wel plaas. Hierdie letsel begin as klein areas in die nukleus van die *colliculus caudalis* vanwaar hulle na die serebellum sprei. Die hipotalamus word eers aangetas as asfiksie langer as 'n halfuur aanhou. Eers as hierdie deel van die brein aangetas is, sal ataksie, tremor en spastiese paralise klinies waargeneem kan word. Die serebrale korteks en rugmurg word gewoonlik nie aangetas nie [14].

B. GLIKOGEENRESERWES EN METABOLISME

In die hond vind daar 'n geweldige vinnige aansameling van glikogeen in die lewer gedurende die laaste 10 dae van sy prenatale lewe plaas [40-42]. Direk na geboorte egter, vind daar weer 'n dramatiese afname in die lewerreserwes plaas. Binne 'n tydsbestek van drie uur na geboorte het die glikogeeninhoud na ongeveer 10 persent van die oorspronklike waardes gedaal. Die afname geskied nieteenstaande voedselinname gedurende hierdie periode. Hierdie lae lewerglikogeeninhoud bly redelik konstant vir die eerste drie dae voordat dit geleidelik begin toeneem om

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* Onder hierdie hoof is vier referate deur die outeurs by die Kliniese Kongres van die Witatersrandtak van die Suid-Afrikaanse Veterinêre Vereniging in Junie 1972 gelewer. Hierdie referaat is die eerste van die reeks.

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waardes soortgelyk as die van die volwasse gedurende die daaropvolgende drie weke te bereik [18].

Die hartspierglikogeeninhoud is omgekeerd korreleerbaar met die ontwikkelingstadium wat die betrokke spesies by geboorte bereik het. Die marmot, wat besonder goed ontwikkel is by geboorte, (oë oop en goed ontwikkelde haarkleed) het dan slegs 5 mg glikogeen per gram hartspier, terwyl die hondjie as 'n onderontwikkelde organisme by geboorte 15 mg/g spierweefsel bevat [16 42].

In teenstelling hiermee is die spierglikogeeninhoud direk korreleerbaar met volwassenheid. Spesies wat gebore word met die vermoë om hulle liggaamstemperatuur te reguleer en wat aktiewe spierbewegings kan uitvoer, het besonder hoë spierreserwes. Vergelyk byvoorbeeld die varkie met 70 mg glikogeen per gram spierweefsel met die hondjie se 15 mg glikogeen per gram spierweefsel. Die algemene tendens is ook dat die pasgebore oor ongeveer twee keer soveel spierglikogeen beskik as die volwasse dier. In dié spesies wat net na geboorte baie aktief is neem hierdie reserwes baie gou af [42].

In die ander weefsels, soos die brein, long, nier, skelet en plasenta, is die glikogeenreserwes besonder laag met geboorte.

Die liggaam se glikogeenreserwe is selfs voor geboorte al van besondere belang. Gedurende die prenatale periode funksioneer die fetuslewer soos die van die volwasse [18 21]. As die fetus aan anoksie blootgestel word, word die lewerglikogeen gebruik om die bloedsuiker konstant te hou [21]. As die anoksiese toestande egter aanhou, vind uitputting plaas, met gevolglike hipoglikemie en daling in hartspierreserwes.

Gedurende geboorte moet spierglikogeen en lewerglikogeen onmiddellik vrygestel kan word. Die pasgebore moet nie net alleen asemhaal nie, sorgdra dat hy voeding kry nie, maar hy moet ook sy liggaamstemperatuur konstant hou. Alhoewel die meeste hondjies binne 30 minute na geboorte suip moet die oorspronklike lewerglikogeen nogtans aangewend word om die bloedsuiker konstant te hou. Die brein, wat oor baie lae glikogeenreserwes beskik, is desnieteenstaande aktief. Vir sy energiebenodigdhede moet die lewer-reserwes ook instaan, want gedurende hierdie stadium kan die spierglikogeen nie hiervoor aangewend word nie [42].

Uit 'n praktiese oogppunt gesien moet eerstens sorg gedra word dat die hartspierglikogeen nie uitgeput raak nie, want dit is van kardinale belang dat sirkulasie gehandhaaf moet word [16]. Aanvulling van hierdie reserwe is wel moontlik, maar dit geskied stadiger as die verbruikstempo en is uitputting 'n wesentlike gevaar. Voorbehoeding is beter as genesing, veral omdat herhaalde blootstelling aan anoksie akkumulatief werk [30].

Soos reeds vantevore beklemtoon, moet die lewerglikogeenreserwes vir prakties al die fetus of pasgebore se benodigdhede instaan, maar daaraan is ook perke. Gelukkig kan die proses van glukoneogenese help om die aanvraag op die lewer-reserwes te verlig. Nadat die eerste krisis van geboorte oorbrug is en die lewer ingestaan het vir die onmiddellike energiebenodigdhede, word vet een van die vernaamste metaboliete [17]. Hierdie verhoogde omset van vet tot brandstof word aangehelp deur verhoogde produksie van hidrokortisoon; dit gee aanleiding tot die verhoogde produksie en vrystelling van gliserol, wat aangewend kan word vir oksidatiewe prosesse. Hierdie proses gee die lewer weer die geleentheid om sy reserwes uit eksogene bronne gedurende die daaropvolgende dae aan te vul.

As die glikogeenreserwes alreeds met geboorte laag is, moet die uiteinde 'n toestand van hipoglikemie wees. Gelukkig is die pasgebore se brein nie so gevoelig vir hierdie lae glikogeengehalte nie. Die rede hiervoor mag wees dat die brein se energiebenodigdhede relatief laer is (lae adenotrifosfatase-aktiwiteit) [47]. Dit bly egter noodsaaklik dat sirkulasie gehandhaaf moet word, sodat die brein gebruik kan maak van die sirkulerende gliserol en laktaat [42].

C. DIE ASEMHALINGSTELSEL

Nuwere inligting dui daarop dat die fetus wel binnebaarmoederlike asemhalingsbewegings uitvoer. Ongelukkig is geen spesifieke data aangaande die hond beskikbaar nie maar eksperimentele resultate soos in die skaap verkry kan ook hier van toepassing wees [19].

As die skaap-fetus sy onreaktiewe stadium binnegegaan het, die sogenaamde inertia-stadium (ongeveer 60 dae na bevrugting), dan reageer hy slegs nog as hy aan asfiksie blootgestel word. Alhoewel hy maar slegs die helfte van sy binnebaarmoederlike periode deurgemaak het, is hy in staat om asemhalingsbewegings uit te voer. Op hierdie stadium kan egter nog nie ritmiese asemhalingsbewegings met belugting bewerkstellig word nie. Die fetus of pasgebore kan alleenlik 'n stabiele alveolêre volume handhaaf in die teenwoordigheid van 'n oppervlakte-aktiewe lipoproteïen [19 39]. Hierdie „surfaktans" word eers gedurende die einde van die dragtige periode aangetref [9 10 19]. Hierdie stof is 'n lipoproteïen met dipalmitiel-lesitiengliseraat as die vernaamste lipiedkomponent. Bykomstig tot die daarstelling van alveolêre stabiliteit verhoed hierdie stof ook dat transudasie van vloeistof vanuit die kapillêre vate in die alveolêre ruimtes in plaasvind. Onvoldoende neerlegging en faktore wat hierdie substans beskadig, soos bv. lae suurstofspanning, gee aanleiding tot abnormale transudasie en fibrinogeen-neerlegging in die alveoli („membraansiekte" in babas [6]).

Samehangend met die produksie van genoegsame surfaktans moet die long self eers sy klierstadium ontgroei en genoeg lugspasies ontwikkel voordat belugting voldoende is. Hierdie stadium van ontwikkeling wissel van spesies tot spesies. So bv. word voldoende surfaktans in die konynfetus al op die 29ste dag van dragtigheid aangetref, terwyl die longe alreeds van die 27ste dag belug kan word. Die skaapfetus se longe kan alreeds op die 110ste dag belug word maar genoegsame hoeveelhede surfaktans word eers teen die 125ste dag aangetref. Geen syfers is vir die hond beskikbaar nie, maar volgens data van ander spesies afgelei behoort die longe op 55-58 dae belug te kan word en behoort genoegsame surfaktans alreeds op 50 dae teenwoordig te wees.

Verdere inligting dui daarop dat die longvloeistof nie dieselfde is as die amnionvloeistof nie [1 2]. Daar mag 'n bietjie vermenging by geboorte plaasvind, maar die is gewoonlik baie gering. Van hierdie longvloeistof word met die geboorteproses uit die longe gedruk en via die lugweë verwyder. Die grootste deel word besonder gemaklik deur die limfstelsel afgelei: 30% van die totale volume word binne 2 uur na geboorte afgelei [19].

D. DIE BYBRING VAN VERSMORENDE KLEINTJIES

Wanneer 'n fetus of hondjie deur middel van 'n keisersnee gelewer word en tekens van apnee wys, weet ons nie hoe ver die versmoringstadium gevorder is nie. Dit is ook besonder moeilik om te oordeel of die toestand, soos klinies waargeneem, dalk die gevolg is van 'n langdurige plasenta-onvermoë en of dit miskien die invloed is van verdowing of berustingmiddels aan die moeder toegedien.

Die verskillende stadia en simptome van versmoring word besonder goed in die werk van Campbell *et al.* geïllustreer waar die konyn onmiddellik na geboorte in 'n waterbad gedompel word[8].

Onder sulke eksperimentele toestande gaan die fetus deur 'n periode waar gewone asemhalingsbewegings geregistreer word voordat primêre apnee intree – 'n fase wat normaalweg 2 tot 7 minute mag duur. Gedurende hierdie periode maak hy „snakbewegings" of hygende asemhalingspogings. Dit is 'n vinnige strekbeweging van die hele liggaam met oop bek en uitgesette borskas. Sulke snakbewegings is korter as gewone asemhalingbewegings en veroorsaak ook 'n meer dramatiese val in bloeddruk. Hierdie hygende asemhaling kan teen 'n tempo van 1/min vir 'n periode van 20 minute aanhou. Met die laaste snakbeweging („laaste asem uitblaas") gaan die proses oor na sekondêre apnee. In hierdie toestand bly die pasgebore totdat hartaktiwiteit ophou [8].

Algemeen kan gesê word dat alhoewel die patroon in die verskillende spesies dieselfde is, die tydsverloop van versmoring tot dood egter verskil [46]. Hierdie periode is korter in spesies wat in 'n meer volwasse stadium gebore word (bv. marmot met beperkte hartspierglikogeenreserwes). Hierdie periode is heelwat langer indien die moederdier algemene verdowing ondergaan het.

Wanneer 'n mens voor die probleem van versmoring te staan kom, moet dit in gedagte gehou word dat die pulmonêre arteriole van die pasgebore besonder gespierd is en as dié gedurende suurstofnood saamtrek gee dit aanleiding tot 'n besondere weerstand teen bloedvloei. Die implikasie is dat sirkulasie in die longe tot stilstand gedwing word as die bloeddruk val. Hoe langer na verstryking van primêre apnee gewag word om effektiewe behandeling in te stel, hoe langer neem dit om weer normale asemhalingbewegings te stimuleer. Byvoorbeeld, as behandeling binne die eerste minuut toegepas word, neem dit slegs 2 minute voor die dier weer begin asemhaal. As behandeling tot 7 minute na die einde van primêre apnee uitgestel word, dan neem dit 12 minute voor asemhaling weer begin.

Hartspiermassering en afwisselende positiewedruk-belugting is die beste metodes om versmorende fetusse weer by te bring [4]. Met eersgenoemde metode word 'n positiewe effek op die bloeddruk verkry. Die bloed word deur die longe en die hartslagare geforseer en sirkulasie word herstel. Afwisselende belugting met suurstofryke mengsels is baie betroubaar omrede dit onmiddellike uitsetting van longe bewerkstellig en afvoer van koolsuurgas verseker. Die pulmonêre weerstand verlaag en dit help weer sirkulasie aan [19]. Die gevaar aan hierdie metode verbonde is die daarstelling van pneumotoraks en edeem van die tragea[13].

Analeptika, soos niketamied en lobelien [15], stimuleer hiperpnee in die normale dier, sodoende kan die sirkulasie op 'n meer effektiewe vlak ingestel word. Of dit wel in asfiksie ook so is, word betwyfel. Hierdie stimuleermiddels kan wel die periode van primêre apnee verkort, maar het geen effek op sekondêre apnee nie. Verder het hierdie middels ook die nadelige uitwerking om 'n drastiese val in bloeddruk te veroorsaak [15].

Die toediening van alkali om die bufferkapasiteit van die bloed weer te herstel behoort, veral samehangend met suurstofryke belugting, positiewe waarde vir die fetus of pasgebore in te hou [3 4 7 13].

E. TEMPERATUUR-REGULERING

Nieteenstaande veranderings in die omgewingstemperatuur slaag die volwasse dier gemaklik daarin om sy liggaamstemperatuur tussen 35-40°C konstant te hou. Die pasgeborenes poog ook om dit te doen, maar om verskillende redes vind hulle dit nie so maklik nie en soms selfs onmoontlik.

Gedurende 'n gegewe periode, wanneer die liggaamstemperatuur konstant is, is die tempo waarteen hitte geproduseer word eweredig aan die tempo waarteen dit verloor word. Hitte word geproduseer gedurende oksidatiewe metaboliese prosesse. Gedurende nie-oksidatiewe prosesse, soos bv. met glikolise, word baie min hitte vrygestel. Daarom is dit aanvaarbaar dat ons hitteproduksie mag meet volgens die suurstofverbruik. Hitteverlies hierteenoor vind plaas deur uitstraling, geleiding en verdamping. Die tempo van hitteverlies hang af van die grootte van dier, termiese isolasie, en die verskil tussen sy liggaamstemperatuur en dié van die omgewing.

Hoe die temperatuur-reguleringmeganisme funksioneer is besonder goed deur Hill [33] geïllustreer. Die katjie van 3 weke ouderdom is volgens hierdie werk reeds 'n ware homeotermiese dier. Op hierdie ouderdom sal die liggaamstemperatuur slegs 'n geringe 0,5°C wissel, terwyl die omgewingstemperatuur tussen 34°C en 18°C varieer. Die hitteverlies is groter as die omgewing kouer word, maar die dier kompenseer hiervoor deur aktiewe metabolisme. Die merk waar die aktiewe verhoging van metabolisme eerste opgemerk word staan bekend as die „laer kritiese temperatuur" (Lkt). Bokant hierdie temperatuur is daar 'n temperatuurbestek waar die metaboliese temperatuur konstant is. Hierdie gebied is bekend as die „neutrale temperatuurbestek"[12].

Die totale hitteverlies bestaan uit twee fasette, naamlik hitteverlies deur geleiding en uitstraling (HU) en hitteverlies deur verdamping (HV). Benede die Lkt styg HV deur verdamping vanuit die longe en deur onbewustelike of onmerkbare sweet. Bokant die Lkt poog die liggaam eers deur termiese geleiding hitteverlies te verhoog, d.w.s. deur verhoging van velbloedvloei, maar as die perk hiervan bereik word, dan moet HV progressief verhoog word om die liggaamstemperatuur konstant te laat bly. In die boonste gedeelte van die neutrale bestek neem die dier aktiewe stappe om HV te verhoog deur sweet en versnelling in asemhaling.

Die laagste perk (omgewingstemperatuur) waarby 'n dier nog 'n konstante liggaamstemperatuur kan handhaaf hang af van die dier se effektiewe termiese geleiding en sy maksimale metaboliese reaksie op koue. As hierdie perk oorskry word, val die dier se liggaamstemperatuur onvermydelik. Die dier se effektiewe termiese geleiding word bepaal deur sy vetbedekking en haarkleed, en varieer van spesies tot

spesies [37]. Dus kan prakties gesproke die kritiese temperature van verskillende spesies toegeskrywe word aan die verskil in termiese geleiding. Die dier se maksimale metaboliese reaksie is die maksimale hitteproduksie per eenheid oppervlakte.

Dit is belangrik om daarop te wys dat die termiese geleiding in die pasgebore besonder hoog is omrede die vel van die pasgebore dunner en sy haarkleed en onderhuidse vetlaag baie swak ontwikkel is [12]. Hierdie tekorte word egter binne die eerste twee weke aangevul. Addisioneel hiertoe moet ons in gedagte hou dat hondjies by geboorte nog nat is; totdat hulle droog is het die vel swak isoleringswaarde. Nog 'n nadeel is dat 'n groot hoeveelheid hitte deur verdamping verlore gaan.

Die reaksie van die pasgebore, d.w.s. die tempo van metabolisme a.g.v. omgewingstemperatuur, verskil van die volwasse [26 33] omdat die pasgebore per eenheid oppervlakte 'n laer basale metabolisme het en omdat maksimale metaboliese reaksie op koue beperk is. Die pasgebore hondjie se basale metaboliese spoed per eenheid oppervlakte is omtrent die helfte van die van die volwassene. Op hierdie ouderdom kan hy net nie daarin slaag om sy metaboliese spoed op die stimulasie van verlaagde omgewingstemperatuur te verhoog nie en dus daal die liggaamstemperatuur. Eers 48 uur na geboorte kan die basale metaboliese spoed verhoog word en is 'n reaksie op koue wel moontlik; nogtans is dit nie voldoende nie. Selfs teen die einde van die tweede week, wanneer bykans die volwasse dier se metaboliese tempo bereik word, is dit nog nie voldoende om teen uiterste temperature te reageer nie.

Die nadeel van 'n vaste metaboliese spoed, soos die van die pasgebore, is dat die liggaamstemperatuur slaafs die omgewingstemperatuur naboots [26 35]. Dit is die tipiese reaksie wat deur poikilotermiese diere gevolg word waar daling in liggaamstemperatuur aanleiding gee tot 'n verlaging van die metaboliese tempo. Selfs wanneer die pasgebore nie meer 'n vaste metabolisme het nie, bv. op 2 weke ouderdom, kan poikilotermiese toestande nog maklik verwek word omrede slegs 'n matig koue omgewing benodig word om die dier se perk tot aanpassing te oorskry [11 12]. In so 'n toestand van poikilotermie sal die dier se vermoë om te oorleef uitsluitlik afhang van die graad waartoe sy liggaam nog in staat is om by 'n lae temperatuur te funksioneer.

Opsommend kan ons dus sê dat die metabolisme van die pasgeborene verskil van die volwassene insoverre dat sy basale metaboliese tempo heelwat laer is en dat per eenheid oppervlakte die pasgebore 'n kleiner maksimale metaboliese reaksie op koue het. Dus is die hitteproduksie van die pasgebore, maksimaal en minimaal, laer per eenheid oppervlakte dan in die volwasse. Bowendien funksioneer die pasgebore se vel minder isolerend as dié van die volwasse: d.w.s. per eenheid oppervlakte verloor die pasgebore in 'n gegewe temperatuur makliker hitte dan die volwasse dier.

F. IMMUNOLOGIE

Ter aansluiting by bogenoemde aspekte is dit wenslik om sekere eienskappe van die weerbaarheid van die pasgebore ook toe te lig. Oordraging van immunoglobuliene via die plasenta geskied hoofsaaklik in die mens en aap. Hierteenoor word immunoglobulien in die perd, vark, bees en skaap, eers met die inname van kolostrum oorgedra [45]. Sulke diere word dus aan die buitewêreld blootgestel in 'n toestand van agammaglobulienemie. Aanvanklik was ook geglo dat die hond tot hierdie groep tuishoort maar nuwere inligting dui daarop dat geringe plasentale oordraging ook in die hond plaasvind [5]. Die meganisme verantwoordelik vir hierdie spesiesverskille asook die verskynsel van selektiewe deurlaatbaarheid is nog nie duidelik nie. Om een of ander rede is slegs IgG in staat om die plasentaskans te oorbrug en dus word slegs teëliggaampies wat tot hierdie groep globuliene behoort deurgelaat. IgA met 'n soortgelyke molekulêre gewig word nie deurgelaat nie [27 28 29].

Dit is belangrik om die oordraging en klasverskille van immunoglobuliene in gedagte te hou wanneer weerbaarheid van die fetus en die pasgebore beoordeel word. So byvoorbeeld gee die somatiese O antigeen van *E. coli* en ook sekere van die Salmonellas hoofsaaklik aanleiding tot IgM-vorming, terwyl die flagella van die organismes na verhouding meer die produksie van IgG stimuleer. As die pasgebore hondjie met 'n gepaste toets serologies ondersoek word voordat kolostrum ingeneem is, dan sal wel 'n positiewe titer teen bv. *E. coli* opwys, want IgG kan die plasentaskans oorbrug. Wat weerbaarheid aangaan, mag dit egter nie van veel waarde wees nie, omrede teëliggaampies deur flagella verwek nie die liggaam teen die patogene effek van *E. coli* beskerm nie [45].

In spesies waar oordraging uitsluitlik via die kolostrum plaasvind, bewerkstellig die uier 'n tienvoudige konsentrasie van immunoglobuliene [38]. In sulke spesies vind ook vir 'n kort periode na geboorte geen diskriminasie tussen IgA, IgM of IgG plaas nie en hulle kan as sodanig geabsorbeer word. Die vermoë van die pasgebore om hierdie globuliene net so op te neem is maar van korte duur en daarom moet sorg gedra word dat die pasgebore sy kolostrum binne hierdie afgebakende periode ontvang. By verstryking van hierdie periode word hierdie immunoglobuliene net soos enige ander proteïen afgebreek voordat dit geabsorbeer word [36]. Dan het hulle geen immunologiese eienskappe meer nie. 'n Moontlike verklaring vir hierdie verskynsel mag opgesluit lê in die pH-gehalte of die pepsien-inhoud van die verteringstelsel [45]. In lammers, bv., is die pH normaal (6,6 - 7,0) gedurende die eerste 36 uur na geboorte. Hierna verminder die pH skielik na 3 [32]. Pepsien is slegs aktief by hierdie lae pH-waardes. In die geval van die hond is dit heelwaarskynlik die pepsien-konsentrasie wat baie laag is en nie soseer die suurgehalte van maagsekreet nie. In die mens, waar oordraging via die plasenta plaasvind, word pepsien alreeds in die fetus se maaginhoud aangetref. Binne 5 uur na geboorte is die pH van die maaginhoud van die mens besonder suur en sodoende word die opname van immunoglobuliene vanuit kolostrum onmoontlik gemaak. Addisioneel tot hierdie meganisme mag ander faktore, soos uithongering, sekretien en ander bestanddele van kolostrum, ook meewerk om die opname van globuliene selektief te laat geskied [45]. Dit is belangrik vir die klinikus om te weet hoelank maternale teëliggaampies in die pasgebore gaan sirkuleer. Dit word geensins betwyfel dat hierdie immunoglobuliene vanaf die moederdier van wesenlike belang vir die pasgebore is nie, maar dit moet nie buite rekening gelaat word dat hulle 'n demper plaas op die pasgebore se vermoë om sy eie te produseer. Die

afname van maternale teëliggaampies in die pasgebore se liggaam is afhanklik van die aanvanklike konsentrasie, die kataboliese tempo en die vermeerdering van neonatale sirkulasie-volume [28]. Normaalweg is die titer teen *B. abortus* in die kalf maksimaal 24 uur na geboorte, waarna dit gedurende die daaropvolgende paar weke geleidelik afneem. In die geval van kalwers met 'n aanvanklike titer van 2×10^{11} neem dit tot 18 weke voor die titer heeltemal verdwyn, en dit nieteenstaande 'n konstante metaboliese spoed en 'n Ig-halflewe van 21 dae. In die hond is Ig-halflewe ± 8 dae [20].

Die inhiberende uitwerking van maternale teëliggaampies op die produksievermoë van die pasgebore kom in alle spesies voor, selfs in die wat reeds lank voor geboorte immunologies bevoeg is [31 43 45]. Hierdie onderdrukkingsverskynsel is besonder spesifiek. Maternale immunoglobiene Sx, byvoorbeeld, sal net die fetus se vermoë om Sx te produseer beïnvloed en geen remming op die vermoë om ander tipes globuliene te vorm, hê nie. Dat die hondjie wel by geboorte immunologies bevoegd is, is bekend, maar of hy in staat is om teen alle antigene maksimaal te kan reageer word sterk betwyfel. Gedurende die eerste paar dae *post partum*, wanneer hy onder die ,,sambreel" van die maternale teëliggaampies skuil, is sy immunogenestelsel nog steeds besig om te ontwikkel, insoverre 'n onderskeidingsvermoë tussen ,,eie" en ,,nie-eie" aan die ontplooi is [31].

'n Groot gedeelte van die pasgebore se liggaam is opgebou uit substanse soortgelyk aan die stowwe van vreemde organismes waarteen hy homself moet beskerm. Alhoewel hierdie program van identifikasie van ,,eie" gewaarwordings alreeds voor geboorte afgehandel word, moet hy nog 'n *post partum*-periode deurmaak waar hy die geleentheid gegun word om sy afweerstelsel teen wat ,,nie-eie" is te volmaak [31 45].

Met hierdie meganisme in gedagte kan verdrabaarheid (toleransie) makliker verklaar word, d.w.s. die verskynsel waardeur die fetus die ,,nie-eie" as ,,eie" dokumenteer. Die praktiese implikasie is dat 'n fetus wat gedurende die fetale periode aan 'n patogene substans blootgestel word dit as ,,eie" mag merk. Indien hy dan later in sy neonatale periode weer aan dieselfde patogene antigeen blootgestel word kan hy immunologies nie daarteen reageer nie. Of hy die skadelike invloed van hierdie patogeen gaan oorbrug hang uitsluitlik van sy nie-spesifieke verdedigingsmeganisme af [45].

Dit is bekend dat die hond alreeds op die 40ste dag van fetale lewe met produksie van limfosiete in aanvang neem, terwyl hy op 48 dae 'n afstotingsmeganisme teen veloorplantings ontwikkel het. Ongeveer 'n week voor geboorte besit hy reeds die vermoë om immunoglobuliene, veral IgM, te produseer [28 45]. Dit is belangrik vir die klinikus om hierdie informasie tesame met die funksionele aspekte en die weerbaarheid van die pasgebore te oorweeg wanneer kliniese waarneembare afwykings beoordeel moet word. Dan alleen sal dit moontlik wees om afwykings meer akkuraat te kan diagnoseer. Dit is ook deurgaans makliker om die abnormale raak te sien as daar oor 'n grondige kennis van die normale beskik word.

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BOOK REVIEW

BOEKRESENSIE

VETERINARY APPLIED PHARMACOLOGY AND THERAPEUTICS

G.C. BRANDER AND D.M. PUGH

Baillière Tindall, London: 2nd Edition (1st Edition by P.W. Daykin), 1971. Pp. x + 515; Figs. 11; Tabs 14; over 160 Illustrations of Structural Formulae. Price: R10.50.

This book represents a very much revised edition of P.W. Daykin's Veterinary Applied Pharmacology and Therapeutics which was first published in 1960.

In this new edition sections of the text have been enlarged or condensed to meet with modern requirements and the subject matter has been extensively re-arranged. Moreover, the drugs which are dealt with now have been grouped on the basis of their actions rather than their chemical relationships. Several new chapters also have been added. These include those on the essentials of drug action, the fate of drugs in the body, the principles of pharmacotherapeutics, the control of the formation and coagulation of blood, the anabolic steroid compounds, the mediators of allergy, anaphylaxis and shock, and finally the management of metabolic diseases in the ruminant.

The book is divided into five parts. The first of these deals with the essentials of basic pharmacology and the principles of pharmacotherapeutics. Part II is concerned with the drugs used in the modification of cell, tissue, organ and system function and describes in detail the actions and uses of such compounds in a systematic manner. Part III deals comprehensively with chemotherapy and the control of infectious diseases. This section is rather extensive and makes up about a third of the whole text. The essentials of pharmacy in veterinary practice, including prescription writing, dispensing and the legal obligations in the United Kingdom, are covered in Part IV. The final part of the book is comprised of appendices on latin abbreviations, weights and measures, the treatment of poisoning, and international and proprietary names of drugs.

There is no doubt that this new edition of Veterinary Applied Pharmacology and Thereapeutics is a useful addition to the range of available veterinary text books. The subject matter is well presented and easy to follow as a result of careful arrangement.

Because of the considerable advances which take place almost daily in the discipline of pharmacology, it is always difficult when preparing a book to cover all the drugs currently in use. Similarly it is often hard to judge when finally to lay antiquated remedies to rest. The authors must be commended for finding a reasonable balance in most cases.

Some criticism may well be directed towards the limited coverage of the basic concepts of pharmacology and especially of pharmacokinetics. These aspects are so fundamental to the understanding of systematic and clinical pharmacology that they might well have enjoyed greater emphasis in a text such as this.

This book certainly can be recommended for use by students studying veterinary pharmacology for the first time and then once again for reference in later clinical years. Practitioners who feel the need for some revision or continuing education with respect to modern veterinary pharmacology would also gain much benefit from this second edition of Veterinary Applied Pharmacology and Therapeutics.

W.L.J.

INLIGTING

INFORMATION

HORSESICKNESS VACCINE

Nine distinct serological types of horsesickness virus are presently known to occur in nature, but owing to technical reasons they were not all represented in the polyvalent horsesickness vaccine. The outbreak of horsesickness in the Nelspruit area has been shown to be due to type 4 virus. A safe and efficient attenuated strain of type 4 virus was developed and issued as a monovalent type 4 horsesickness vaccine.

Since then it has been decided to incorporate the attenuated strain of the type 4 virus into the polyvalent vaccine. All supplies of the existing polyvalent vaccine and those of the monovalent vaccine have been recalled. As interim measure they are now issued together in the form of two dose pack of the monovalent vaccine and two doses of the polyvalent vaccine. The contents of the three containers freeze-dried vaccine are reconstituted with 10 m*l* sterile water according to instructions, to supply two doses of a comprehensive vaccine. These are administered as usual in 5,0 m*l* doses subcutaneously. As soon as these supplies are exhausted, a comprehensive polyvalent vaccine will be issued.

Director of the Veterinary Research Institute, Onderstepoort.

THE PERINATAL PERIOD OF DOGS*

NUTRITION AND MANAGEMENT IN THE HAND-REARING OF PUPPIES

R.J. MAPLETOFT**, A.P. SCHUTTE†, R.I. COUBROUGH† AND R.J. KÜHNE

SUMMARY

A compilation has been made from data in the literature to provide the practitioner and research worker with practical guidelines in the nutrition and management of hand-reared puppies. On the basis of neural development and behavioural patterns, and metabolic requirements, recommendations are made regarding handling, management and feeding. The various methods and formulae are detailed as well as the provision of suitable ambient temperatures. The pup's behaviour, appearance and mass gain are the most important criteria to judge adequacy of feeding and management, which should be kept as simple as possible to be acceptable to the average pet owner.

INTRODUCTION

The raising of orphaned puppies has become a well-practised art by dog breeders throughout the world. Through necessity, they have developed diets and methods of handling which are both practical and successful. Research in the development of dog-breeding colonies and of specific pathogen-free puppies has made a more recent contribution to this field. The practising veterinarian must be able to advise pet owners on the care and feeding of orphan puppies but all too often he has little or no personal experience in this field.

This review is intended to give the practitioner and research worker guidelines to follow in the nutrition and management of hand-reared puppies. The development of neonatal behaviour patterns will be reviewed followed by an outline of facilities and diets. A general discussion on handling and care will summarize the important aspects in hand-rearing puppies.

NEONATAL BEHAVIOUR PATTERNS

Although the newborn puppy's behaviour appears somewhat random, it actually consists of precise reflexes and tropistic responses. These are extremely necessary in ensuring the survival of the newborn with its immature sensory and neuromotor systems. Tables 1-4[17] briefly outline the puppy's development from birth to two weeks of age. These facts must be known before attempting to raise puppies in an artificial environment.

The suckling reflex in a puppy is an excellent example of an inherent reflex present at birth [7 16]. A healthy, delivered puppy immediately seeks a mammary gland and begins to suckle [1]. The location of the mammary gland and teat also involves the use of reflexes and tropisms[17]. The puppy attempts to make contact with the bitch or litter mates by bobbing and weaving its head from side to side [17]. Reflex systems in the cranial part of the puppy's body are most mature at birth; when its head makes contact it

Table 1: GENERAL RELATIONSHIP OF PHYSICAL AND BEHAVIOURAL DEVELOPMENT

Age	State of physical development
At birth	Brain soft and jelly-like; sulci poorly formed
	Brain waves barely present: activity sporadic and asymmetrical
	Cerebral cortex: two cellular layers distinguishable
	Myelin coating on CNS nerve fibres underdeveloped except on trigeminal fibres and non-acoustic portion of auditory fibres
	Retina undeveloped
	Media of eye not transparent
	Eyelids and auditory meatus closed
1st week	Olfactory stimuli affect EEG
	Eyelid reflex present but weak
2nd week	Rods and cones appear

Table 2: GENERAL RELATIONSHIP OF PHYSICAL AND BEHAVIOURAL DEVELOPMENT

Age	Motor reflexes and simple conditioning
At birth	Random motor movements and twitches
	Labial sucking reflex
	Positive thigmotaxic reflex
	Positive thermotropism
	Elimination reflexes
	Spontaneous head movement; horizontal and vertical
	Crawl: slow and poorly coördinated; anterior portion of body better coördinated
1st Week	Spontaneous muscle twitching when asleep.
	Rooting or 'burrowing' reflex
	Upward head reflex when pup suckles
	Adult postural reflexes beginning to appear
2nd Week	Gustatory appetitive and aversive conditioning obtained
	Backing movements appear
	Mobility increases perceptibly

* Under this heading four papers had been presented at the clinical Conference of the Witwatersrand Branch of the South African Veterinary Association in June, 1972. This paper is the fourth in the series but the second to be published.

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Table 3: GENERAL RELATIONSHIP OF PHYSICAL AND BEHAVIOURAL DEVELOPMENT

Age	Relationship to environment
At birth	Sensitive to touch, taste, pain, cold and hot stimuli Underdeveloped systems: Auditory, olfactory, visual, temperature regulation Searching and food-getting reflexes present Distress vocalization present
1st Week	Limited olfactory sensitivity present but pup does not appear to react to odor of dam
2nd Week	Nociceptive withdrawal response appears

Table 4: GENERAL RELATIONSHIP OF PHYSICAL AND BEHAVIOURAL DEVELOPMENT

Age	Social interaction
At birth	Food-getting from mother Grooming by mother Elimination reflexes stimulated by mother Warmth from mother Retrieving by mother Tactual contact with mother and litter mates
1st Week	General peak of mother licking pups Mother seldom leaves pups General peak of non-protest vocalization
2nd Week	General peak of protest vocalization Pups begin to move after mother to nurse

reflexly moves foreward [6]. The temperature gradient between the mammary gland and the puppy and alignment with other puppies also assists it in locating the teat. When the puppy has consumed enough milk, its motor activity decreases and it sleeps [17].

Although the senses of vision, hearing and smell are underdeveloped at birth, trigeminal fibres are functional [17]. Contact stimulation inside the puppy's mouth is one of most effective stimuli for suckling [7]. External stimuli such as contact and temperature also activate a suckling response. At birth suckling is not initiated by hunger but is reflex controlled. Hunger, however, can influence the intensity and frequency of suckling [7].

At birth puppies are also sensitive to pain and tactile stimulation [17]. These senses are important in giving direction to movement [6]. It is also possible to stimulate respiration in weak puppies by tactile stimulation during the first 2 or 3 days of life [4]. The gastrointestinal and urinary tracts are also very poorly developed at birth. By tactile stimulation to the perineal region the bitch is able to stimulate the anogenital reflex for evacuation in the newborn [4 17].

Although puppies are homeothermic at birth, they do depend a great deal on the environment for the maintenance of body temperature [4 26]. This relative degree of poikilothermy decreases gradually until approximately 2 weeks of age [17]. The puppy is able to overcome the problem of temperature control by its reflex tropism for thermogradients. As body temperature drops, the puppy is stimulated to seek the warmth offered by the bitch and its litter mates [14]. When temperature levels exceed an optimum, the litter disperses. The spatial density of the litter is controlled first by temperature and then by contact [17 25]. The puppy is attracted to the bitch primarily because she offers warmth, comfort and food.

Increased activity and vocalization in a litter usually is an indication of stress [17]. This may be due to hunger, cold or pain but also can result from loss of litter contact. Temperature would appear to be the over-riding factor, as a hungry puppy is not vocal provided it is kept warm [25]. A pleasure call is also recognized in relation to the presence of satisfactory conditions [17].

Development is rapid. It can be seen from the preceding tables that by the second week of age most of the senses are fairly well developed. Eyes open at 10-12 days[6] and ears open at 15-17 days[9]. At 2 weeks of age a puppy will begin to move from its nest and by 3 weeks of age it can walk and eat solid food [1 9]. A puppy can be weaned by 4 weeks of age[4].

HAND-REARING FACILITIES

In preparing facilities for hand-rearing, one must decide whether the puppies are to be reared individually or in a litter system. Depending on the system used, sanitation and temperature control become the two most important factors to consider. Single rearing is usually preferred by commercial units, as the puppies can be more closely observed and sanitation is more easily maintained [11]. Temperature regulation is more critical, however, because body contact is eliminated. This method also has the obvious advantages that the puppies do not disturb one another and that body sucking is avoided [4]. Plastic or wooden rearing boxes of approximately 35 cm x 55 cm x 20 cm in size are adequate[23] but it is also possible to purchase a commercial incubator with individual rearing boxes [4].

Litter rearing tends to be more practical for most pet owners, because facilities are less demanding. Temperature control is also less critical because of litter contact and the puppies require less personal care because of tactile stimulation from litter mates. By 2 weeks of age puppies kept together will attempt to keep clean and will leave the bed to relieve themselves [11].

Facilities for litter-raising puppies must have geographical limitations but size is not critical. The litter box must be large enough, however, for the litter as it grows. Most pet owners find a dog basket acceptable.

Body sucking can be a problem in the litter system, particularly after 2 weeks af age [7]. It tends to develop as a result of acute hunger, frustration or too rapid feeding [20]. Fox describes body sucking as a displacement activity to alleviate oral tension [4]. It can be avoided by allowing the puppies sufficient opportunity to suckle normally while feeding on an adequate diet. Personal care and attention will relieve stress and frustration experienced by puppies raised without a mother.

No completely adequate bedding has been found [13]. Shavings and straw must be avoided, as these materials can be aspirated or eaten. Newspaper has been found to be too slippery for puppies. The most acceptable types of bedding must be comfortable, sanitary and non-injurious to the puppies. These in-

clude cellulose paper, shredded paper and washable rags [23].

Because puppies are unable to regulate their own body temperature, heating is one of the most important considerations in artificial rearing. Chilling is accompanied by increased activity, vocalization, weight loss and even death [8 25]. Survivors often grow at a retarded rate and may even develop neurologic and behaviour abnormalities [4]. Overheating can be almost as serious a problem as chilling: every attempt should be made to keep the puppy's environmental temperature at a constant optimum. When a litter is maintained at the correct ambient temperature, the puppies are equally dispersed. They lie in lateral recumbency and show the occassional muscle twitch as they sleep peacefully. If they are awakened, they yawn, are not vocal and have good muscle tone [14].

Puppies are best maintained in a heated room with an infrared lamp suspended approximately 60 cm above their bed [11 23]. Convection currents which draw cold air over the puppies must be avoided [14]. Temperature changes can be detected if a thermometer is left on the bed close to the puppies [11]. Commercial units for rearing puppies singly have a thermostat which regulates the temperature automatically [23].

Pet owners without facilities for rearing puppies can overcome the heating problem by the use of heating pads or hot water bottles [14]. Plastic bottles filled with hot water and wrapped in towels make a very good substitute for standard hot water bottles.

The optimal temperature requirements for puppies reared individually during the first four weeks of life are as follows [23]:

First week: 32 – 30°C
Second week: 30 – 28°C
Third week: 28 – 26°C
Fourth week: 26 – 24°C

With litter rearing the temperature may be maintained at a level of 5-8°C below that recommended for individual rearing. After the first week of age, litter-reared puppies can be maintained at a constant environmental temperature of 20°C if temperature control is not easily achieved.

NUTRITION

Because placental transfer of antibodies in the canine is very slight, colostrum is necessary for the survival and thrift of newborn puppies. Besides providing passive immunity, colostrum is high in nutrients and has laxative properties [15 24].

Colostrum is best absorbed in the first 12-24 hours of a puppy's life, hence it is necessary to have a source available at that time [9 26]. It is possible to collect colostrum from a recently whelped bitch and to freeze it for emergencies [15 24]. As little as 8 gm of colostrum per kg body mass will provide protection in the lamb [24]; the average puppy should only require 2-4 *ml* colostrum. In the absence of colostrum it is possible to induce passive immunity with gammaglobulin or with blood serum from an adult canine [9 15]. If haemolytic disease is suspected in the newborn, colostrum must be withheld for at least 24 hours [9].

Table 5 shows the composition of bitch's milk as compared to that of other species [15]. The milk from a bitch contains approximately 5 kJ/gm. There are numerous discrepancies in the published data on the composition of bitch's milk owing to marked variations between different stages of lactation [2 22].

Table 5: COMPOSITION OF MILK OF DOMESTIC ANIMALS [15]

	Water	Fat	Protein	Lectose	Ash
Cow	86,2	4,4	3,8	4,9	0,7
Ewe	82,9	6,2	5,4	4,3	0,9
Goat	87,1	4,1	3,7	4,2	0,8
Sow	83,0	7,0	6,0	4,0	0,9
Cat	82,0	5,0	7,0	5,0	0,6
Dog	79,0	8,5	7,5	3,7	1,2
Horse	89,0	1,6	2,7	6,1	0,5
Man	87,4	3,8	1,6	7,0	0,2

The ideal bitch's milk substitute should have the following constituents [8]:

Water 80%
Protein 8%
Fat 9%
Lactose 3%

It should also contain 4 kJ/gm, 20% of which should be of high quality protein [8 11].

Undiluted cow's milk is a poor substitute for puppies: fat and protein contents are too low and that of lactose is too high [11]. Cow's milk is also rather deficient in vitamins as compared to that of the bitch [10], although the Ca: P ratio of 1,2:1 exists in the milk of both species [2]. Diarrhoea may result if puppies are fed undiluted cows milk [4], because of two factors[5]: the high lactose content of cow's milk stimulates excess gastric acid secretion which cannot be neutralized and the saturated fat in cow's milk stimulates excess bile secretion. These problems can be overcome by diluting cow's milk with sterile water [4 5].

Goat's milk apparently causes no problems in puppies and can be used successfully as a substitute [11]. Sow's milk is also very similar to that of the bitch, hence piglet milk substitutes are useful for hand-feeding puppies [23]. Several manufacturers supply substitutes closely approximating bitch's milk in composition [4 8 11]. These are easily prepared and very well used by pet owners and dog breeding establishments.

Evaporated milk has the same level of protein and fat as bitches' milk but the lactose is three times too high [8]. It is also fortified with vitamins. Many dog breeders have found that evaporated milk diluted with water makes a very good substitute for feeding orphan puppies. The usual rate of dilution varies from 50-80%; nevertheless, there is still a possibility of diarrhoea developing [8]. In this case the water content has to be increased. Lime water at a level of approximately 20% also assists in the treatment of diarrhoea in puppies.

With careful management, puppies fed evaporated milk diluted with water can gain in mass as do naturally reared puppies (Fig. 1) [19]. Chilling has a profound adverse effect on a pup's gain in mass (Fig. 1) [19].

A diet for orphan puppies must be simple and easily prepared to be of use to the average pet owner. For this reason cow's milk is usually used as a basis for most puppy formulae, its deficiency in protein and fat being compensated by the addition of egg yolk, which contains 11% protein and 10% fat. Equal parts of whole cow's milk and egg yolk will then result in a preparation containing the following [22]:

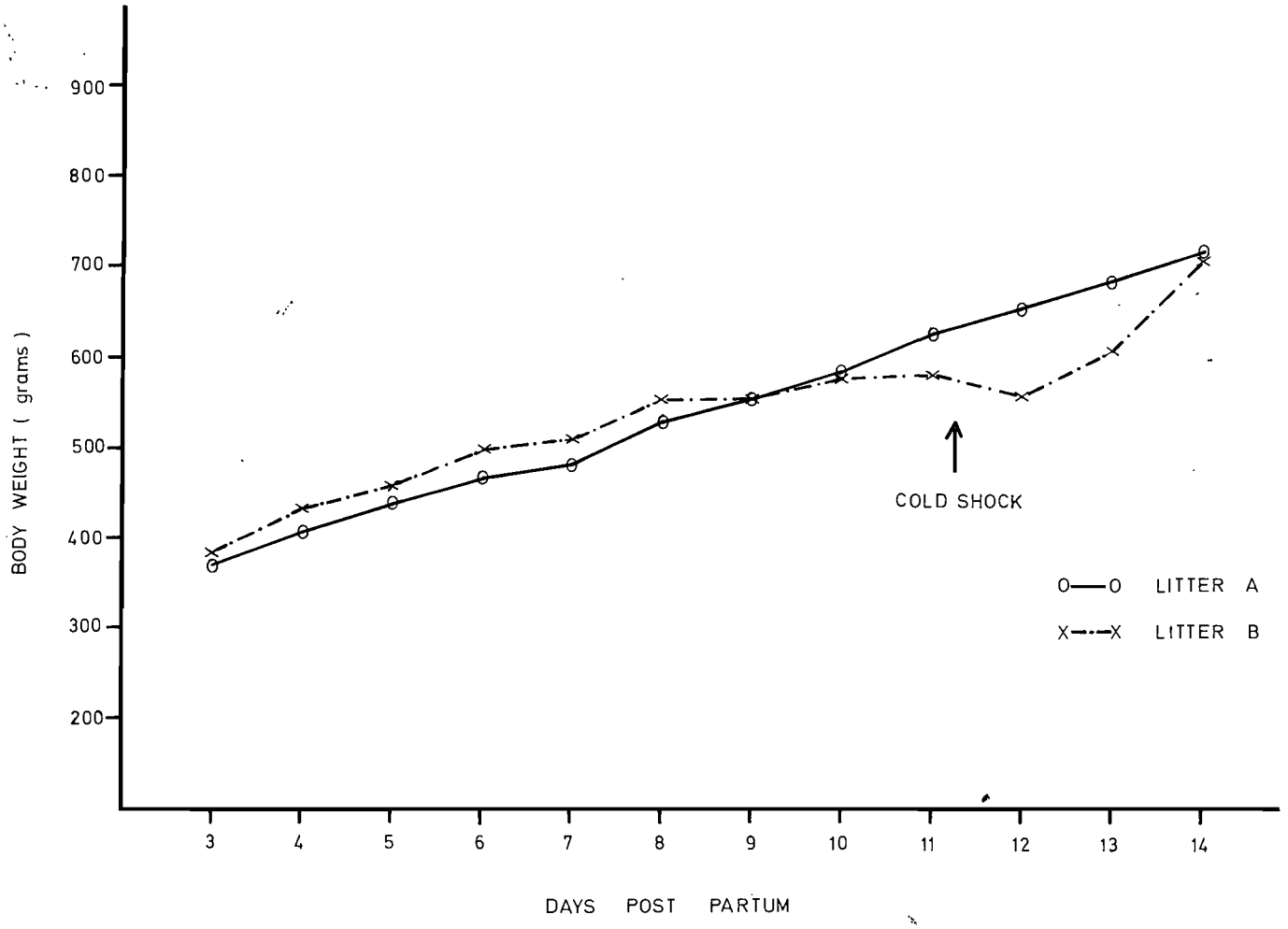

Figure 1 – Comparison of mass gains by naturally reared puppies (Litter A) and hand-reared puppies (Litter B). [19]

Protein 7%
Fat 7%
Lactose 2,24%

This is a sound basis for formulating a puppy diet as it comes very close to the ideal bitch's milk substitute[11]. Egg white must be exluded, as it is undigestible and causes diarrhoea.

Many variations of the above diet have been recommended; although somewhat more complex, they also have proven successful. They are as follows:

1. Whole cow's milk	800 ml
Cream (12% fat)	200 ml
Bone meal	6 gm
Citric acid	4 gm
Vit. A	2000 IU
Vit. D	500 IU
Egg yolk	1 (± 15 ml) [3]
2. Top portion of settled unhomogenized whole milk	225 ml
Egg yolk	1 (± 15 ml) [9 11]
3. Evaporated milk and sterile water 1 : 4	
Dicalcium phosphate	5 gm/l
Add complete vitamin supplement [5]	
4. Evaporated milk	120ml
Sterile water	120 ml
Egg yolk	1 (± 15 mL)
Corn syrup	15 ml
Halibut liver oil	1 drop/day
Thaimine HC1	1 mg [12]
5. Egg yolk	4 (+ 60 ml)
Whole cow's milk	1 quart (1136 ml)
Corn oil	1 tablespoon (15 ml) [18]

The energy requirements of puppies vary depending on mass and age. A very simplified formula to follow is as follows[23]:

First week: – 800kJ/kg body mass/day
Second week: – 920 kJ/kg body mass/day
Third week: – 1 025 kJ/kg body mass/day
Fourth week: – 1 110 kJ/kg body mass/day.

It is also possible to calculate the amount of food required by a puppy in a 24 h period as a percentage of its body mass [8 11]. The best guide is that given by Strasser [23] (Table 6). As most puppy diets contain 4 kJ/g (1 kcal/g), the amount of food required by a puppy in a day can be determined quickly. This can only be used as a guide, however, as no two puppies are identical in metabolic requirements. A puppy must be fed until it is full. Most puppies are capable of handling 10-20 ml of milk per feed [15 21].

The frequency of feeding puppies has been somewhat open to question. In the past it has been recommended that puppies be fed six times daily [4 8 22]; it is now felt that feeding three times daily is adequate [11 23].The number of feeds per day depends entirely upon meeting the energy and water requirements of the puppy and upon the maintenance of an optimal environmental temperature. In other words, three feeds per day would be adequate, provided the puppy receives sufficient food at each feeding, continues to grow, does not become dehydrated and is not required to produce its own body heat.

Table 6: NUTRITIONAL REQUIREMENTS OF PUPPIES BY MASS [23]

Mass (g)	1st week kJ (k cal)*/ day	2nd week kJ (k cal)/ day	3rd week kJ (k cal)/ day	4th week kJ (k cal)/ day
250	201 (48)			
300	247 (59)			
350	285 (68)	322 (77)		
400	322 (77)	368 (88)		
450	364 (87)	414 (99)		
500	406 (97)	465 (111)		
550		507 (121)	569 (136)	
600		553 (132)	620 (148)	
650		595 (142)	670 (160)	724 (173)
700		649 (155)	724 (173)	783 (187)
800		737 (176)	825 (197)	892 (213)
900		833 (199)	934 (223)	1 005 (240)
1 000		921 (220)	1 034 (247)	1 118 (267)
1 200			1 239 (296)	1 340 (320)
1 400			1 444 (345)	1 562 (373)
1 600			1 636 (395)	1 788 (427)
1 800			1 859 (444)	2 010 (480)
2 000			2 064 (493)	2 232 (533)
2 250				2 512 (600)
2 500				3 349 (800)

*Original figures (in brackets) converted to nearest whole SI units (Ed.). The table has been condensed from the original, which gives in addition the daily feed mix in grams, as well as the amount per feed.

Puppies should be weighed at birth and daily thereafter [21 23]. Problems, whether they be due to disease or management, are usually associated with a mass loss of 50-100 gm/24 h [9]. A loss of mass on two consecutive days is extremely serious and the cause must investigated immediately [13]. Weak, dehydrated or chill-

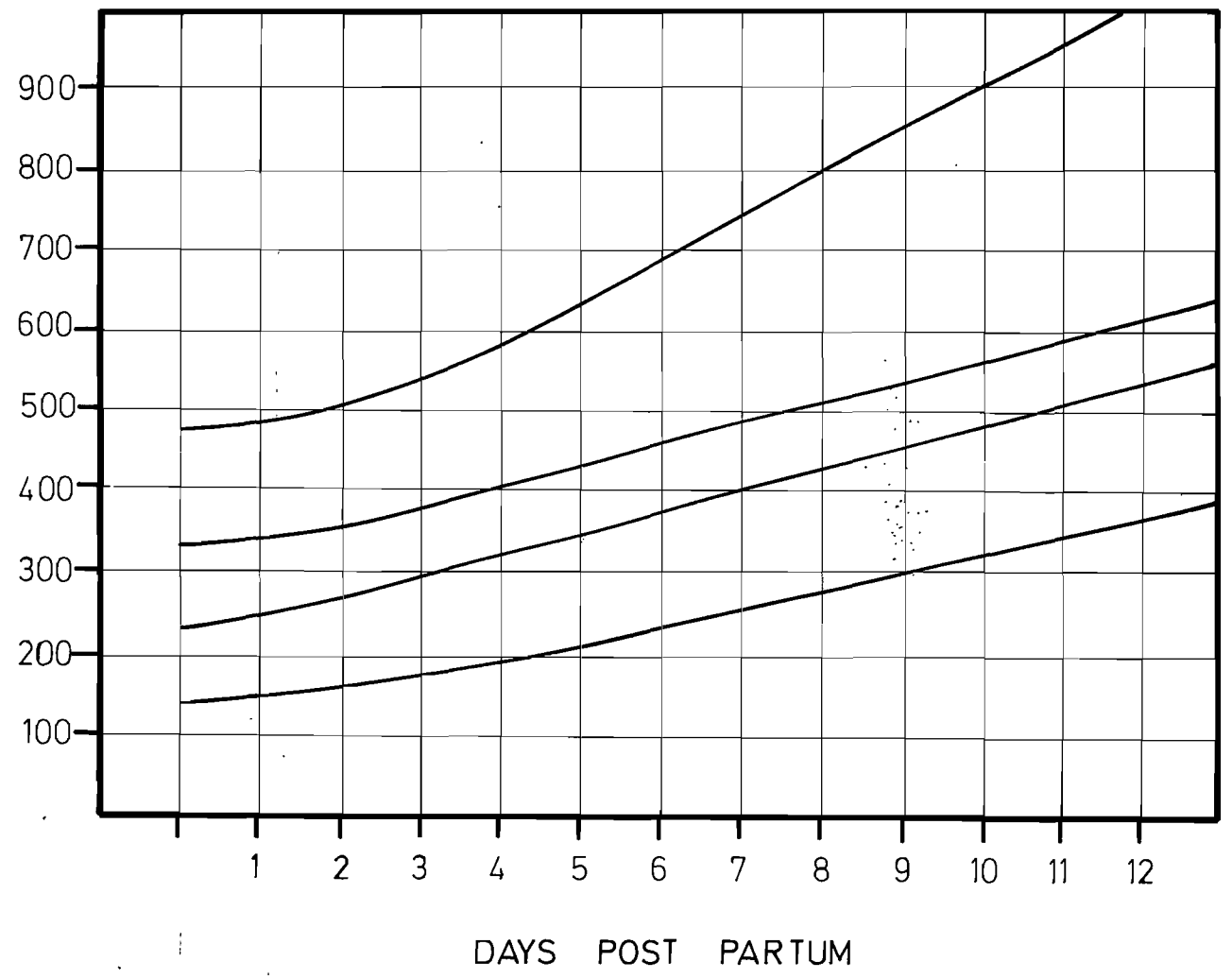

Figure 2 – Average rate of gain of puppies of different birth mass. [19]

ed puppies should be separated and provided with extra heat. They can be given 5 or 10% dextrose with an eye dropper or by stomach tube at a rate of 1 m*l* every 30 minutes until they are strong enough to suckle [5].

It may also be necessary to provide symptomatic supportive therapy in some cases. As the puppy regains strength it can be returned to its litter mates but it must be closely observed and fed more frequently until its mass gains are normal again.

Figure 2 illustrates the expected rate at which puppies of different birth mass should gain [19]. Unlike human infants, puppies should not lose mass in the first 24 hours of life [4 9]. Rate of gain for newborn puppies is nearly linear: a puppy should double its birth mass within 10-14 days [9 19]. Provided management is adequate, artificially reared puppies should gain as well as those left with a dam. This chart can be used to determine if puppies, whether they be naturally or artificially reared, are gaining as well as can be expected.

METHODS OF FEEDING

A foster-parent is by far the most ideal way to raise orphan puppies [8]. A cat queen is also acceptable [4]. Although the necessity to feed the puppies may not be eliminated, the managemental requirements are definitely reduced. One can encourage a foster-mother to take extra puppies by wiping them with a damp cloth from the foster-bitch's own puppies or with her own mammary secretions [4].

Often hand-feeding is unavoidable. It is possible to feed a puppy with a teaspoon or an eye dropper [8 22] but it is difficult to gauge the amount of food it has taken. Perhaps it is best to feed until the puppy is satisfied or until its abdomen is taut. These methods are messy and do not give the puppy an opportunity to suckle.

Gavage feeding [21] has gained a great deal of popularity because it is fast and safe. There is also very little chance of aspiration and the necessity of 'burping' the puppy is eliminated. The problems with gavage feeding are that it may be too fast and that it denies the puppy the opportunity to suckle. This can lead to oral tension and body sucking [20]. Although it is not a recognized problem with gavage feeding, fast fed puppies tend to gain mass at a lesser rate than normally fed puppies [16]. We are unaware of studies concerning the incidence of body sucking in gavage fed puppies. The most important drawback with gavage feeding is that pet owners are rather reluctant to employ this technique.

The most widely accepted and best used method of hand-feeding puppies is with a bottle and nipple. A small bottle for human infants and a nipple with a broad tip is best accepted by puppies [23]. Both the bottle and nipple must be easily washable, although sterilization does not seem to be necessary [11]. A doll's bottle and nipple can also be used [4 8]. The most important consideration with this method of feeding is that the hole of the nipple be of the correct size [11]. When the bottle is inverted the milk should drip out one drop at a time or at a rate of approximately one drop per second. If the hole is too large, the puppy may feed too fast and the chance of aspiration is increased. If the hole is too small, the puppy may not obtain sufficient food or it may become frustrated and stop suckling altogether. Again one must consider the possibility of oral tension developing which can lead to body sucking.

FEEDING

A normal puppy is a contented, warm, sleepy little creature which must be awakened before feeding. It spends approximately 90% of its time sleeping. When the puppy is wide awake, it is necesary to stimulate its eliminative functions [11]. The anogenital reflex may be stimulated by gently stroking the puppy's abdomen or perineum with a warm, damp cloth. Fretting or failure to nurse during feeding may also indicate the necessity to releave [11].

The puppy should be placed on a warm towel for feeding. Gentle handling is important at all times. Time and patience are required in teaching a puppy to use a nipple. This is particularly true if the puppy has suckled naturally before hand-rearing [23].

Gentle withdrawal of the nipple from the puppy's mouth from time to time will stimulate suckling [23]. After the puppy has eaten its fill, it is again necessary to stimulate defaecation. One must also 'burp' the puppy after feeding [8 11]. This is done by gentle massage of the puppy's abdomen. Most puppies, when warm and full, will immediately go back to sleep [11].

GENERAL MANAGEMENT AND SUMMARY

At birth all puppies should be examined closely and weighed. Any showing evidence of congenital defects must be culled [9]. The suckling reflex can be checked by gently inserting a fingertip into its mouth. This will determine whether the puppy can be bottle fed or gavage fed. Normal puppies have good muscle and skin tone.

Orphan puppies should be raised with a bitch if possible. Failing this, it is probably more practical to rear them together than individually. A point to consider is that puppies are easier to raise artificially from birth than to have them adjusting to bottle-feeding after having nursed normally [23]. In making recommendations to the average pet owner, a veterinarian must make every attempt to make the procedure of raising orphan puppies as simple as possible.

A simple, easily prepared diet is most likely to be used. Evaporated milk diluted with water 1:1 is perhaps the simplest diet and it has been used with as much success as many of the more complicated formulae [8]. Only enough food for a 24 hour period must be prepared at a given time and it should be refrigerated. The food must be warmed to body temperature immediately before feeding [8 18].

Feeding three times daily is much easier and more practical than feeding more frequently. The clinical condition of the puppy and its mass gains are the best indications as to whether the feeding schedule being used is adequate. Although it is possible to estimate the amount of food required by a puppy in a 24 hour period (Table 6) one must allow it to consume its fill at each feeding. This is perhaps the most important factor in reducing the number of feeds per day, provided all other conditions are optimal.

The necessity of stimulating eliminative functions and of 'burping' must be emphasized. Gentle bathing

after feeding will keep the puppy and its bedding clean. Application of olive oil will prevent the skin from drying and massage will stimulate the circulation and musculature [8 18]. The importance of isolation and sanitation cannot be over-emphasized.

Puppies should be identified by means of a small metallic or plastic number tied to their necks; they should be weighed daily. A sudden change in rate of growth is the first and major indication of illness or of nutritional deficiencies[9]. It is the practitioner's responsibility to prepare his clients to recognize potential problems for early treatment and subsequent favourable response. A puppy should double its birth mass in 10-14 days.

After 2 weeks of age puppies become more active and are able to look after some of their own eliminative problems [4]. They also tend to stimulate one another and socialize if reared as a litter.

By 3 weeks of age puppies are able to walk and even eat solid food. They now become nearly independent, being able to control their own body temperature and their own eliminative problems [17]. At 3 weeks of age puppies are visually and auditorially responsive [6 17] and begin to socialize [4]. At 4 weeks of age weaning can be completed [4].

ACKNOWLEDGEMENTS

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BOOK REVIEW

BOEKRESENSIE

AVIAN ANATOMY
PARTS I & II: INTEGUMENT

ALFRED M. LUCAS & PETER R. STETTENHEIM

Agriculture Handbook 362. Pp. 750. Sept. 1972. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $13 per 2 part set.

The publication of this first volume of what will most certainly become a reference classic on Avian Anatomy, is indeed a most gratifying event for both authors and readers. It was preceded by the 'Atlas of Avian Hematology' (1961). Both these publications fill a void much felt by scientists in a wide variety of scientific fields.

The first volume with its parts I & II deals only with the integument of the chicken, turkey, duck, the common coturnix and the common pigeon. Emphasis is on the chicken. The other organ systems, viz. the skeletal, muscular, vascular, nervous, respiratory, digestive, excretory, male and female reproductive and endocrine systems will be dealt with in later volumes.

The subject matter on the integument comprises a discussion of the regions of the body, the principles of pterylosis and ptilosis; pterylae; the structure, growth and pigmentation of feathers; and the histology of the skin and its derivatives. The gross anatomy of the skeletal muscles, ligaments, nerves, bloodvessels and lymphatics to the skin will be dealth with in the appropriate systems when published later on. A special Chapter on technique has been added as well as an appendix in which a classified list of birds mentioned in the text and in the Nomina Anatomica Pro Avi, based on the Nomina Anatomica as revised for the third edition (1966) are given.

This volume is exceedingly well written, the numerous diagrams, all black and white, are thoroughly annotated and with the tremendous amount of basic and applied information incorporated in the text the authors have really succeeded in compiling a reference work, which, because of its thoroughness, cannot ever really become outdated. Without the slightest hesitation I can gladly recommend it.

W.H.G.

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BLOOD GROUPS IN HORSES*

D.R. OSTERHOFF**

SUMMARY

The current status of horse blood grouping in South Africa is outlined and the international nomenclature of blood group factors and biochemical variants in blood serum is discussed.

Haemolytic jaundice of the newborn is explained as a disease directly related to incompatible blood groups. Reference is made to the rôle of blood and serum groups as genetic markers in the study of populations and breed relationships. A most important practical aspect, i.e. the verification of horse pedigrees, is emphasized and exemplified.

INTRODUCTION

Initial studies on blood group serology invariably began with the discovery of naturally occurring antibodies. In horses, Klein[6] and Panisset & Verge[10] proved that naturally occurring isoagglutinins could be present in horse serum. According to Hirschfeld & Przesmycki[5] horses' blood could be divided into classes A, B and 0; later researchers, under the influence of findings on human blood group factors, also believed that horses should fit into an A-B-O system [4 5 6]. In a study performed twelve years later, Chary[1] tried unsuccessfully to fit horses into A and B classes with five subtypes in each.

Lehnert [7], in 1939, was the first to investigate blood typing of horses by the use of immune antibodies. In all later investigations immune sera were used and only in exceptional cases were some sera containing naturally occurring antibodies included in the panel of test sera [3 4 11 15].

MATERIAL AND METHODS

The first efforts to produce immune antisera in South Africa began in 1967. Naturally occurring isoagglutinins are rare and very often very weak in horses: immunization was initiated by injecting 50 m*l* erythrocyte/saline suspensions from donors intravenously into recipients obtained from the Virology Section at Onderstepoort. Mules and horses were used as donors, and horses as recipients. These injections were repeated twice a week until antibodies were formed against the foreign red cell antigens. An average of eight injections was given in the various series, but very often no antibodies were formed. These non-reactors were used in a re-immunization series about six months later; in general, a higher titre of antibodies was obtained after repeated immunization.

The production of antisera containing a suitable level of antibodies against horse blood factors is a complicated process and in spite of thousands of immunizations performed in many laboratories all over the world there is still no short-cut or fool-proof method of producing such antibodies.

The blood used for immunization was drawn from the donor's jugular vein into 600 m*l* bottles containing 60 m*l* of a mixture of 2,5 per cent sodium citrate and 0,5 per cent NaCl in distilled water. The blood was washed twice and the packed red cells were diluted with saline at a ratio of 1 : 1 before injection into the jugular vein of the recipient.

The antibody concentration was controlled by comparing serum samples from the recipient obtained before the fourth and after subsequent injections. The serum samples were tested undiluted and in dilutions of 1 : 2, 1 : 4 and 1 : 8 against red blood cells of 10 selected animals including the donor. Where antibody had been produced, it led to complete lysis by the second reading at dilutions of 1 : 16 in the haemolytic test, or complete agglutination at dilutions of 1 : 4 in the direct agglutination test.

Three litres of blood was collected into preservation jars (900 m*l*) usually one week after the last injection. To obtain the maximal amount of serum, about 300 m*l* blood was collected into each jar, the jars were placed for one hour in a water bath at 37°C and then left overnight in an inclined position to produce a clot of maximal surface area. The serum was decanted, freed of blood cells by centrifugation, frozen and stored at –15°C.

The antisera obtained by immunizations are usually polyvalent in the sense that they contain antibodies for more than one antigenic factor. For fractionation of the sera and the isolation of blood group reagents it is necessary, therefore, to subject most of the antisera to thorough analysis by means of absorption and subsequent testing of the absorbed fraction.

The following absorption technique was adopted. Antiserum was mixed with an equal amount of washed and packed erythrocytes from animals of different blood groups. One or two m*l* antiserum was absorbed in these trials. The antisera were diluted with isotonic saline solution according to their antibody concentration before absorption, the dilution usually being 1 : 2 or 1 : 4.

The cells used for absorption were chosen in such a way that they in turn contained all factors except the one for which antibodies were to be isolated. When animals representing all the wanted combinations of factors desired were not available, cells from two or more animals were pooled in order to obtain these combinations.

The mixture of antiserum and selected packed cells was kept at room temperature (22 – 26°C) for 20 minutes, centrifuged, and the supernatant pipetted into another tube for admixture of an equal amount of packed cells of the same animal. This mixture was then left for 20 minutes in the refrigerator and after re-centrifugation the serum (now referred to as absorbed serum) was stored at –15°C.

Each antibody fraction appearing to be homogeneous was tested against erythrocytes of 20

* Lecture delivered at the Biennial Scientific Congress of the South African Veterinary Association, Pretoria, October 1973

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horses, which constituted a test panel of erythrocytes called a checklist. The results of such tests were usually sufficiently conclusive to determine whether a reagent was purified to such an extent that absorptions with positively reacting cells resulted in complete exhaustion of all haemolysins or agglutinins.

Finally, these reagents were then subjected to International Standardization Tests. Rapid accumulation of new knowledge in the field of horse blood typing required co-ordination among the workers in this field. By international agreement a duty laboratory would submit 40 blood samples to participating laboratories every two years and would co-ordinate their results, the final aim being a one hundred per cent standardization with reference to all typing reagents used in different parts of the world.

RESULTS

The production of horse blood typing reagents at Onderstepoort are outlined in table 1.

Table 1: PRODUCTION OF HORSE BLOOD TYPING REAGENTS

Year	No. of Immunizations	Reagents produced
1967	86	3
1968	552	21
1969	341	6
1970	117	0
1971	66	4
Total	1 162	34

It would be impossible to give the exact immunization and absorption procedure of each reagent separately, but all these reagents were internationally compared in four different Horse Comparison Tests (Table 2). Other genetic markers which were compared together with the blood typing reagents are included for later reference.

Table 2: INTERNATIONAL HORSE COMPARISON TESTS

Year	Duty Laboratory	Participating Laboratories	South Africa's Contribution	
			Blood Group Reagent	Other Genetic Markers
1968	Davis, U.S.A.	5	11	4
1969	Paris, France	10	29	5
1971	Uppsala, Sweden	11	32	7
1973	Newmarket, Engl.	17	30	10

From the thirty blood group reagents produced in our laboratory, sixteen were in agreement with those of other laboratories. The inheritance of the 16 blood factors was studied in laboratories in California, Sweden, Germany, France and also in our laboratory. Analysis of the data showed that each of these blood factors is inherited as a simple Mendelian dominant in contrast to its absence; also, that certain of the blood factors belong to the same genetic systems. In all, eight genetic systems were indicated, named A, C, D, K, P, Q, T and U. All factors belonging to these systems and which have been internationally compared and accepted are indicated in table 3.

Table 3: BLOOD GROUP SYSTEMS IN HORSES

Genetic Systems	Antigenic Factors
A	A_1 A_2 H_1 H_2 A' Z_1 Z_2 F
C	C
D	D_1 D_2 E_1 E_2 E'G J_1 J_2
K	K
P	P_1 P_2 P'
Q	Q R S_1 S_2 X
T	T_1 T_2
U	U_1 U_2

STUDIES ON OTHER GENETIC MARKERS

Studies in our laboratory have also disclosed genetic variation in different systems of haemoglobins, serum proteins and various enzymes in horses. From table 2 it can be seen that in the first international comparison test in 1968 four of these other genetic markers were included, i.e. haemoglobin, transferrin, albumin and serum esterase. In various publications these markers were also used in comparisons between the different species in the family Equidae and in a particular study of the Basuto Pony [8 9].

In later years other genetic markers were studied in our laboratory and new enzyme markers, i.e. 6-Phosphogluconate dehydrogenase (6-PGD), Phosphoglucomutase (PGM) and Phosphoglucose isomerase (PGI) could be included. All genetic markers and all types established in our laboratory are tabulated in table 4.

Table 4: GENETIC MARKERS IN HORSE BLOOD ESTABLISHED IN SOUTH AFRICA

Marker	No. of alleles	No. of phenotypes
Haemoglobin	2	3
Albumin	2	3
Pre-Albumin	6	26
Transferrin	5	20
Esterase (Serum)	3	6
6 – PGD	2	3
Carbonic Anhydrase . .	4	10
PGM	2	3
Acid Phosphatase . . .	2	3
PGI	2	3

A detailed description of all these findings would exceed the framework of this paper.

DISCUSSION

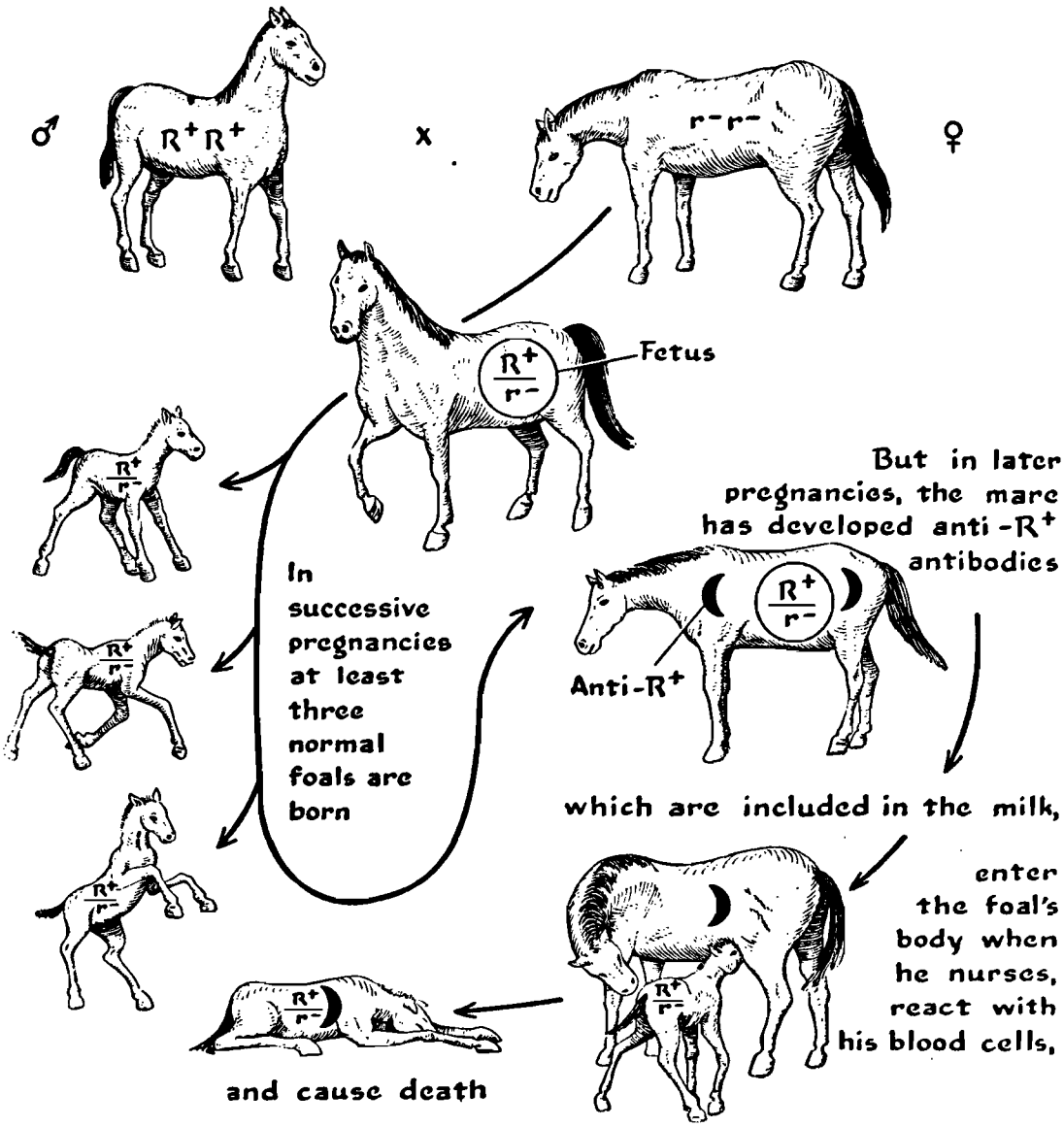
Only two aspects will be discussed here in detail:

(i) the significance of blood groups with regard to *erythroblastosis foetalis;*

(ii) paternity tests in horses.

(i) *Erythroblastosis foetalis*

The basis of this incompatibility in horses, which depends largely on ordinary gene difference, is illustrated in the figure. A foal inherits from his sire the ability to produce a particular substance, absent in his dam, which acts as an antigen when it reaches the mother's circulation from the foetus; she elaborates



Blood group incompatibility in horses

antibodies capable of reacting specifically with the substance. For the first three or more pregnancies the antibodies, if they are present at all, are apparently present in levels too low to cause any serious damage. In later pregnancies, however, the antibodies in the dam's colostrum may react with the antigen produced by the foal by virtue of the gene inherited from his sire; this reaction is often fatal to the foal, jaundice being one of the early symptoms of the disorder.

The interpretation of this incompatibility in horses was relatively easy, because an essentially similar situation in human beings was already widely known. This is the Rh factor, causing *erythroblastosis foetalis* in human infants. The condition is comparable to the severe jaundice of the foal described above, with one major exception: instead of being transmitted primarily through milk, Rh antibodies are transmitted from mother to foetus primarily across the placenta.

At this stage no laboratory in the world is able to differentiate between the 'Rh positive' and 'Rh negative' horses in order to predict the outcome as explained in the figure. Scott claims that he has produced several new antisera which could establish these differences [14]. It would be of great value to be able to distinguish the positive from the negative 'Rh' carrier, because this incompatibility is rather frequent in South African race horses; at least 20 foals have been lost to *erythroblastosis foetalis.*

ii) *Paternity tests in horses*

All parentage tests are based on the principle of genetic exclusion. The burden of proof in such tests depends upon showing that a given animal could not be a parent of the off-spring in question.

Genetic characteristics to be used in resolving problems of questionable parentage must meet certain requirements. Such characteristics must be simply and directly inherited; this implies that they must be dominant; the genetic basis for their inheritance must be fully understood; they should be developed at birth or shortly thereafter; they must be stable qualitative traits that are not influenced by changes in the environment, which implies that they will remain unchanged throughout life; and they must be capable of detection by means of tests which are reliable and objective. The latter requirement introduces the human element, and it should follow without to much reiteration that the tests should be performed and interpreted only by persons who are fully qualified through training and experience with the methods. Moreover, such persons must be com-

pletely familiar with the genetics of all characteristics under examination.

Foremost among the genetic characteristics which meet the foregoing requirements are the antigenic characters of the erythrocytes. Many of the proteins, including enzymes of blood serum, are under rather simple and direct genetic control. The methods used in detecting genetic variation in these proteins are of recent development, notably the technique of starch gel electrophoresis. From the many parentage tests performed in our laboratory, two examples will be given, in which both the serological and the starch gel electrophoresis technique have been used. Table 5 represent a paternity test performed for the breeder of Arab horses whereby four stallions were involved. Only those haemolysins and agglutinins which reacted with the respective reagents are recorded in the table.

In the second case the antigenic characters of the erythrocytes could not contribute to a solution of the problem. The protein and enzyme systems allowed the case to be resolved, as shown in table 6. This case was solved with the final statement: the stallion Powder Rock was excluded as a possible sire and the stallion Veronese qualifies as the parental stallion with proof in the pre-albumin-, 6-PGD-, esterase- and the LDH-systems.

The results demonstrate that such tests† are efficient in solving problems of questionable parentage in horses and they attest the validity of the methods. They provide an important advance in the practice of horse breeding.

Table 5: HORSE PARENTAGE CASE

Animal	Haemolysins									Agglutinins						Hb	Tf	Alb	Ca	Es
	A	C	5	7	8	14	17	22	25	J	K	1	2	4	5					
POSSIBLE SIRES:																				
STORIK	+	+	+	+	+		+	+	+			+			+	Aa	DH	AB	IS	FI
RAKTHA	+	+	+		+							+				Aa	DO	AB	IS	FF
MASRIK	+	+	+		+		+	+				+			+	Aa	DH	AB	IS	II
AZYMDAR	+	+	+		+					+		+		+		Aa	FF	BB	FS	II
DAM:																				
SALLY	+	+		+	+	+	+				+	+	+			Aa	HH	BB	SS	FF
FOAL:	+	+	+	+		+	+			+	+	+	+	+		Aa	FH	BB	FS	FI

Hb = Haemoglobin. Tf = Transferrin. Alb = Albumin. Ca = Carbonic Anhydrase
Es = Esterase.

Table 6: HORSE PARENTAGE CASE

	Haemolysins								Agglutinins										
	A	H	C	SA f	SA 14	SA 17	SA 19	SA 29	J2	NA 5	NA 7	Hb	Tf	Alb	Pre Alb	6–PGD	Est	LDH
Foal	+	+	+	+	+	+	+	+	–	+	+	Aa	DF	AB	FS	FS	FS	FS
Tasmin (Dam)	+	+	+	+	+	+	+	–	–	–	–	Aa	FF	AB	SS	FF	SS	FF
Powder Rock (Sire)	+	+	+	–	+	–	–	–	+	+	+	Aa	DO	AB	SS	FF	SS	FF
Veronese (Sire)	+	+	+	–	+	–	–	+	+	+	+	Aa	DD	BB	FS	SS	FS	FS

Pre-Alb = Pre-albumin. 6–PGD = 6–Phosphogluconate dehydrogenase. LDH = Lactate dehydrogenase. Others as before.

The case was solved with the final statement: the stallions Storik, Raktha and Masrik are excluded as possible sires; Azymdar qualifies as sire of the foal with proof in the agglutinin, transferrin and carbonic anhydrase systems.

+ Information regarding the services offered by the author's laboratory is available upon request.

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THE DIAGNOSIS OF SUBCLINICAL MASTITIS IN LACTATING COWS*

W.H. GIESECKE**

SUMMARY

A critical evaluation of relevant literature published between 1833 to 1973 suggests that for an incredible period of 140 years of mastitis research the work was based on an inaccurate definition of mastitis. An accurate definition pertaining to the most characteristic criterium of mastitis, i.e. pathological damage to the mammary epithelium, is suggested. The status of the epithelium of the lactating udder can be assessed accurately by determining milk concentrations of serum albumin by means of a radial immunodiffusion test. This test, used jointly with currently accepted diagnostic criteria, facilitates diagnosis of true mastitis and teat canal infections without resorting to cistern puncture. Information pertaining to the development of this approach to mastitis diagnosis, published elsewhere, is summarized. The practical application of the test is elucidated by data established on 1 734 foremilk samples of 440 dairy cows and two commercially available antibiotics formulated for the intramammary therapy of septic mastitis. Results are summarized in four figures and five tables.

INTRODUCTION

The unprecedented accuracy of the electronic method of counting cells in milk, repeatedly confirmed and generally accepted since the original work[22], the sensitivity of bacteriological methods, the availability of potent antiseptics and therapeutics, the vast accumulation of knowledge regarding the aetiology and pathogenesis of mastitis and the increased awareness of the importance of the disease, engendered a sense of confidence pertaining to the control of this disease, either explicitly stated [26] or by implication [12 24]. Nevertheless, a satisfactory degree of success in mastitis control continues to be as evasive as it was two decades ago. 'We are not controlling bovine mastitis today [16]'.

In the face of such a situation, it is considered essential to analyse critically the concept of what constitutes mastitis. In other words, the definition of mastitis must be re-evaluated and a critical distinction must be drawn between such a definition and the practically applicable criteria by means of which mastitis is being diagnosed.

THE DEFINITION OF MASTITIS

From a critical appraisal of pertinent literature published between 1833-1973 [4] it is apparent that 'mastitis' means inflammation of the mammary gland [15 17 18]. According to the definition of mastitis proposed by the International Dairy Federation (IDF) in 1967 [12] and elucidated and standardized subsequently in considerable detail[24], 'mastitis is an inflammatory change of the mammary gland which, along with physical, chemical and microbiological changes, is characterized by an increase of somatic cells, especially leukocytes in milk, and by pathological changes in the mammary tissue'. Nevertheless, as far back as 1959, it was pointed out that such changes are not pathognomonic of mastitis [14].

Considering that mastitis most frequently results from galactogenous infections [8 15 17 18], it appears reasonable to regard pathological damage to the epithelium lining the cisterns, lactiferous ducts and alveoli as the primary stage of mastitis. The constitution and condition of the affected cow, the severity of pathological epithelial damage and pathogenic properties of the aetiological agent would determine the nature and magnitude of any subsequent inflammatory reaction. Consequently, the accurate definition of mastitis should read: 'Mastitis is an inflammation of the mammary gland. It is characterized by pathological damage to the mammary epithelium, followed by subclinical and/or clinical inflammatory reactions. Their magnitude may cause localized and/or generalized pathological changes.'

Surprisingly, on examination of the voluminous pertinent literature contained in text books on bovine mastitis [8 15 18] and early literature [17], contemporary workers [4] have failed to discover any indication that pathological damage to udder epithelium has hitherto been considered of sufficient significance in the pathogenesis of mastitis to warrant appropriate reference in any of the currently acknowledged definitions of mastitis. Consequently, no attempt has ever been made to diagnose such epithelial damage or even develop methods for such a diagnosis.

This failure to recognize pathological epithelial damage as the most significant evidence of mastitis has most important implications with regard to mastitis research and practical mastitis control.

In the case of mastitis characterized by clinically acute tissue alterations and/or distinct changes in secretion, the pathological changes are so distinctly inflammatory in nature and magnitude that they cannot be confused with any physiological alterations that may simulate mastitis. Hence the implications referred to are of little practical significance.

In the case of subclinical mastitis, however, the nature and magnitude of inflammatory reactions are of such a low order that they may be confused easily with physiological changes such as pre-inflammatory leukocytosis and premature regression [4 5] in particular. Consequently, those criteria which facilitate an accurate diagnosis of acute clinical mastitis are not necessarily equally applicable to the diagnosis of subclinical mastitis.

The internationally accepted definition of subclinical mastitis, as proposed by the IDF[12 24] reads as follows:

'. . . 2. *Subclinical mastitis* shows no macroscopic evidence of inflammation but examination of the milk reveals udder infection, an increased cell count and also alterations in the chemical properties of the milk'.

The relevent criteria used for the laboratory diagnosis of bovine mastitis, including subclinical mastitis, are cited in Table 1:

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* Paper delivered at the Biennial National Veterinary Congress, Pretoria, October 1973

** Veterinary Research Institute, Onderstepoort

Table 1: ASSESSMENT OF CYTOLOGICAL BACTERIOLOGICAL FINDINGS IN MASTITIS DIAGNOSIS [24]

Cell count per *ml* milk	Pathogenic micro-organisms	
	not isolated	isolated
< 500 000	normal secretion	latent infection
> 500 000	non-specific mastitis	mastitis

These criteria are applicable when quarter milk samples are collected aseptically at the usual milking time from the initial milk (after discarding the foremilk) from cows in normal lactation [12 24].

Where criteria of the IDF [12 24] are relied upon to control subclinical mastitis, the accuracy of its diagnosis depends on:

1. the diagnostic significance of clinically detectable udder changes which apparently are found exclusively in clinically mastitic udders;
2. the diagnostic significance of pathogenic bacteria in milk, the absence or presence of which apparently facilitates diagnoses such as 'mastitis negative', 'latent infection', 'septic' and 'aseptic' mastitis respectively, when used jointly with somatic cells counts (see Table 1);
3. the efficacy of aseptic sampling procedures for the culture of pathogenic micro-organisms originating from the udder cavities and excluding those from the cow's surroundings;
4. the diagnostic significance of low or elevated somatic cell counts which presumably characterize 'mastitis negative' or 'positive' quarters respectively.

As to the diagnostic significance of clinically detectable udder changes, clinical udder examinations were already regarded as rather valueless in 1932 [19]. Others [11] suggest that fibrosis of the udder should be interpreted as meaning that the udder either is or has been mastitic. From these and other data reviewed [4] it is concluded that non-acute clinical changes of udder parenchyma (i.e. fibrosis) are not pathognomonic of active inflammation. This criterium consequently is also invalid for distinction between clinical and subclinical mastitis as has been suggested [12 24].

As to the diagnostic significance of pathogenic micro-organisms isolated from teat samples, the teat canal was already recognized as a major source of milk contamination in 1921 [13]. In 1934 [10] it was found that most cases of mastitis diagnosed by laboratory means are, in fact, teat canal infections. This was fully confirmed in more recent years [1 3 6 7]. The above and other data reviewed [4] suffice to indicate that isolation of bacteria, whether pathogenic or non-pathogenic, from milk samples collected via the teat canal as specified by IDF, is not pathognomonic for mastitis as IDF would suggest [12 24]. Nor are such isolations synonymous with *udder infection* proper or with *mastitis* as suggested by the considerable number of workers involved in the development and/or promotion of 'dry cow therapy' [2].

The contemporary attitude towards the diagnostic significance of somatic cell counts of milk was ably summarized in 1968 [23]. Increased somatic cell counts in milk are regarded as virtually synonymous with 'microscopically determinable pus' as indicated by statements such as:

> 'Under consideration of physiological variations, an increased cell content in milk is to be considered as an obvious symptom of existing mastitis or secretional disturbances. Hence, the cell content represents a reliable indicator for irritation of the mammary gland. The cells concerned are leukocytic cells, glandular or ductular epithelial cells and connective tissue cells. The reliable determination of these criteria is of interest concerning mastitis diagnosis, quality grading of raw milk and various aspects of research' [23].

On comparison with early literature [4], it becomes apparent that a significant change has taken place concerning the actual meaning of 'pus cells' found in milk. Whereas early workers [20] referred to *leukocytes*, the international standards currently in use [12 24] include cells of *mammary* origin as well. The types of mastitis of major economic importance have also changed, and cytological methods have become highly sensitive. The method able to produce the highest cell counts and hence the greatest frequency of 'positive' mastitis diagnoses became accepted as being diagnostically the most accurate one. Lack of an absolute cytological standard, however, the wide range of cytological variations produced by physiological changes, or induced by the methods pursued, and the universal disregard by generations of mastitis researchers of the necessity to use elementary research controls to distinguish between physiological and pathological function of the udder epithelium, make it increasingly difficult to retain confidence in cytological means of diagnosing subclinical mastitis. In fact, it is plainly unrealistic to expect any significant accuracy in the diagnosis of subclinical mastitis based on *leukocyte* counts, and even more so if the diagnosis is based on somatic cell counts. Recent publications [4 5 21] show clearly that leukocyte counts of millions/m*l* may be associated with pre-inflammatory cellular reactions resulting from teat canal lesions and/or infections which, like damage to udder epithelium, have hitherto been completely disregarded in diagnostic considerations. Highly elevated epithelial cell counts may result from stress which affects the dairy cow and initiates varying degrees of premature regression. Consequently it stands to reason that elevated somatic cell counts representing the sum of leukocyte and epithelial cells/m*l* of milk are not pathognomonic of mastitis, as has been suggested [12 24].

These conclusions are not only contrary to currently accepted diagnostic standards [12 24] but also suggest that a considerable proportion of currently available knowledge, established over a period of 140 years on the aetiology, pathogenesis, therapy, prevention and other aspects associated with bovine mastitis in general, and with subclinical mastitis in particular, is of doubtful value. They are not disproved by the success of control measures against *Streptococcus agalactiae*, neither do they preclude success against other types of mastitis diagnosed by currently accepted methods. Since current criteria for the diagnosis of subclinical mastitis result in a considerable proportion of false positive diagnoses ($\bar{X}$ = 43,13%; SD = 20,8%) and the reverse is not true[5], mastitis control can be effected on the basis of these

accepted criteria. *But to proceed further with such empirical rather than conclusively proven criteria results in ill-afforded waste of time and effort;* it casts serious doubts on the justification of any legal actions which may be instituted concerning subclinical and/or non-acute clinical types of mastitis, based as they are on chemical, bacteriological and cytological qualities of milk. In addition, it is conceivable that where practical and research work on mastitis control depend on the currently inaccurate diagnostic criteria, direct and/or indirect financial losses may be incurred possibly equal to, but more likely greater than, those caused by true mastitis alone.

It is fully appreciated that the above represents serious criticism of a considerable mass of research data and the practical application thereof; the validity of this criticism must be supported by appropriate evidence. Moreover, criticism concerning inaccurate diagnoses would be of no value whatsoever unless a practically feasible and more accurate alternative method of truly diagnosing mastitis is made available. Both the former and the latter are now provided by means of detailed analyses of literature [4] and experimental data [5].

SERUM ALBUMIN IN MILK AS TRACER OF PHYSIOLOGICAL AND PATHOLOGICAL STATUS OF LACTATING MAMMARY EPITHELIUM

Pathological damage to tissue is followed almost immediately by perfusion with serum constituents which results *inter alia* in elevated levels of serum albumin in the damaged extravascular region concerned. Provided this generally acknowledged pathological phenomenon is correct, it also applies to the lactating mammary gland, where normal/pathological epithelial activity is associated with low/high serum albumin milk concentrations respectively.

The possibility of using serum albumin values of milk as indicator for mastitis was already pointed out in 1932 and subsequent workers fully confirmed this viewpoint in principle [5]. Owing to the inaccurate definition of mastitis and the even more inaccurate diagnostic criteria, the true significance of serum albumin in milk remained obscure. This becomes apparent on comparison of previous [9] and recent work [5] concerning the determination of serum albumin concentrations of milk by means of almost identical methods.

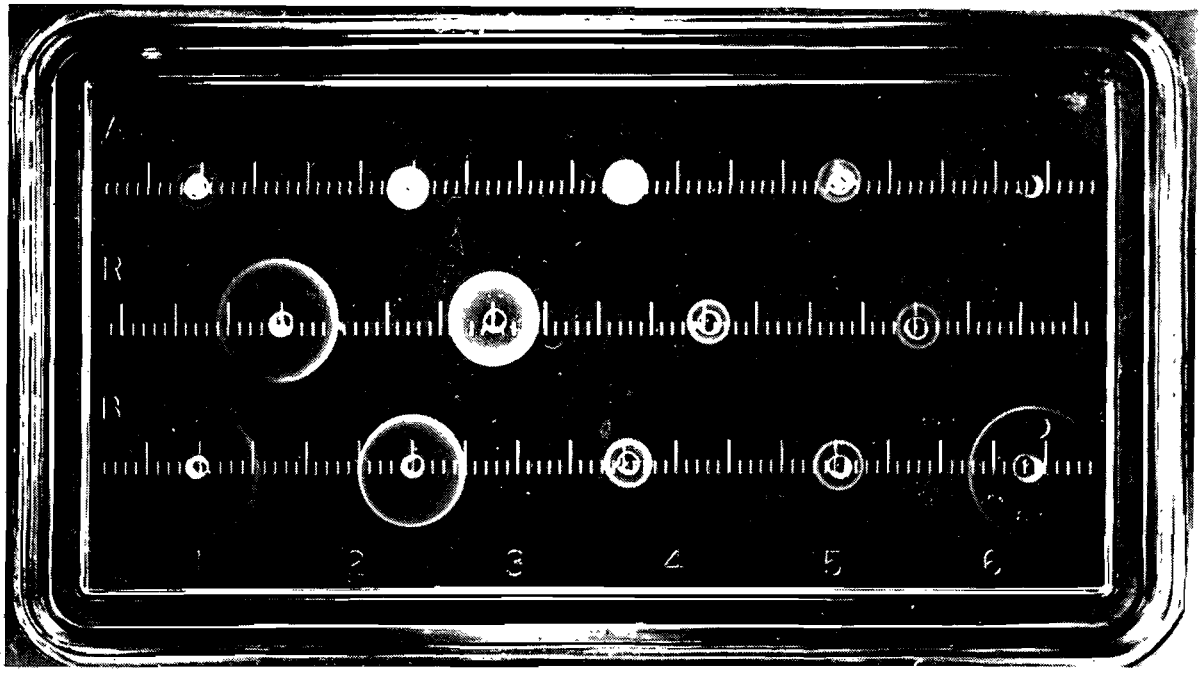
The method concerned and subsequently referred to as Monomastest (MMT), is a highly sensitive immunological method based on radial diffusion of bovine serum albumin (BSA) against anti-BSA immune serum [5 25]. Test results are depicted in figure 1, which indicates low or elevated BSA concentrations in milk by means of small or large precipitation zones respectively.

BSA concentrations in mastitis negative foremilk and strippings result in precipitation zones with diameters (mean ± standard deviation) of 3,43 ± 0,97 mm or 4,25 ± 0,98 mm respectively[25].

BSA concentrations in mastitis negative milk samples collected conventionally from cows in normal lactation are depicted in figure 2.

With due consideration of the physiological variations which occur in the mastitis negative quarters of such cows, normal and mastitic BSA concentrations are compared in figure 3.

From figure 3 it is apparent that during normal lactation the test differentiates between mastitis-negative and mastitis-positive quarters as indicated by the threshold values. Nevertheless, the full diagnostic potential of this test is only utilized when it is read in conjunction with the conventional diagnostic criteria as shown in table 2.



Precipitation zones from eight mastitis-negative (small rings) and five mastitis-positive (large rings) milk samples and one well (top row, right corner) filled with water as a control.

Fig. 1 Radial immunodiffusion of low and elevated concentrations of BSA of mastitis-negative and subclinically mastitic milk samples respectively.

Table 2: A KEY FOR DIFFERENTIATION BETWEEN MASTITIS AND TEAT CANAL INFECTIONS IN LACTATING COWS BY MEANS OF A COMBINATION OF IMMUNOCHEMICAL, CYTOLOGICAL AND BACTERIOLOGICAL TESTS

DIAGNOSTIC CRITERIA			MASTITIS DIAGNOSIS	FINAL DIAGNOSIS	POSSIBLE DIFFERENTIAL DIAGNOSIS
MMT (mm)	Somatic Cells/ml ($\times 10^3$)	Bacteriological Culture			
	< 500	Negative		Completely negative	–
	< 500	Positive		Irrelevant* teat canal infection	Extraneous contamination of completely negative milk
< 8.0			Negative †		
	> 500	Negative		Non-specific cellular reaction	Initial stage of premature regression
	> 500	Positive		Relevant** teat canal infection	Extraneous contamination of milk with non-specific cellular reaction
	⩾ 500	Negative		Aseptic mastitis	Advanced stage of premature regression
⩾ 8.0			Positive ††		
	⩾ 500	Positive		Septic mastitis	Extraneous contamination of milk from aseptic mastitis

For routine purposes:

1. † Does not preclude presence of fibrotic tissue changes and/or few small floccules in first jet of milk from udders with undamaged epithelium.
2. †† Subclinical where milk is macroscopically normal; clinical where milk is macroscopically abnormal and/or distinct tissue changes (e.g. acute) are doubtlessly associated with damaged epithelium.
3. * Irrelevant due to lack of cellular reaction; it includes extraneous contamination of completely negative milk.
4. ** Relevant since infection is severe enough to elicit a cellular reaction in the udder cavity, suggesting an ascending mastitogenic tendency; it includes extraneous contamination of milk with non-specific cellular reaction.

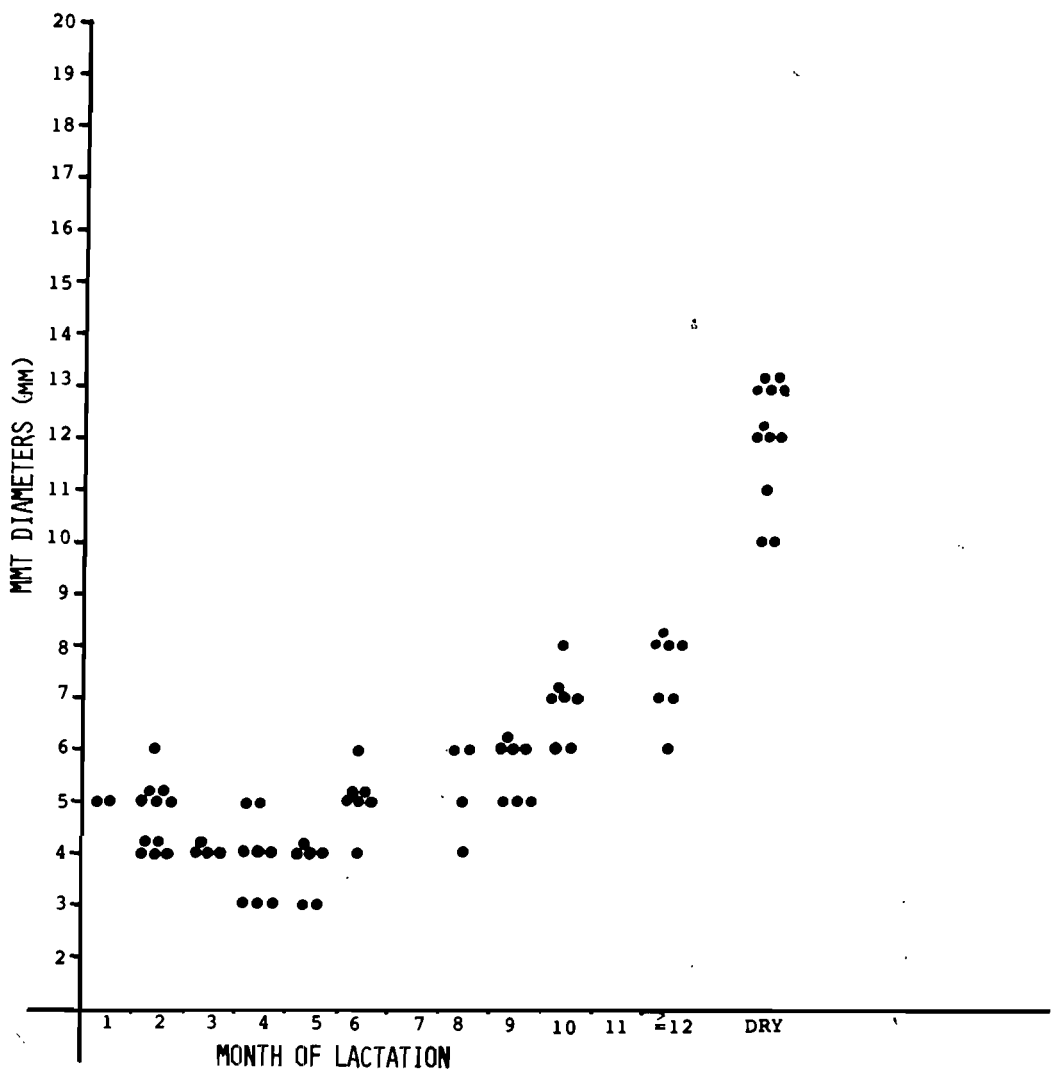
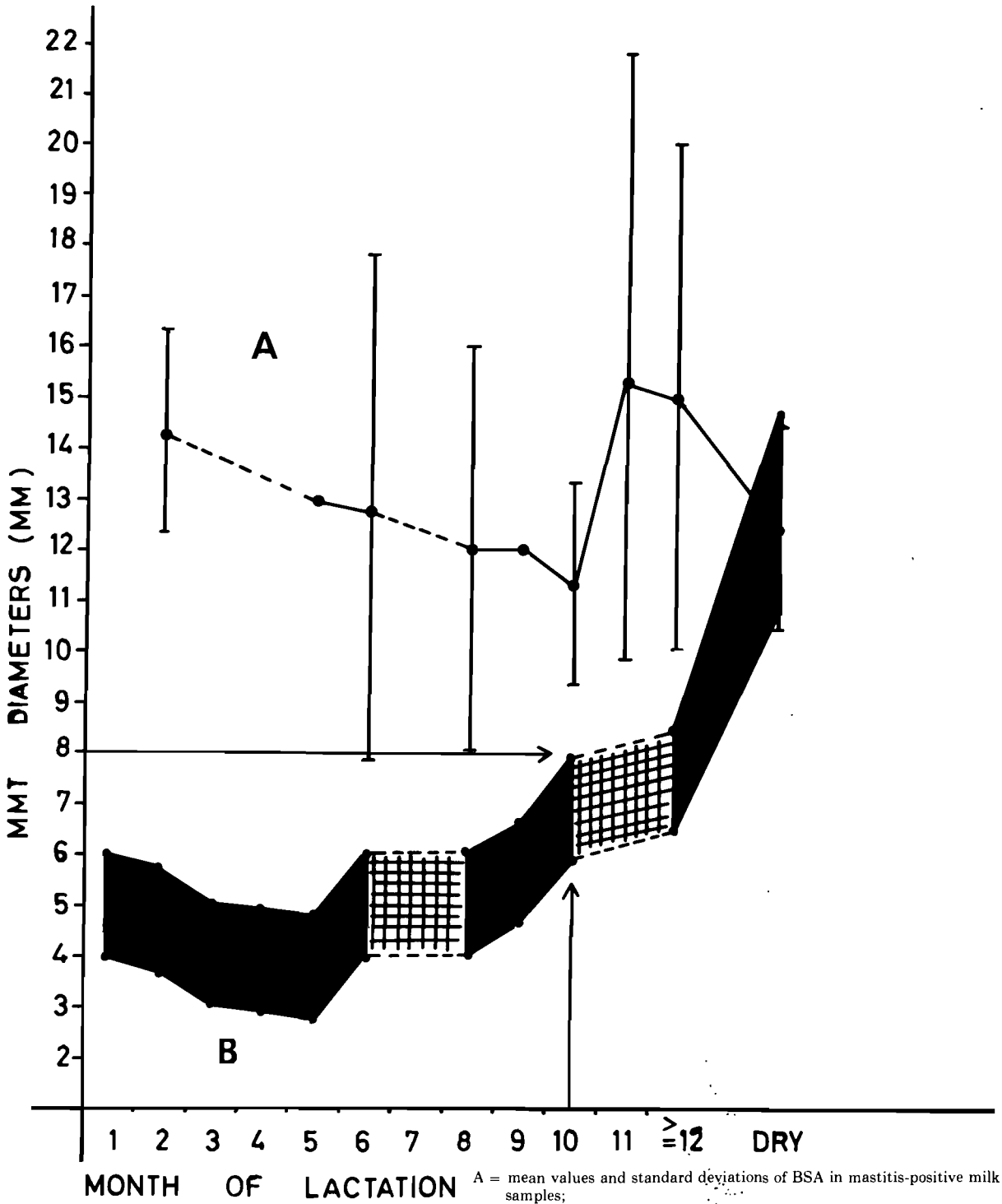


Fig. 2. BSA concentrations in 81 mastitis-negative milk samples collected from 38 cows at different stages of lactation



A = mean values and standard deviations of BSA in mastitis-positive milk samples;
B = mean values and standard deviations of BSA in mastitis-negative milk samples;
--- = presumed values since no data available.
➡ thresholds suggested for normal milk

Fig. 3 Comparison of BSA concentrations in 81 mastitis-negative and 69 positive milk samples collected from 38 cows at different stages of lactation

Elaborate differentiation of diagnoses according to table 2 might at first be considered of academic value only. It must be understood, however, that diagnostic differentiation is of practical significance provided it is realized and appreciated that most mastitis herd problems are associated with diseased teat canals, the normal function of which, in turn, appears to be essential for the effective preservation of udder health. For example, infections of the teat canal with *Staphyloccoccus aureus* which ascends into the udder cavity are of primary importance in the pathogenesis of this type of mastitis. Consequently it is conceivable that the diagnosis, treatment and prevention of such potentially mastitogenic teat canal infections at an early stage and prior to the onset of actual mastitis will be a considerably more efficient means of mastitis control than the current ones which, as far as therapy is concerned, only come into effect after mastitis has been established.

The validity of the diagnostic criteria summarized in table 2 is supported by data obtained from samples collected concurrently by conventional aseptic teat sampling and teat cistern puncture respectively (Table 3).

As shown in table 3, diagnoses based on IDF criteria [24] suggest an incidence of two quarters with aseptic and 13 with septic mastitis. Examination of cistern samples confirms the occurrence of five

Table 3: SUMMARY OF DIAGNOSES ESTABLISHED BY IDF[24], MMT[5] OR MMT PLUS IDF STANDARDS RESPECTIVELY ON SAMPLES COLLECTED CONVENTIONALLY AND BY CISTERN PUNCTURE FROM 26 LACTATING QUARTERS OF 7 COWS

ORIGIN OF SAMPLE	DIAGNOSTIC CRITERIA	DIAGNOSES							
		MASTITIS				LATENT INFECTION	NONSPECIFIC CELL REACTION	TEAT CANAL INFECTION	
		NEGATIVE	POSITIVE						
			TOTAL	ASEPTIC	SEPTIC			RELEVANT	IRRELEVANT
TEAT CANAL	IDF ($500x10^3$ cells/ml	5	15	2	13	6	0	0	0
	MMT (8mm)	21	5	0	0	0	0	0	0
	MMT + IDF	21	5	0	5	0	2	8	6
TEAT CISTERN	IDF ($500x10^3$ cells/ml	5	7	2	5	0	0	8	6

quarters with septic mastitis, whereas the remaining 8 quarters have, in fact, relevant teat canal infections only (see notes, Table 2). Six quarters with latent udder infection diagnosed according to IDF criteria actually have irrelevant teat canal infections on examination of cisternal samples (see notes, Table 2). The presence of only 5 true cases of septic mastitis is also confirmed by MMT performed alone or jointly with IDF criteria. This combination of diagnostic criteria also reveals that two quarters with aseptic mastitis diagnosed according to IDF, are in fact, quarters with non-specific cellular reactions unassociated with mastitis.

Application of current diagnostic criteria [24] and the MMT, alone or jointly, to milk samples collected aseptically from experimental cows in normal lacta-

Table 4: DIFFERENTIATION OF 42 'MASTITIS POSITIVE' QUARTERS ACCORDING TO IDF STANDARDS [24] AND MMT [5] AS SUGGESTED IN KEY FOR DIAGNOSTIC DIFFERENTIATION (Table 2)

DIAGNOSTIC CRITERIA	MASTITIS POSITIVE QUARTERS AND PERCENTAGE THEREOF (%)							
	MASTITIS POSITIVE				MASTITIS NEGATIVE			
	Latent Infection	Septic	Aseptic	Total	Total	Non-specific cell reaction	Teat canal infection	
							Relevant	Irrelevant
IDF AT								
300 x 10^3 cells/ml	4(9,5%)	28(66,7%)	10(23,8%)	38(90,5%)	0	0	0	0
500 x 10^3 cells/ml	7(16,7%)	26(61,9%)	9(21,4%)	35(83,3%)	0	0	0	0
$\bar{X}$ (%)	13,1%	64,3%	22,6%	86,9%	0	0	0	0
MMT + IDF	0	8(19,0%)	1(2,4%)	9(21,4%)	33(78,6%)	9(21,4%)	17(40,5%)	7(16,7%)

Table 5: SUMMARY OF DIAGNOSES ESTABLISHED BY IDF[24] OR MMT[6] PLUS IDF STANDARDS RESPECTIVELY ON SAMPLES COLLECTED CONVENTIONALLY FROM 1 734 LACTATING QUARTERS OF 440 COWS IN 3 COMMERCIAL DAIRY HERDS

IDF CRITERIA			QUARTERS WITH MMT PRECIPITATION DIAMETERS (% = PERCENTAGE OF ALL QUARTERS EXAMINED)		IDF TOTALS
BACTERIA		SOMATIC CELLS/ml	< 8 mm	⩾ 8 mm	
PATHOGENIC MICRO-ORGANISMS	ABSENT	< 500 x 10^3	1 183 (68,23%)	4 (0,23%)	1 187 (68,46%)
		⩾ 500 x 10^3	99 (5,71%)	13 (0,75%)	112 (6,46%)
	PRESENT	< 500 x 10^3	258 (14,88%)	3 (0,17%)	261 (15,05%)
		⩾ 500 x 10^3	147 (8,4 %)	27 (1,55%)	174 (10,03%)
MMT		TOTALS	1 687 (97,2 %)	47 (2,70%)	– –

tion resulted in diagnoses as exemplified in table 4.

Diagnostic criteria identical to the above were applied to three large commercial dairy farms. The results obtained are summarized in table 5.

As indicated by table 5, application of IDF criteria alone suggest an incidence of 68,46% mastitis-negative quarters, 6,46% had aseptic mastitis, 15,05% latent infection and 10,03% septic mastitis. In contrast, the MMT performed alone suggests tentatively that 97,22% of the quarters are free from mastitis and 2,70% are affected. The MMT and IDF criteria used jointly according to table 2, however, facilitate differentiation of diagnoses such as:

1. quarters with MMT$<$8mm precipitation diameter
   68,23%: absolutely negative,
   5,71%: non-specific cellular reaction,
   14,88%: irrelevant teat canal infection,
   8,40%: relevant teat canal infection, totalling 97,22% mastitis negative quarters; and
2. quarters with MMT $\geqslant$ 8mm precipitation diameter
   0,98% (0,23% + 0,75%): aseptic mastitis,
   1,72% (0,17% + 1,55%): septic mastitis, totalling 2,70% mastitis positive quarters.

Quarters with premature regression could cause some inaccurate mastitis positive laboratory diagnoses. Since such quarters usually are indurated and produce decreased and frequently very small amounts of milk-like secretion, the rather limited proportion of such diagnoses could be corrected during the clinical examination of mastitis-positive quarters performed for prognostic purposes prior to treatment [4].

Because BSA is a whey-protein, application of the BSA test to both fresh and sour milk provides results which are equally accurate; this enhances application under field conditions.

Apart from its considerable value in mastitis research, the MMT is likely to be of great use in assessing the degree of udder irritation induced by intramammary administration of remedies formulated for the purpose of local mastitis therapy. Appropriate tests performed with two commercially available mastitis remedies resulted in udder irritation as summarized in figure 4.

From figure 4 it is apparent that pathological function of mammary epithelium does result from intramammary administration of mastitis remedies. The elevated BSA milk concentrations occurring subsequent to such administration provide a convenient, reproduceable, accurate and objective means of evaluating udder irritations caused by these compounds.

To enhance field application it may be necessary to convert the original radial immunodiffusion test [5 25] into a test which is more practical but equally sensitive.

CONCLUSION

From data reviewed[4] and obtained experimentally[5] it is concluded that international diagnostic criteria [12 24] are inaccurate and incomplete and therefore incapable of ensuring continued progress in the control of subclinical mastitis. The highly sensitive BSA-immunodiffusion test, however, is capable of distinguishing between physiological and pathological functioning of the udder epithelium during normal

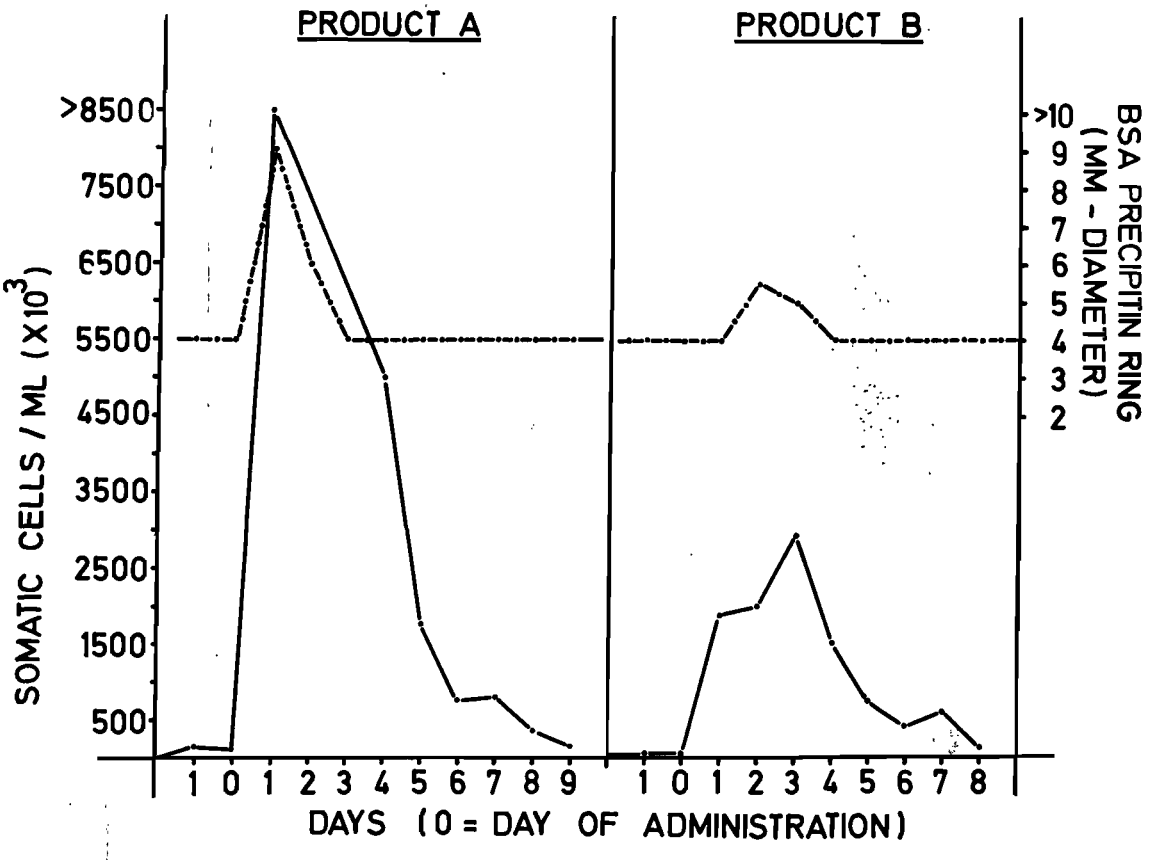


Fig. 4 Alterations of somatic cell count and BSA concentration due to intramammary administration of antibiotic mastitis remedies.

lactation and therefore augments the deficiencies inherent in current methods of mastitis diagnosis [12 24]. Joint application of the MMT [5] and IDF-criteria [24] facilitates accurate differentiation of diagnoses concerning the health status of teat canal and udder epithelium.

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SCOURS IN PIGS AND CALVES

A possible cure for *E. coli* scours, formally known as neonatal colibacillosis, has been found by researchers at Ohio State University. The condition is fatal, especially when outbreaks occur in very young pigs. Losses may range up to 50 per cent, depending on the age and vigour of the pig; also the effectiveness and promptness of the treatment.

The breakthrough in this case is an oral vaccine which may one day be prepared by country veterinarians from a bacterial culture. The procedure is to obtain live bacteria from a diseased pig; the sample is purified and multiplied in the laboratory. The bacteria are then collected, mixed into an extender and poured over a sow's feed for three successive days, between two to four weeks before farrowing. This helps the sow build immunity to that particular strain of bacteria by developing antibodies which she passes through her milk to nursing pigs. L.M. Kohler, veterinary researcher at Ohio State University is encouraged with the favourable results achieved by use of the oral vaccine. Nevertheless, the *E. coli* immunization practice requires a high level of technical knowledge and professional skill to administer and is to be considered only in the research stage at this time.

Scours is also a major disease problem of new-born calves in both dairy and beef cow herds. It is estimated that the disease costs cow-calf producers between 18 and 24 million dollars annually due to death losses, mass losses, drugs and labour costs in the State of Nebraska alone.

The development of a vaccine against scours caused by a reo-like virus by Nebraska University researchers has set the stage for future developments that will help control different forms of calf scours. In actual field tests, data were obtained on 10 411 calves vaccinated with the reo vaccine in 1972, and on 5 816 calves in the same herds which had not been vaccinated. The incidence of diarrhoea had been 50 per cent, with a death rate of 9,3 per cent or 539 head. The 10 411 vaccinated calves had 6,1 per cent or 1 735 head sick, with a death rate of only 1,2 per cent or 130 head.

A new vaccine now under study appears to be capable of preventing both the reo and corona virus scours during the early life of the calf. That is not its only advantage. This vaccine is given to the cow rather than calf, bypassing the critical management that must accompany vaccination of the calf.

Tests of the vaccine, involving 29 000 cows in the 1973 spring calving season, will provide data necessary to show whether or not the vaccine is ready for licensing. Results from experimental vaccine in previous trials were very promising and University veterinarians are hopeful that this new vaccine will protect the newborn calf against both viral agents.

Personal Communication and *Farm, Ranch and Home Quarterly.* The University of Nebraska College of Agriculture, Lincoln (Spring 1974). *Agricultural Report No. 124.* Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, N.W. Washington D.C. 20008, USA. Published by the Department of Agricultural Technical Services, Pretoria.

ISOLATION OF CYTOPATHOGENIC STRAINS OF BOVINE VIRAL DIARRHOEA VIRUS IN SOUTHERN AFRICA

A. THEODORIDIS* AND S.E.T. BOSHOFF**

SUMMARY

From outbreaks of bovine viral diarrhoea-mucosal disease on two farms, one in the Republic of South Africa and one in Rhodesia, cytopathogenic strains of bovine viral diarrhoea virus were isolated. When the new isolates were compared serologically with the Oregon C24V reference strain they appeared to be identical. This was the first isolation and identification of mucosal disease virus in Southern Africa.

INTRODUCTION

The virus causing mucosal disease-bovine virus diarrhoea (MD-BVD) is known to be pathogenic only for cattle. The distribution of the disease is world wide and the severe enteritis which it produces in young animals is responsible for considerable economic loss [6 8 9 10 12]. The epizootiology of this disease is not fully understood and the morbidity is difficult to determine because of the numerous subclinical cases which occur [9].

The majority of MD-BVD virus strains isolated from all over the world appear to be serologically related to the prototype strain Oregon C24V described by Fernelius, Lambert & Booth [4]. Despite the occurrence of common antigens amongst various isolates, however, these authors have suggested that distinct antigenic differences do occur, and have classified the naturally occurring strains into three serological groups namely C24V, NADL and non-cytopathogenic viruses.

The serological survey conducted in Southern Africa, in which randomly selected bovine sera were tested against the prototype strain Oregon C24V, showed that the disease is widespread [15].

This paper describes the isolation of strains of MD-BVD from two farms in Southern Africa between 1969 and 1970 and compares their serological relationship to the prototype Oregon C24V strain.

MATERIALS AND METHODS

Tissue Culture

Primary calf testicle and kidney cell monolayers were grown in roller tubes in Hank's high bicarbonate and yeastolate solution containing 2% lactalbumin and 10% bovine serum free of antibodies to bovine viral diarrhoea (MD-BVD) virus. The monolayers produced from these cells were tested for susceptibility to MD-BVD and, where satisfactory, cultures of the second and third subculture were used in the tests.

Virus Strains

(a) The cytopathogenic Oregon C24V reference virus, isolated by Gillespie & Mc Entee[7], was received at the 34th passage in bovine kidney cells. This virus was further passaged in our laboratory with four passages in foetal calf kidney cells (CFK). Tissue cultures infected with the 41st passage of the virus were harvested and centrifuged at 2000 rpm for 15 minutes, after which the supernatant fluid was lyophilized and stored at -20°C.

(b) The cytopathogenic strain B23 was isolated from a nasal swab taken from a diseased calf on a farm in the Marandellas district, Rhodesia. Heparinized blood samples, nasal and rectal swabs, and organs taken *post mortem* were submitted to this Institute for examination. A suspension in phosphate buffer was prepared from all the specimens submitted. Subcultured CFT tissue culture monolayers were inoculated with 0,2 m*l* of these suspensions, and left rolling for 1 hour at 37°C, after which the inoculum was washed off, 1 m*l* Hank's medium without serum then being added to the cultures. The monolayers were examined daily under the light microscope. They were harvested and passaged on the seventh day. Samples showing a cytopathic effect after the second passage were passaged further in order to achieve a more satisfactory and consistent cytopathic effect. The tissue culture fluid from the ninth passage of the nasal swab virus of sample B23 was harvested. This virus suspension was centrifuged at 2000 rpm for 15 minutes, the supernatant fluid lyophilized and stored at -20°C.

(c) The cytopathogenic strain K3 was one of a number of isolates which originated from clinically diseased cattle on a farm in the Transvaal. Citrated blood, nasal, pharyngeal and rectal swabs of diseased calves and cows were treated as described above. Passage of sample K3 was continued until the 11th passage, when the tissue culture fluid was harvested. This fluid was then centrifuged at 2000 rpm for 15 minutes, the supernatant was lyophilized and stored at -20°C.

Preparation of Specific Immune Sera

Three colostrum-deprived calves were kept in an isolation stable. At six months of age they were used for the preparation of antiserum. One calf was inoculated intravenously with 10 m*l* of a suspension of one of the three strains, K3, B23 or C24V at the passage levels indicated above. All three strains had a titre of $10^{5.5}$ $TCID_{50}$/m*l*. The inoculation was repeated 14 days later. Four weeks after the second injection the required volume of blood was taken from each animal and the serum separated by centrifugation. These sera were then used in cross-neutralization tests.

Cross-neutralization Tests with Bovine Anti-MD-BVD Sera

The constant antigen serum dilution method was employed. Each virus strain was tested against the homologous and heterologous anti-sera under identical conditions. Serial fivefold dilutions of each serum were mixed with equal volumes of the respective virusses diluted to contain an estimated 100 $TCID_{50}$/m*l*. The final reading of the cytopathic effect

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in the incubated tubes was made on the seventh day after inoculation; the neutralizing titre of each serum was calculated for each of the three strains of virus.

Transmission of MD-BVD to Calves

Four colostrum-deprived calves kept in isolation were infected intravenously with 10 m*l* citrated blood collected from a MD-BVD affected adult cow from the same herd from which the K3 virus strain had been isolated. The calves were examined clinically for 15 days following the infection; blood samples were taken at various intervals for the determination of white cell and differential cell counts. Four weeks after infection, serum from these calves was tested for the presence of MD-BVD antibodies.

RESULTS

Virus Strains

(a) Of all specimens processed from the herd infected with the cytopathogenic strain B23, only the nasal swab and intestinal mucosa from the sacrificed calf produced a characteristic cytopathic effect. On the third day a few disseminated groups of round cells with a granulated appearance were visible. This was followed by the formation of larger foci, cell destruction and detachment. By the seventh day most cells were detached. After the ninth passage, the virus isolated had a titre of $10^{5,5}$ $TCID_{50}$/m*l* in CFK cells.

(b) The cytopathogenic strain K3 from citrated blood samples, and from nasal and pharyngeal swabs produced a characteristic cytopathic effect from the second passage onwards. After the eleventh passage the titre of the isolated virus was $10^{5,5}TCID_{50}$/m*l* in CFK cells.

The isolation of MD-BVD virus from various specimens submitted from clinically diseased cattle is summarized in table 1.

Table 1: ISOLATION OF MD-BVD VIRUS FROM CLINICALLY DISEASED CATTLE

Material tested	Number tested	Number positive	Number doubtful
Whole blood	10	9	1
Nasal swab	4	2	2
Rectal swab	4	–	4
Pharyngeal swab . . .	2	1	1
Lung	2	–	2
Intestinal wall	1	1	–
Liver	1	–	1
Spleen	1	–	1

Neutralizing Antibody Titres

The neutralizing antibody titres of the antisera produced by the three calves inoculated with the virus strains *C24V, K3, and B23 are shown in table 2.*

Table 2: NEUTRALIZING ANTIBODY TITRES OF ANTI-SERA FROM CALVES INFECTED WITH STRAINS OF BVD VIRUS

Calf No.	Viral strain inoculated	Serum antibody titres		
		Anti-C24V	Anti-K3	Anti-B23
8231	C24V	734*	734	734
8245	K3	532	532	532
8209	B23	532	532	532

*Reciprocal of neutralizing antibody

Transmission of MD-BVD to Calves

The experimentally infected calves developed only very mild clinical symptoms. There was an elevation of the temperature and by Day 7 there was a distinct mucous nasal discharge. Salivation was seen together with erosions on the muzzle. Faeces were pulpy and yellow in all cases. By the twelfth day after infection the clinical signs in all calves had returned to normal. The white cell and differential count over the trial period is set out in table 3.

DISCUSSION

Isolation of MD-BVD virus for diagnostic purposes from field samples appeared best from preserved whole blood and nasal swabs taken from clinically infected animals (Table 1). Paired serum samples, taken 28 days apart, also proved to be reliable for diagnostic purposes [16]. The agar gel diffusion technique used by Darbyshire[2] to detect the presence of virus in tissues of infected cattle using a known positive MD-BVD serum, was also tried in our laboratory with satisfactory results [16]. According to Darbyshire [2], the preferred tissues from affected cattle are oesophagus, abomasum, small intestine, colon, rectum, pancreas, mesenteric lymph nodes and salivary gland.

The viruses isolated from the two outbreaks of viral diarrhoea investigated in this paper produced the typical cytopathic effect in foetal calf kidney cell cultures shown by the prototype Oregon C24V strain[7].

Table 3: HAEMATOLOGICAL OBSERVATIONS ON EXPERIMENTALLY INFECTED CALVES

Calf No.		White Cell Count			
		Day 0	Day 7	Day 12	Day 17
8014	Total	11 700	6 400	16 200	15 000
	Neutrophils . . .	37%	22%	50%	27%
	Lymphocytes . . .	62%	74%	50%	72%
7996	Total	8 900	5 800	11 200	14 800
	Neutrophils . . .	26%	23%	24%	26%
	Lymphocytes . . .	72%	77%	73%	72%
7980	Total	10 600	6 200	12 000	10 500
	Neutrophils . . .	12%	58%	60%	56%
	Lymphocytes . . .	88%	41%	39%	40%
7995	Total	10 000	6 000	11 000	9 800
	Neutrophils . . .	29%	32%	38%	36%
	Lymphocytes . . .	68%	68%	57%	67%

Although the neutralizing antibody titres of the specific sera were not high, the two local strains and the reference strain showed a close serological relationship. These findings and the results of the earlier serological survey [15] indicate that the two MD-BVD virus strains of Southern Africa are identical to the prototype Oregon C24V strain. The incidence of serologically positive cattle in Southern Africa, which averaged 60%, is one of the highest in the world [15] when compared to the USA (57%) [12], Denmark (38%) [1], Sweden (6%) [3]. while in West Germany a variation of 72% in the North to 19,4% in the South was found [17]. Despite the high serological incidence, it is difficult to assess the economic importance of MD-BVD in Southern Africa, since serious problems have only been encountered on a few cattle farms where it was considered that the animals were under nutritional and environmental stress. Under normal circumstances the disease is regarded as only of a very mild nature [8]: pyrexia, leukopaenia and oral lesions were the most pronounced symptoms seen, in contradistinction to the high morbidity and mortality described by Fleming [6]. The four experimentally produced cases of the disease suffered only very mild symptoms when compared to the severe symptoms observed on the farms from which the isolates were made. It would appear, therefore, that in order to produce the severe MD-BVD syndrome in cattle experimentally, it is necessary to create an artificial stress situation in the experimental animals. Indeed, even injection of cortisone preparations prior to infection with BVD virus failed to produce the severe form of the disease [13]. All our experimentally infected calves, however, showed the haematological changes considered characteristic for MD-BVD by Rhode[13]. The white cell count showed an initial drop in the number of cells during the course of the mild reaction (Day 7). By Day 12 the total count rose above the normal value, even though clinical symptoms were no longer apparent, thus following the described pattern[13].

When the economic importance of the disease was realized in some countries, the development of an effective vaccine was initiated by various workers [11 14]. Experiments with a formalin inactivated polyvalent vaccine [10] induced the development of a good immunity against this virus as well as against infectious bovine rhinotracheitis (IBR) and parainfluenza 3 (PI-3). Monovalent vaccines of MD-BVD virus inactivated with either beta-propiolactone or chloroform induced the production of high levels of circulating neutralizing antibody against the virus [5] with the additional advantage that this inactivated vaccine did not cause MD-BVD symptoms as experienced by McKercher *et al* [11] with the virus attenuated *in vitro*. Their MD-BVD cases were attributed to either subclinical infections of vaccinated animals or the presence of pathogenic MD-BVD strains in the calf kidney cells used in the vaccine.

Notwithstanding, attenuated live-virus vaccines have been widely used for prophylactic purpose against IBR, MD-BVD and PI-3. Although the animals developed some protection, it is considered dangerous to vaccinate young animals and pregnant cows, since abortions have been observed after vaccination with MD-BVD and IBR viruses. In view of the fact that the number of feedlot farms is increasing steadily, more outbreaks of MD-BVD, possibly with a more severe course, may be expected in this country in the future. The use of an effective vaccine should be considered in South Africa, particularly in animals which are going to be introduced on to feedlot farms.

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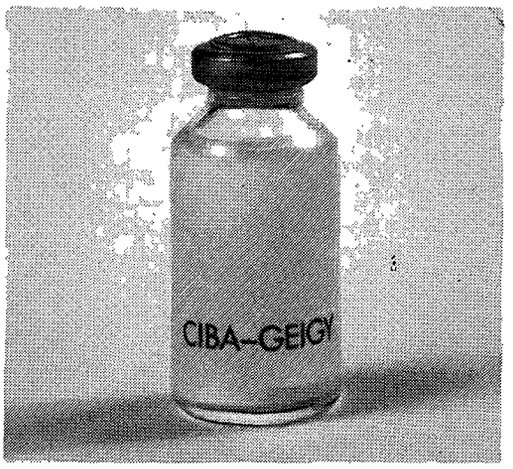

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STUDIES IN CATTLE ON THE DEVELOPMENT OF A LIVE VACCINE AGAINST BOVINE BESNOITIOSIS*

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SUMMARY

The immunizing potency of a live tissue culture vaccine prepared from a strain of *Besnoitia besonoiti* isolated from blue wildebeest was studied in cattle. The vaccine contained either $1x10^5$, $1x10^6$ or $2x10^6$ living parasites per dose.

In the laboratory trials, cattle of various ages and sexes were challenged from 3 to 32 months after vaccination by the intravenous administration of a tissue culture grown bovine strain of *B. besnoiti*, at a concentration at least hundredfold higher than that contained in the vaccine. Fairly good evidence of immunity was obtained. Although the immunity produced was inadequate to prevent subclinical infection, the practical results were eminently satisfactory.

Field trails showed that vaccination induced a durable immunity to the clinical form of the disease in 100% of vaccinated animals. When judged by the appearance of cysts in the scleral conjunctiva a low incidence of subclinical infection was observed.

INTRODUCTION

The detection of *Besnoitia* cysts in the cardiovascular system of blue wildebeest [2 12] led to this investigation. The hypothesis that a reservoir host for the bovine disease had been discovered was disproved by biological studies involving transmission of the parasite to bovine and rabbit hosts [9]. The development and distribution of the wildebeest parasite, and the symptoms and lesions it caused, were different from those produced by bovine strains of *Besnoitia besnoiti* [1 4 5 7 13]. Despite this biological distinctiveness, infection with the blue wildebeest strain of the parasite induced immunity to challenge with bovine strains[9]. *B. besnoiti* can be grown in cell culture [3], providing numbers large enough for the production of a vaccine. Furthermore, the low level of pathogenicity of the blue wildebeest strain for cattle appeared to make it suitable for use as a live vaccine against bovine besnoitiosis. Preliminary studies in rabbits produced very promising results [8]. This paper provides a resumé of a comprehensive investigation of the immunization of cattle involving laboratory and field trials.

PRODUCTION OF VACCINE

The blue wildebeest strain was first passaged in rabbits for 78 generations by subinoculation of blood collected during the acute phase of the disease before it was isolated in lamb kidney tissue cultures. The strain was stored as a frozen stabilate which served as a source of seed material for vaccine production. This was done by serial passage of the seed material in either lamb or monkey kidney cultures[3]. Parasites and associated cells were harvested and suspended in an appropriate volume of ice cold serum-free Hanks' or Eagle's medium to give the required number of living parasites per dose of vaccine. The vaccine was maintained at 4°C throughout.

LABORATORY TRIALS IN CATTLE

Material and Method

The objective was to study the immunogenicity of the vaccine as well as its level of pathogenicity. Initially the parasites were grown in primary lamb kidney cell cultures. The vaccine dose of $2x10^6$ parasites, selected on the basis of results obtained in rabbits [8], was administered subcutaneously with minimum delay to calves, pregnant cows, sexually mature bulls and oxen (Table 1); their reactions to vaccination were studied. Apart from an invariable swelling at the inoculation site, regional lymphadenopathy and an occasional mild febrile reaction, vaccination was uneventful. The semen quality of bulls was not significantly affected[10] and cows vaccinated at different stages of pregnancy all calved down normally[11]. No cysts of *B. besnoiti* could be found in inoculated cattle examined meticulously about 3 months later when they were slaughtered for this purpose.

The animals were challenged at intervals varying from 3 to 32 months after vaccination with a tissue culture grown bovine strain of *B. besnoiti*, injected intravenously at a hundredfold higher dosage level of parasites. The level of protection induced by vaccination was assessed on the basis of the severity of the symptoms, the presence of trophozoites in blood smears during the acute phase of the disease, and the number of cysts detectable in the fascia and on the intima of the superficial veins, particularly in those animals slaughtered about three months after challenge, as compared to unvaccinated controls.

Results

A resumé of the results obtained appears in table 1. Quantitation of the results in terms of the abovementioned criteria was not very satisfactory and the difference in the severity of the disease in vaccinated and control animals was not always very clear-cut. On the whole, however, there was sufficient evidence that vaccinated animals were protected from the severe form of the disease. The immunity did not prevent the occurrence of a low level of infection, as indicated by the presence of small numbers of cysts developing from the challenge strain. Generally, however, cysts were much more plentiful in the controls (Table 1).

Later the immunizing potency of the vaccine strain grown in monkey kidney cells was compared at dosage levels of $1x10^5$ and $1x10^6$ parasites per dose, with essentially similar results (Table 1).

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Table 1: LABORATORY TRIALS

1. PARASITES GROWN IN LAMB KIDNEY CELLS

Animals		Vaccine dose	Time Interval (months)	Challenge		
				Severity symptoms	Trophozoites	Cysts
Oxen & Cows	2	2×10^6	3	M	0	< 10
	5	"	12	M	0	< 10
	3	"	32	M	0	< 10
	8 controls	–	–	FS (1D)	+	> 100
Bulls	2	2×10^6	12	M	0	< 10
	4	"	15	M	0	< 10
	4 controls	–	–	FS	+	< 10
Calves	8	2×10^6	15	M	0	< 10
	4 controls	–	–	FS	+	> 10
2. PARASITES GROWN IN MONKEY KIDNEY CELLS						
Oxen & Cows	3	1×10^5	4	M	0	< 10
	1 control	–	–	FS	0	> 100
Oxen & Cows	4	1×10^6	6	M	0	< 10
	1 control	–	–	FS	0	> 10

M = mild
FS = fairly severe
D = died

0 = absent
+ = present

FIELD TRIALS IN CATTLE

Material and Method

The vaccine was produced and used in the same way as described above. It was stored at 4°C and inoculated within 7 days of production. Prior to vaccination the cattle were examined for the presence of cysts in the scleral conjuctiva as described elsewhere [6]; only cattle in which no cysts could be detected were inoculated. In the first series of experiments, in which a vaccine containing $2x10^6$ parasites per dose was used, approximately 10% of the animals were left unvaccinated as controls. In a later series, in which the efficacy of doses consisting of $1x10^6$ and $1x10^5$ parasites was compared, the controls constituted approximately 25% of each herd. The vaccinated cattle and controls were re-examined about three months after vaccination for clinical disease and cysts in the scleral conjuctiva, whereupon positive cases were excluded from the experiment on the assumption that they had contracted the disease prio to vaccination [5]. Further examination was carried ou yearly in winter. In doubtful cases, especially wher only one or two cysts were present in the scleral con juctiva, suspected cysts were removed by biopsy an the diagnosis confirmed microscopically [6].

Results

No clinical cases of besnoitiosis occurred in vac cinated animals over the period of observation tha varied from one to four years in the individual herd (Table 2). The incidence of subclinical infection i vaccinated animals, as evidenced by finding a fe cysts in the scleral conjunctiva, was very low, varyin from 0 to 1,79% (Table 2). In the controls subclinica infection varied from 4,1 to 35%, and clinical diseas from 0 to 10% (Table 2).

Study of the available data shows that a single in oculation with the vaccine gave 100% protection t clinical infection (at all the dosage levels used) for a

Table 2: FIELD TRIALS

Farm	Incidence before vaccination %	Year after vaccination	Incidence after vaccination	
			Vaccinated %	Controls %
I	18,9	1	1,7	22,5
II	12,8	1	0,4	4,1
		2	1	12,8 (1,8 CI)
III	28	1	0	8
		2	1	4,4
IV	37,5	1	0,5	35,5
		2	0,9	14,3
V	33,6	1	1,3	7,1
		2	2	25 (10 CI)
		3	0	33,3
VI	18,9	1	0	10,8 (1,5 CI)
		2	0,4	17,5 (3,5 CI)
		3	0,4	29,6 (3,7 CI)
		4	0	22,2

CI = clinical infection

least one to four years, depending on the period of observation (Table 3). The protection against subclinical infection was also good (Table 3).

Table 3: FIELD TRIALS: PROTECTION INDUCED BY VACCINATION

Dose	Year post-vaccination	% Protection to	
		Clinical infection	Subclinical infection
2×10^6	1st	100	98,4
	2nd	100	96,3
	3rd	100	93,5
	4th	n.c.	93,5
1×10^6	1st	n.c.	100
	2nd	100	100
1×10^5	1st	n.c.	86,3
	2nd	100	74,6

n.c. = incalculable

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INFORMATION INLIGTING

EMBRYONIC MORTALITY RELATED TO TEMPERATURE

Body temperature of 0,5° to 1° C degrees above normal in the cow at the time of insemination can affect the mortality of the embryo 30 to 40 days later. Reproductive specialists have estimated that 20 to 60 per cent of all potential young die during embryonic development. In the bovine this occurs up to 40 days following conception.

This discovery by the University of Arizona is of practical importance in the breeding and management of beef and dairy cattle, where body temperatures at this level occur quite commonly. The body temperature of the animal can be raised by 0,5° to 1°C by disease, exercise and high ambient temperature, separately and collectively. In Arizona the problem is particularly evident during the summer months. Studies during the past decade in Arizona have shown that seasonally high climatic temperatures drastically reduce the fertility in dairy cattle and that a high rate of embryonic death is associated with the seasonal depression.

By manipulating body temperatures of the cow at short intervals before and after insemination, delineation of the critical period within a matter of hours has been made. During hot summer months, when body temperatures are generally 1° to 2,8° above normal throughout most of the day, cows in oestrus were placed in an air conditioned barn. As a result body temperatures were lowered toward normality and the cows then inseminated. Surprisingly, it took up to 14 hours to reduce the body temperature of these animals to normal levels (39,4 ± 2,3 degrees to 38,3 ± 0,2 degrees).

Cows remaining in the barn for 14 hours before being bred had a lower body temperature by 0,5°C and higher fertility (30 per cent pregnancy against 9 per cent) than cows held in the barn for only 9 hours; thus indicating that body temperature within a few hours of insemination was critical.

A similar experiment was conducted during the winter, when body temperatures were raised 0,5° to 1,1/C before insemination. Animals whose body temperatures were 0,5° to 1,1° above normal when inseminated and held for one hour had a high rate of embryonic death (5 out of 10). Those heated, cooled and then bred, conceived but did not show embryonic mortality.

Evidently body temperature is critical when semen is first placed in the uterus, and for a short time after, prior to ovulation and fertilization. Apparently, the semen is directly affected by the above-normal temperature of the uterus, resulting in the latent embryonic catastrophe.

Suggested tips to follow in order to avoid the problem when inseminating dairy and beef cattle are:

1. Inseminate only once each day during the mid-morning hours. Cows showing signs of heat throughout the day should be inseminated the following morning. This increases the probability of successful breeding in two ways (a) the body temperature of the cow during the hot season is nearer normal during the morning hours than other periods of the day, and (b) ovulation occurs near 12 hours after the signs of oestrus; therefore spermatozoa have less time to become senile before actual syngamy occurs.
2. Avoid excessive exercising or exciting the cattle before inseminating. This raises body temperature as well as depresses hormone release essential for moving spermatozoa to the site of ovum fertilization.

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PROTEINS AND ECONOMICS

Sir,

It was with great interest that I read your editorial 'Proteins and Economics' in the latest copy of the S.A.V.A. Journal (Dec. 1973). This article certainly gives one food for thought, in particular the last paragraph of your editorial where you pose the question as to whether health aspects and economics are related, and whether the veterinary profession should in any way be involved in the economics of the animal industry.

In my humble opinion, the answer to both these questions is a very definite 'yes', because, as the guardians of the health of the animal industry, we as a profession have not only the right, but I believe the moral obligation to become involved in anything that affects the well-being of that industry.

Apropos of the above, I would like to draw your attention to a statement made by the Minister of Agriculture at the opening of the bull testing station at Armoedsvlakte. This statement was published in 'Agricultural News' of 10th August 1973, and here I quote:

> "Daar word beraam dat vrektes weens siektes 'n jaarlikse verlies van 5 tot 11 persent tot gevolg het. Die onregstreekse verlies weens siektes, inwendige parasiete en wanvoeding beloop na raming van 20 tot 35 persent. As daarin geslaag kan word om die verliese te beperk, kan 'n aansienlike verhoging in produksie verkry word.
>
> Die lae kalfpersentasie van 50 tot 55 persent van die gemiddelde vleisbeeskudde in die Republiek is een van die groot faktore wat produksie aan bande lê. Dit is dus duidelik dat positiewe stappe gedoen sal moet word om sake te verbeter, het mnr. Schoeman gesê".

If one takes the figures as quoted by the Minister and by means of a little simple arithmetic converts the animal losses into an annual economic loss, the final figure is startling to say the least of it, as the following table will show:

	Total in Republic (June 1973 Census)	Annual loss at 5% owing to Disease	Loss converted into economic terms: Bovine at R100; Sheep at R15; and Pig at R15
Cattle	12,666,943	633,347	R63,334,700
Sheep & Goats	36,573,054	1,828,652	R27,429,780
Pigs	1,550,769	77,538	R 1,163,070
		TOTAL	R91,927,550

Added to this must be the 'production losses' which amount to ± R267 million if worked on a conservative figure of 25% of the gross value of animal products for 1972/73.

From these figures it will be seen that the annual loss to the animal industry is in the region of R359 million.

Having worked in rural areas for the past 20 odd years, I am of the opinion that by far the greater percentage of these losses are preventable, and are due in the main to either ignorance or negligence on the part of the stock owner.

In attempting to find an answer to the problem of markedly reducing this utter waste of red meat, at a time when there is an acknowledged shortage of this commodity, one is continually faced with the problem of the critical shortage of veterinarians in the rural areas.

In my opinion, it is basically the veterinarian who, by virtue of his training and experience, can play the major rôle in educating the farmer and making him 'veterinary conscious', with all that this implies as regards preventive rather than curative medicine. Only by preventing disease, improving animal management, hygiene, nutrition etc., and improving calving and lambing percentages, will *true nett productivity* be increased.

It is in this context that one begins to wonder if we, as a veterinary profession, have in the past played our full part towards the reduction of these losses, or are willing to assume our full responsibility towards doing so in the future.

When one studies the distribution of veterinarians in South Africa as a whole, and compares the proportion of those engaged exclusively in small animal urban practice to those engaged in rural or semi-rural areas, one is inclined to ask the question 'is not something wrong, and if there is something wrong, what are we as a profession going to do about it?'.

While not in any way decrying the valuable rôle played by our urban practitioners in attending to the needs of the urban pet population, and by so doing keeping up the morale of our city dwellers, I think we must face facts and realize that a large segment of our profession is contributing very little towards the health of our animal industry as a whole, and incidentally that it is the 'country cousins' who are doing most to ensure that supply for red meat for those selfsame city dwellers and their pets.

I do not profess to have all the answers as to how to correct this unbalance in the distribution of veterinarians, but with the figures I have given it can surely not be a question of finance. In comparison to the annual loss of R359 million, which in my opinion is, to a large extent, preventable and reducible, the economics of providing a vastly increased number of veterinarians in the rural areas by way of:

(a) placing more emphasis in the present veterinary course on large animals and the animal industry as a whole, while keeping the present orientation towards small animal urban practice in its proper prespective;
(b) increasing the yearly output of new graduates;
(c) increasing the financial attractiveness of the rural areas;

should not prove insurmountable.

With these few thoughts as to the moral responsibility of our profession towards feeding our ever-growing millions, I leave it to wiser heads to find the answers.

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FURTHER OBSERVATIONS ON *SCHISTOSOMA MATTHEEI*, VEGLIA & LE ROUX, 1929, IN THE KRUGER NATIONAL PARK

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SUMMARY

Extending the area of a previous survey to include the southern, central and northern sections of the Kruger National Park, the authors found fourteen animal species harbouring *Schistosoma mattheei;* of them, about half were considered of any importance in transmission of the parasite; the rest were probably 'dead end' or chance infestations. The degree of infestation varied from the consistently dense *S. mattheei* populations around man-made dams, where perennial transmission probably occurred, to dry areas with little or no transmission, with at least three grades in between. Transmission patterns are considered to depend primarily upon the nature of the water supply, including seasonal effects, the movements of animals and their faecal characteristics. Some anomalous infestations are recorded, including what is believed to be the first report of *S. mansoni* in an antelope in Africa: dead eggs of this parasite were found in the droppings of one waterbuck at a man-made dam. To the problems created by man-made dams no solution is offered, nor is one throught to exist at the moment. Prevention of establishment of imported exotic schistosomes is considered desirable.

INTRODUCTION

A previous communication[3] described some ecological aspects of *Schistosoma mattheei* populations in the southern Kruger National Park and the surrounding area in wild and domestic animals. Briefly the *S. mattheei* populations in the Park were divided into those which were focal in distribution and maintained in non-migrating animals such as waterbuck[0] and those with a more widespread distribution and maintained in wandering animals such as buffalo. Mixing between schistosomes in wild and domestic animals was thought to be minimal.

The present study which includes the southern, central and northern sections of the Park, is an attempt to demonstrate the influence of water types and definitive host species on *S. mattheei* populations.

MATERIALS AND METHODS

The same methods as described previously were used except that the size of the faecal sample examined microsopically was increased from 1/30 or 1/40 to 1/20 of the total sample collected. This was not thought to influence the subsequent results regarding egg output significantly but may have influenced prevalence.

The areas surveyed have been divided into eight geographic but not necessarily ecological entities. Water bodies within these areas have been classified where possible, and data recorded accordingly.

AREAS SURVEYED (See map)

The Lebombo Hills extend North/South along the whole eastern border of the Park separating Mocambique from the Transvaal.

Table 1: CLIMATIC AND GEOGRAPHIC FEATURES OF EIGHT AREAS IN KRUGER NATIONAL PARK

Area	Annual rainfall mm	Altitude m above sea level	Water types	Water temperature fluctuations Winter – summer °C
1	750 W 550 E	400 W 200 E	Perennial Sabi River.	
2	750	450	Winter-pooling streams	Perennial rivers
3	750 W 650 E	400 W 150 E	Perennial Crocodile River	10 – 28
4	650	250	Perennial Sabi River, pooling streams, man-made dam	
5	550	300	Pooling streams, man-made dams	Pooling streams 7 – 35
6	500	300 – 400	Pooling Letaba River, pooling streams, man-made dams	
7	500	250 – 300	Pooling streams, dry in North, windmills	Man-made dams
8	650 W 450 E	250 N 500 S&W	Perennial Levubu River, springs and pooling streams, dry in South-east with windmills and open pans	12 – 35

Table 1 gives certain climatic and geographic features of the 8 areas.

Accurate animal population figures are not available for all areas, nor for all animal species, e.g. baboons, monkeys, but a rough guide to the comparative abundance of species found excreting *S. mattheei* eggs is given in table 2 for each area. Of necessity this is somewhat vague. No comparison is intended between different species.

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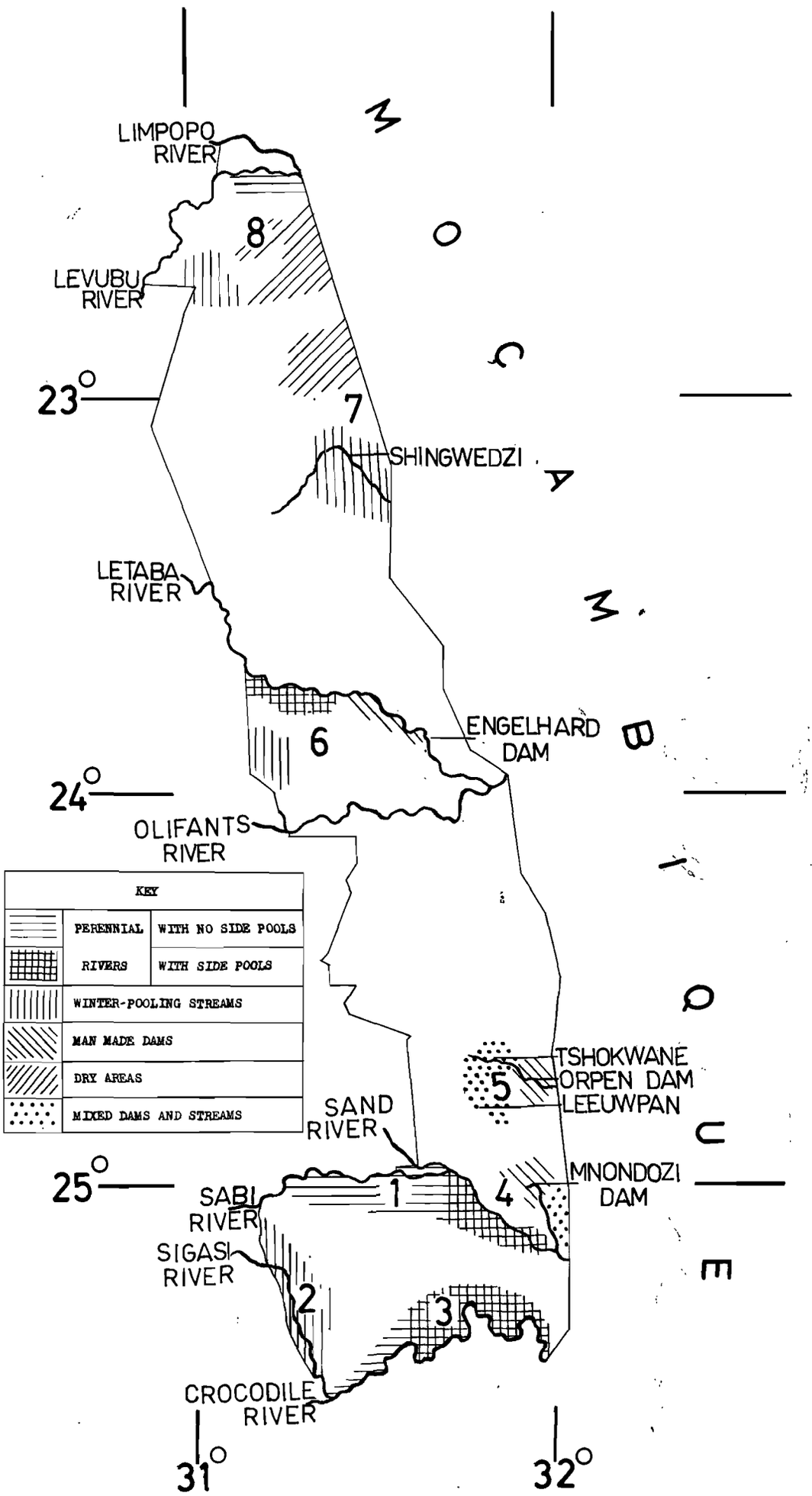
[0] Zoological nomenclature of all animals surveyed is given in tables 2 and 5.



Map of Kruger National Park showing areas surveyed

Table 2: RELATIVE CONCENTRATIONS IN AREAS SURVEYED OF ANIMAL SPECIES FOUND WITH *S. MATTHEEI* EGGS IN DROPPINGS*

Animal species	Relative abundance of species in area							
	1	2	3	4	5	6	7	8
Baboon *Papio ursinus*	+++	+	++	++	++	+	+	++++ along river
Monkey *Cercopithecus aethiops*	Common in all areas especially along rivers							
Zebra *Equus burchelli*	+	++	+	+ summer ++++ winter	+ summer ++++ winter	++	+++	++
Bushpig *Potamochoerus porcus*	+	+	0	0	0	0	0	++ along river
Warthog *Phacochoerus aethiopicus*	+	+	++	+++	+++	+	+	+
Giraffe *Giraffa camelopardalis*	++	+	++	+++	++++	+	+	0
Kudu *Tragelaphus strepsiceros*	++	+++	++	++	++	++	++	+++
Nyala *Tragelaphus angasi*	0	0	0	0	0	+	+	+++ along river
Bushbuck *Tragelaphus scriptus*	+++	++	+	+	+	+	+	+++ along river
Sable Antelope *Hippotragus niger*	0	+++	+	+	+	++	++	+
Waterbuck *Kobus ellipsiprymnus*	+	+	+ W ++ E	+++	++++ + Orpen	++	+++ along river	+
Wildebeest *Connochaetes taurinus*	+	++	+	See Zebra	See Zebra	+	++	+
Impala *Aepyceros melampus*	++++	+	+++	+++	++++	++ along river + rest	++ along river + rest	+++ along river + rest
Buffalo *Syncerus caffer*	++	+	++++ E + W	++++	+++	++++	++++	++++

* No comparison between different species can be made

Area 1: Area South of the perennial Sabi River from its entrance to the Park in the West to a few kilometers from its exit in the East, including area between Sand and Sabi Rivers. Dry acacia bush country giving way to dense riverine vegetation along western half of the river, where it forms occasional large deep pools. Less dense vegetation along eastern half, with numerous small shallow pools adjacent to main stream. Tributaries flowing into the Sabi from the South hold water temporarily after rain.

Area 2: Area along the south-western border of the Park. Rolling park land with a few granite outcrops, watered by the Sigasi River and its tributaries, forming pools during winter. Inhabited by numerous animal species, none particularly abundant but, with the exception of buffalo, resident within the area.

Area 3: Area bordering the north bank of Crocodile River (southern boundary of the Park). Generally very much the same as area 1 in its western and eastern halves but, owing to an exotic vegetation eradication programme, the riverine vegetation is less dense than along the Sabi River. River is perennial but flow varies a great deal from winter to summer; much of its water removed for irrigation South and West of the Park. Buffalo inhabiting areas [1 3] not known to cross Sabi River except one herd in far East near Mocambique border, and an occasional bull.

Area 4: Area between Sabi River in the West and Mocambique in East. Dry acacia savannah with one man-made dam, Mnondozi, in a small pooling stream; dam, usually permanent, is a fairly large body of water in summer and may support a dense animal population in winter.

Area 5: Area surrounding Tshokwane, including Orpen Dam and Leeupan. Dry acacia bush country similar to and immediately North of area 4, bounded in the East by Lebombo Hills and Mocambique. Contains several

man-made watering sites such as earthen dams with water from windmills and dams in river beds which may dry up in winter. Orpen Dam built in a small river entering Lebombo Hills; supports resident populations of waterbuck, impala, hippopotamus, crocodile and baboon. Does not usually dry up during winter. Leeupan a natural swamp area which usually dries up in winter. Herds of zebra and wildebeest migrate to and through areas 4 and 5 from further North to eastern half of Sabi River during dry winters.

Area 6: Area South of Letaba River from its entrance to the Park in the West to the Engelhard Dam in the East. Several years ago Letaba River was perennial; with increasing irrigation demands West of the Kruger Park it now forms pools in winter in its western section. Dry mopane/combretum bush country with patches of thick riverine vegetation along the river in the West. In the East, Engelhard Dam holds water throughout the year: its influence is evident 7 km up-stream. A few 'winter-pooling' streams in the South-west. Large herds of buffalo, elephant and hippopotamus along the river, small herds of zebra and wildebeest.

Area 7: Flat mopane savannah country surrounding Shingwedzi in the South with winter-pooling streams bordered by thick riverine vegetation; flat dry grassland with little natural water; few man-made water holes in the North.

Area 8: Area adjoining the perennial Levubu River in the North southwards to area 7. Savannah veld, dry and sandy in the South-east with a few windmills; thick riverine vegetation along Levubu River. Open montane woodland with numerous springs and winter-pooling streams in South-west of area. Areas 6, 7 and 8 the only areas in the Park which support nyala; Levubu River the only site from which bushpig droppings were collected.

RAINFALL

Rainfall in the Park starts during September and continues intermittently until March, after which very little rain falls during winter. Floods may occur in spring and throughout summer and flush those rivers and streams in which dams have not been built.

CHARACTERISTICS OF ANIMALS

The habits and characteristics of most of the animal species surveyed relative to *S. mattheei* transmission have been described [3]. Some of the more important are tabulated in table 3, in which the movements relative to the area are also indicated.

Table 3: SOME CHARACTERISTICS OF INFESTED ANIMALS WHICH INFLUENCE *S. MATTHEEI* TRANSMISSION

Animal species	Movement in area	Water habits	Concentration and fluctuation within an area	Faecal characteristics
Baboon	Resident	Enter some waters freely at any time	Large troops. Numbers static	Soft, moist. Dry slowly. Communal at sleeping site.
Monkey	Local resident	Enter rarely. Shy	Troops Numbers static.	Soft. Dry rapidly. Communal at sleeping site
Zebra	Migrant	Enter freely to drink	Large herds. Numbers fluctuate winter and summer	Soft, moist. Dry slowly. Scattered
Bushpig	Local resident	Enter freely. Wallow.	Small parties. Numbers static.	Soft, moist. Dry slowly. Scattered.
Warthog . . .	Local resident	Enter freely. Wallow.	Small parties. Numbers static.	Soft, moist. Dry slowly. Scattered.
Giraffe	Wander	Enter seldom	Loose herds. Numbers static	Hard, dry. Scattered
Kudu	Wander	May enter sometimes	Loose herds or single. Numbers static.	Hard, dry. Scattered.
Nyala	Local resident	Enter shallow water to negotiate streams	Small herds or single. Numbers static	Soft, moist. Dry slowly. Scattered
Bushbuck . . .	Local resident	May enter	Single or pairs. Numbers static	Soft, moist. Dry slowly. Scattered
Sable	Resident	Enter freely to drink	Herds. Numbers static	Soft, moist. Dry slowly. Scattered
Waterbuck . . .	Resident	Enter freely at any time. Sometimes lie in shallow water	Herds. Numbers static	Soft, moist. Dry slowly. Communal
Wildebeest . . .	Migrant	Enter freely to drink	Large herds. Occasional single. Numbers fluctuate winter and summer	Soft, moist. Dry slowly. Scattered
Impala	Wander	Sendom enter	Large herds. Numbers static	Hard, dry. Communal
Buffalo	Wander	Enter freely. Wallow.	Large herds. Occasional single. Numbers static	Soft, moist. Dry slowly. Scattered

RESULTS

Table 4 shows the total infestation rates and egg output per gram of faeces of all species excreting *S. mattheei* ova. Table 5 gives the species and number of animals from which typical *S. mattheei* eggs were not recovered, whilst those presenting some anomaly are indicated in table 5 and recorded in table 6.

Table 7 gives in detail the egg output and infestation rates of animals in relation to various water bodies.

Seasonal infection rates are detailed in table 8.

Table 4: INFESTATION RATES AND EGG OUTPUT OF ALL ANIMAL SPECIES FOUND EXCRETING NORMAL *S. MATTHEEI* OVA

Animal species	No.	No. Pos.	% Pos.	No. animals excreting – 3	– 6	– 12	– 25	– 50	– 100	– 200	– 400	Mean egg output
				eggs per gram faeces								
Baboon . . .	595	82	14	44	13	9	7	6	3			9,6
Monkey . . .	180	7	4	3	3	1						3,7
Zebra . . .	203	25	12	19	1	3	1		1			6,0
Bushpig . . .	9	4	44	2	1		1					6,2
Warthog . . .	84	2	2	2								–
Giraffe . . .	95	18	19	13	2	3						3,5
Kudu . . .	90	12	13	4	3	1	2			2		31,2
Nyala . . .	42	7	17	3	2	1	1					7,1
Bushbuck . .	53	2	4					2				–
Sable Antelope . . .	69	13	19	6	2	3	2					7,3
Waterbuck. .	158	102	64	24	15	17	23	14	6	2	1	21,4
Wildebeest .	203	39	19	25	5	7	2					4,3
Impala . . .	403	25	6	7	5	5	6	2				11,9
Buffalo . . .	438	203	46	142	40	18	3					3,3

Table 5: ANIMALS CONSISTENTLY NEGATIVE FOR *S. MATTHEEI* OR WITH SOME ANOMALY REGARDING POSITIVES (see Table 6)

Animal species	No. examined
*Lion *(Panthera leo)*	22
Leopard *(Panthera pardus)*	8
Civet *(Viverra civetta)*	12
Wild Dog *(Lycaon pictus)*	6
Jackal *(Canis mesomelas)*	9
Hyaena *(Crocuta crocuta)*	12
Elephant *(Loxodonta africana)*	241
Rhinoceros *(Ceratotherium simum)* . . .	38
*Hippopotamus *(Hippopotamus amphibius)*	153
*Roan Antelope *(Hippotragus equinus)* .	18
Reedbuck *(Redunca arundinum)*	7
∮Tsessebe *(Damaliscus lunatus)*	35
∮Steenbok *(Raphicerus campestris)*	5
Others	3

* See Table 6

∮ Unlikely to be hosts or transmitters because of their hard dry droppings and/or non-drinking habits.

DISCUSSION

1. INFLUENCE OF WATER TYPES

Obviously because of migration and wandering, and the proximity of some water bodies to each other (see map), some mixing of animals occurs. By and large, however, distinct infection patterns were evident from each of the water body types surveyed, suggesting that schistosome populations were more or less confined to certain areas and, within limits, to specific definitive hosts in some areas.

(a) *Large perennial rivers without small side pools and with thick riverine vegetation* (Three examples in Areas 1, 3, and 8)

A striking feature of these waters was that they did not support a schistosome population in baboons (243 examined: 1 infested) or monkeys (118 examined: 0 infested). Waterbuck dependent on these waters had the lowest infestation rate and egg output of any water body surveyed: nyala and bushpig from the Levubu River, which was the only locality from which droppings of these two species were collected, had

Table 6: POSITIVE ANIMALS PRESENTING SOME ANOMALOUS FEATURE

Animal species	No. examined	No. Positive	Schistosome species	Remarks
Baboon	595	1	*S. mansoni*	4 Eggs/gm. West Sabi River Probable contact across river
Lion	22	1	*S. mattheei*	Eggs all dead or undeveloped 27/gm Probably ingested. Engelhard Dam
Hippopotamus	153	2	*S. mattheei*	Both < 1 egg/gm. Resembled large *S. haematobium* eggs. Orpen Dam
Waterbuck	158	1	*S. mansoni*	Eggs all dead. Mnondozi Dam
Roan Antelope	12	1	*S. mattheei*	Three weeks ex Wankie Park Rhodesia. < 1 egg/gm.

Table 7: INFESTATION RATES AND EGG OUTPUT OF ANIMALS IN RELATION TO WATER BODIES

Animal species	No.	Pos.	%	No. animals with eggs per gram faeces							Mean egg output	Also examined	No.	Pos.	Water body and dates surveyed
				–3	–6	–12	–25	–50	–100	–200					
Bushpig	9	4	44	2	1		1				6,2	Baboon	243	1	Large perennial rivers
Kudu	14	3	21		1		2				17,1	Monkey	118	0	Large pools. Thick
												Warthog	40	0	
Nyala	40	7	17	3	2	1	1				7,1	Zebra	25	0	riverine vegetation
												Giraffe	14	2	
Waterbuck	21	2	10	2							3,0	Bushbuck	53	2	Aug. 72; April 73;
Impala	116	3	2	1		1	1				8,3	Wildebeest	17	0	Nov. 72
Buffalo	66	34	51	21	8	3	2				3,8				
Baboon	101	24	24	15	5	2	1	1			5,3				Large perennial rivers
Monkey	46	7	15	3	3	1					3,8				Small shallow pools.
Zebra	25	9	36	7		2					3,8	Warthog	14	0	No thick riverine vegetation
Waterbuck	34	21	62	6	4	4	4	3			10,0	Giraffe	10	1	
Wildebeest	38	11	29	7		3	1				5,2	Kudu	13	1	Nov. 72; April 73;
Impala	50	6	12	2	2		2				9,0				July 73
Buffalo	98	43	43	32	8	2	1				3,1				
												Baboon	77	1	'Winter-pooling' streams
Sable Antelope	48	13	27	6	2	3	2				7,3	Monkey	1	0	and fountains
Waterbuck	24	14	58	7	5	2					4,2	Zebra	64	2	
												Warthog	14	0	Sept. 72; April 73
Wildebeest	87	11	13	5	4	2					4,1	Giraffe	26	0	
Buffalo	110	35	32	28	7						2,3	Kudu	38	2	Nov. 72; July 73
												Nyala	2	0	
												Impala	132	2	
Baboon	84	27	32	19	4	4					3,6				Mixed 'winter-pooling' streams and man-made dams
Zebra	32	9	28	8		1					3,7				
Giraffe	25	8	32	7		1					3,2				
Waterbuck	9	6	67	3	2	1					3,8	Monkey	1	0	
Wildebeest	38	16	42	13	1	2					3,1	Warthog	15	1	Jan. 73; April 73
Impala	54	13	24	2	3	1	5	2			15,5				
Buffalo	69	43	62	33	6	4					3,0				
Baboon	90	29	32	8	4	3	6	5	3		18,8	Monkey	14	0	Man-made dams in
Zebra	35	5	14	2	1		1		1		20,5	Warthog	1	1	rivers and streams.
Giraffe	18	7	39	4	1	2					4,0	Sable	1	0	
Kudu	25	6	24	2	1	1				2	51,6	Wildebeest	13	1	Jan. 73; June 73
Waterbuck	70	59	84	6	4	10	19	11	6	3	31,9	Impala	21	1	
Buffalo	45	30	67	14	9	7					4,5				
												Zebra	22	0	Dry areas with a few windmills
												Giraffe	2	0	
Buffalo	50	18	36	14	2	2					3,4	Sable	20	0	
												Wildebeest	10	0	April 73; July 73
												Impala	30	0	

moderate infestation rates and egg output. Buffalo had normal infestation rates and egg output for these animals. Other animals examined all had low or zero infestation rates.

These findings suggest occasional light exposures either annually in summer, or at less frequent intervals. In summer the abundant other temporary water is used by many animals but not usually by nyala or bushpig.

(b) *Perennial rivers with side pools but without dense riverine vegetation* (Three examples in Areas 1, 3 and 6)

The western section of the Letaba River is included here because its size and animal populations preclude inclusion in (c) below (see area 6 above).

Infected animals had fairly high to high infestation rates and egg output. It might be argued that because of the closeness of the eastern half of area 1 to area 4 (see map) that many infestations originated in Area 4. Monkeys seldom wander that far; 18 of the 24 infested baboons were from the eastern Crocodile River which is too far from Area 4 for them to have acquired their infestations there; waterbuck, unlike zebra, wildebeest, impala and buffalo, would be unlikely to

Table 8: SEASONAL INFECTION RATES OF ANIMALS EXCRETING *S. MATTHEEI* OVA

Month surveyed	Aug.	Sept.	72	Nov.	Jan.	Apr.	June	July	73	
Animal species	No.	Pos.	%	No.	Pos.	%	No.	Pos.	%	
Baboon	131	0	0	361	78	22	103	4	4	Non-BOVIDAE
Monkey	1	0	—	164	7	4	15	0	0	
Zebra	28	0	0	112	24	21	59	1	1	
Warthog	27	0	0	54	2	4	3	0	—	
Giraffe	19	0	0	61	18	29	13	0	0	
Kudu	11	0	0	40	9	22	39	3	8	BOVIDAE
Sable Antelope	26	4	15	31	4	13	12	5	42	
Waterbuck	0	—	—	113	73	51	45	29	64	
Wildebeest	73	10	14	121	29	24	9	0	0	
Impala	109	0	0	229	23	10	65	2	3	
Buffalo	38	22	58	255	115	45	145	66	45	

wander into Area 4. This was the only water type from which monkeys were found to be infested.

Fairly heavy transmission almost certainly occurs annually from the shallow side pools, after they have reformed; it continues in winter. This might account for high infestation rates in migrating species (zebra and wildebeest) but is thought unlikely. A more likely explanation, based on the time of the year (summer) when samples were taken, is that these particular animals are in fact residents.

(c) *Winter-pooling streams and fountains* (Four examples in Areas 2, 6, 7 and 8)

The infestation rates of waterbuck and egg output of sable were compratively high. All the infested wildebeest were from Area 2, where they are known to be resident. Baboons were very lightly infested (1 out of 77) which may be accounted for by the abundant temporary water during summer.

These findings suggest a transmission pattern similar to (a) above but more intense because of the smaller waters and probably occurring annually.

(d) *Man-made dams in rivers or streams* (Three examples in Areas 4, 5 and 6)

In these instances, which are not affected to the same extent by summer floods as the previous three types of water, baboons, giraffe, kudu, waterbuck and buffalo all had higher infestation rates and egg output than those from any other water body. Zebra had the highest egg output, but not infestation rate, of any area surveyed. The inference from these findings is obvious. Transmission is almost certaintly perennial and heavy.

(e) *Dry areas with a few windmills.* (Two examples in Areas 7 and 8)

Except buffalo, which had low infestation rates, none of the animals was found infected. It is doubtful whether any transmission takes place in these areas. The buffalo almost certainly had acquired their infestations elsewhere.

(f) *Areas of mixed water bodies comprising man-made dams and winter-pooling streams* (Two examples in Areas 4 and 5)

The waters in these areas were situated too closely together for separation. Infestation rates of baboon, zebra, giraffe, waterbuck, wildebeest, impala and buffalo were all high but, with the single exception of impala, egg output was comparatively low, possibly suggesting a change, or frequent changes, in frequenting particular water bodies by the animals during the year. Transmission probably took place mainly from man-made dams during summer and autumn before they dried out.

2. THE INFLUENCE OF HABITS OF ANIMAL SPECIES (See Table 3)

(a) *Local resident species*

These species were thought to be responsible in most cases for local maintenance of *S. mattheei.* They all had characteristics suitable for continued transmission, and included waterbuck from all waters, baboon from man-made dams and large perennial rivers with side pools, sable antelope and some wildebeest from winter-pooling streams, and nyala and bushpig from large perennial rivers with thick riverine vegetation. The origin of these infestations could usually be determined with some degree of accuracy.

(b) *Wandering species*

Concerning the transmission of schistosomes, buffalo were the only important species in this group. Their egg output and infestation rates varied slightly in relation to the water body, which suggests that some herds move away from waters of heavy transmission during summer to large rivers and temporary waters. This is borne out by actual observations. The evidence of variations in the buffalo *S. mattheei* populations, admittedly slight, would be augmented considerably when viewed against the massive bulk and huge daily output of faeces[3] of these beasts. Generally speaking, buffalo were probably responsible for considerable transmission over fairly wide areas but, because of their wandering habits, the exact origin of most buffalo infestations was doubtful.

(c) *Migrating species*

The migrating species, zebra and wildebeest, were occasionally found with comparatively high infestation rates round man-made dams and along the Eastern Sabi River in Area 1. It is possible, however, that these infested animals were in fact resident. The low or zero infestation rates of zebra and wildebeest in the dry parts of Areas 7 and 8 and along winter-pooling waters in Areas 6 and 7 might support the view that members of migratory species with high infestation rates are in fact non-migratory.

Apart from the above exceptions, migrating species were not thought to have much influence on transmission.

(d) *Other species*

Of the other infected animals, none appeared to be

of any significance. Giraffe, kudu and impala (all wanderers) had higher infestation rates and egg output from man-made dams, but their hard, dry droppings are not very suitable for onward transmission. The communal dung heaps of impala may be of some importance. The few cases of infestation in monkey, warthog and bushbuck (all local residents) are thought to be chance infestations only.

3. OTHER OBSERVATIONS AND REMARKS

(a) *Seasonal infestation rates*

There was a striking difference in infestation rates of all non-bovids (baboon, monkey, zebra, warthog and giraffe) examined during August/September 1972 and June/July 1973 and those examined between November 1972 and April 1973 (Table 8). This might suggest that infestations in these animals die out fairly rapidly soon after summer and do not recur. Nevertheless, this interpretation may be fictitious, merely reflecting the fortuitous winter selection of 'poor schistosome areas'. The finding is being investigated further.

(b) S. mansoni *in waterbuck*

S. mansoni eggs (all dead) were found from the droppings of one waterbuck from a man-made dam (Mnondozi) in Area 4. This dam serves as a lookout for visitors who may alight from their cars. There is no latrine accommodation and the hillside sloping down to the stream below the dam is always strewn with human faeces. The observation has not yet been repeated.

This is believed to be the first report of *S. mansoni* in an antelope in Africa.

(c) *Imported schistosomes*

One roan antelope of 12 imported from Wankie Game Reserve, Rhodesia, was found with *S. mattheei* eggs in its droppings 2 - 3 weeks after its arrival in the Kruger Park. During this period the animals were camped.

Importation of *S. mattheei* into South Africa may be of no importance. Importation of exotic schistosome species, some of which *(S. leiperi* and *S. margrebowiei)* are known to occur in neighbouring territories (Botswana) [2], may be very important and should be prevented as far as possible. It is suggested that imported animals be screened and those harbouring exotic schistosomes be treated during their quarantine period.

(d) *Other schistosome species*

From this survey the possiblity of other animal schistosome species being present in the Park seems somewhat remote. *S. hippopotami* was reported as being common in 97 hippopotamus from the Letaba River [1]. The adult worms were mainly found in quite abnormal sites with no egg outlet, and the only viable eggs found were in the adrenals. The probability of an animal schistosome being a definitive parasite specific to one host species appears unlikely but cannot be ruled out completely.

It seems most unlikely from this survey that human schistosome colonies *(S. haematobium* or *S. mansoni)* have become established in wild animals in the Kruger Park (Table 6).

(e) *Droughts*

Droughts often constitute a problem in the Park but are greatly alleviated by dams. These, however, create other problems of lesser importance, which may become very serious in times of severe drought resulting from late summer rains and consequent intensely rapid build-up of cercariae in shrunken waters.

CONCLUSIONS

A survey of this nature must inevitably raise more questions than it can hope to answer and it is freely admitted that many of the conclusions drawn are pure speculation. Nevertheless, it was apparent that flourishing *S. mattheei* populations in the Kruger National Park depended on the water body type and the animal species involved.

Findings from the different water bodies varied from the consistently dense *S. mattheei* populations round man-made dams, where perennial transmission probably occurred, to dry areas with little or no transmission, with at least three grades between these extremes. Fourteen animal species were found harbouring *S. mattheei* of which about half were of any importance from the point of view of schistosome transmission, the rest were probably 'dead end' or chance infestations.

To the problem of man-made dams no solution is put forward, nor is it thought that one exists at the moment.

Prevention of the establishment of imported exotic schistosomes is considered desirable.

ACKNOWLEDGMENTS

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See Corrigenda on p. 125

PRELIMINARY NOTE ON THE LIFE CYCLE OF THE LUNGWORM, *PNEUMOSTRONGYLUS CALCARATUS*, MÖNNIG, 1932

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SUMMARY

By exposing fourteen yellow slugs, *Urocyclus (Elisolimax) flavescens* to first stage larvae of *Pneumostrongylus calcaratus* collected from lung lesions in impala *(Aepyceros melampus)*, all fourteen became infested: first, second and third stage larvae were recovered. The six control slugs remained free from infestation. Larvae of *P. calcaratus* were recovered from four of the ten slugs collected in autumn in the coastal region of Natal, where they are common, and in three of the 34 collected in spring.

INTRODUCTION

During a survey on the incidence of helminths of impala undertaken on a game ranch in Zululand, 20 of the 22 animals tested were found to be infested with the lungworm, *Pneumostrongylus calcaratus* (Mönnig, 1932). At present, the life cycle of this metastrongylid is unknown.

Since Anderson[1] showed that *Pneumostrongylus tenuis* (Dougherty, 1945) utilizes snails and slugs as intermediate host the possibility of *P. calcaratus* having a similiar life-cycle was investigated.

The yellow slug, *Urocyclus (Elisolimax) flavescens* (Keferstein, 1866), is common in the coastal regions of Natal and attempts were made to infect them experimentally with *P. calcaratus*. When these attempts were successful, yellow slugs collected on the ranch were examined for larval stages.

MATERIAL AND METHODS

Experimental Infestations

Twenty yellow slugs were collected on the campus of the University of Zululand; six served as uninfested controls and the remainder were exposed to infestation.

First stage larvae were collected by macerating a lung lesion and were suspended in physiological saline. Fourteen of the slugs were placed for 30 minutes in a petri dish containing the larval suspension. Individual slugs were examined 2, 5, 7, 8, 9, 12, 13, 14, 20, 30, 41 and 90 days after infestation. As these slugs have a large foot (approximately 60mm x 10 mm) three pieces of tissue measuring 2mm x 2mm were removed and examined for larvae, as described by Rose[2].

The slugs were maintained on sterile, moist sand in a glass dish covered with gauze. They were fed daily om 5gm Kreemy meel† and 0,5 gm $CaCO_3$ mixed into a paste with water.

Natural Infestation

During March and May, 1973, ten yellow slugs were collected on the game ranch; in August and September, 1973, a further 34 were obtained. The slugs collected during autumn (March and May) were examined as described above. Those collected during spring (August and September) were small, consequently the whole foot (25 x 5 mm) was examined.

RESULTS

Experimental Infestation

All the experimentally infested slugs contained larvae in the tissue of the foot. Slugs examined on Days 2, 5 and 7 contained first stage larvae. On Days 8 and 9, however, second stage larvae were present, by Days 12 and 13 these larvae had an accumulation of food granules in the gut. Third stage larvae were recovered on Day 14. These larvae were also present in the slugs examined later, including the one examined on Day 90. Food granules were present in third stage larvae recovered on Day 14 but absent from the larvae examined on Days 20, 30, 41 and 90.

The six control slugs did not contain any larvae.

Table : COMPARISON OF THE DIMENSIONS (mm) OF FIRST, SECOND AND THIRD STAGE LARVAE OF *P. CALCARATUS* AND *P. TENUIS*

Larval stage	First		Second		Third	
Species	*P. calcaratus*	*P. tenuis*	*P. calcaratus*	*P. tenuis*	*P. calcaratus*	*P. tenuis*
Number measured . .	10	20	3	1	6	10
Total length	0,322 – 0,341	0,310 – 0,380	0,395 – 0,433	0,715	0,615 – 0,761	0,900 – 1,080
Length of oesophagus	0,091 – 0,163	0,132 – 0,181	0,104 – 0,156	0,242	0,162 – 0,216	0,300 – 0,400
Distance of nerve ring from anterior end	0,065 – 0,098	0,080 – 0,112	0,065 – 0,082	0,101	0,092 – 0,108	0,100 – 0,125
Distance of excretory pore from anterior end	0,072 – 0,091	0,080 – 0,112	0,075 – 0,091	0,113	0,118 – 0,133	0,122 – 0,149
Distance from anus to tail	0,004 – 0,010	0,029 – 0,041	0,008 – 0,012	0,032	0,049 – 0,054	0,031 – 0,045

Measurements of *P. tenuis* according to Anderson [1].

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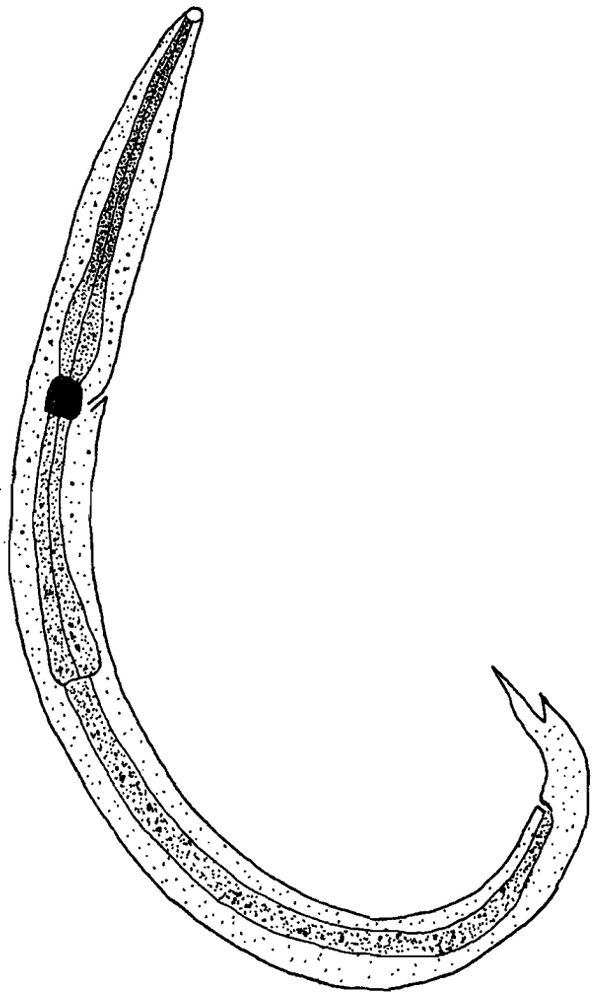
† Hinds Bros. & Co., Durban



0·013 mm

1st LARVA OF PNEUMOSTRONGYLUS CALCARATUS

Natural Infestation

Larvae of *P. calcaratus* were recovered in four of the ten slugs collected in autumn and in three of the 34 collected in spring. Second stage larvae were present in one of the autumn sample slugs and third stage larvae were found in three slugs from this sample. Each piece of tissue examined contained from one to 30 larvae. Three of the slugs collected in spring were infested with a single third stage larvae.

Morphology of Larvae

The features of the first stage larva are shown in the figure. In the table the dimensions of the first, second and third stage larvae of *P. calcaratus* are compared with those of *P. tenuis*.

DISCUSSION

Although the identity of these larvae has not been confirmed by experimental transmission to impala, they are assigned to *P. calcaratus* for the following reasons:

1. Impala do not have access to the university campus so it is assumed that the larvae recovered from these slugs must have originated from their exposure in the laboratory. This supposition is confirmed by the fact that no larvae were recovered from the uninfested control slugs.
2. The larvae from the experimentally infested slugs are identical to those from the naturally infested slugs collected on the ranch.
3. First stage larvae of *P. calcaratus* (Fig.) have a triangular spine on the tail. This spine is present on the sheath surrounding second stage larvae recovered from the foot of *U. (E.) flavescens*.

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INFORMATION

INLIGTING

PERDESIEKTE-ENTSTOF

Daar is tans nege serologies-verskillende perdesiektevirustipes bekend, maar weens tegniese redes was almal nie in die vroeëre polivalente perdesiekte-entstof teenwoordig nie. Die grootskaalse voorkoms van perdesiekte in die Nelspruit-omgewing was deur tipe 4 virus veroorsaak. 'n Veilige en doeltreffende verswakte stam van tipe 4 perdesiektevirus is toe ontwikkel en as 'n monovalente tipe 4 entstof beskikbaar gestel.

Sedertdien is besluit om die verswakte stam van die tipe 4 virus ook in die polivalente entstof te inkorporeer. Alle voorrade van die bestaande polivalente entstof asook dié van die monovalente entstof is teruggetrek en word nou as tussentydse maatreël gesamentlik uitgereik in die vorm van 'n twee-dosis-verpakking van die monovalente tipe 4 entstof met twee dosisse van die polivalente entstof. Die inhoud van die drie houers gevriesdroogde entstof word volgens voorskrif in 10 m*l* steriele water opgelos om twee dosisse omvattende entstof te lewer,wat soos gewoonlik in 5,0 m*l* dosisse onderhuids toegedien word. Sodra hierdie voorrade verbruik is, sal 'n omvattende polivalente entstof in enkele houers uitgereik word.

Direkteur van die Veeartsenykundige Navorsinginstituut, Onderstepoort.

WETGEWING RAKENDE GENEESMIDDELS – MENS, DIER EN PLANT*
LEGISLATION CONCERNING REMEDIES – MAN, ANIMALS AND PLANT

J.G. TOERIEN**

SUMMARY

Explanatory commentary (Afrikaans/English) is made on the relevant provisions under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947), the Abuse of Dependence-Producing Substances and Rehabilitation Centres Act (Act No. 41 of 1971), the Hazardous Substance Act (Act 15 of 1973), the Medicines Control Draft Bill and the functions of the Medicines Control Board as they affect the veterinarian, and particularly the veterinarians-in-industry. Because different Government Departments, Official Bodies and Registrars are all concerned, lack of proper communication and coördination can give rise to serious hitches affecting manufacturer, seller, dispenser and user of certain drugs. It is suggested that veterinarians concerned with registration of stock remedies under Act 36 of 1947 obtain representation on the scheduling committee of the Medicines Control Council and that the Registrar of Stock Remedies maintain close contact with the Registrar of Medicines. The Stock Remedies Act should be reviewed to bring it into alignment with recent legislation and the policy of registration of stock remedies should be placed on a similar footing as that of the Medicines Control Council with its various specialist committees.

Die wêreld met sy magdom inwoners, soos ons dit vandag ken, vorm 'n dinamiese eenheid waar oosterse en westerse ideologieë onafgebroke om die magsposisie met mekaar meeding. Van 'n westerse ekonomiese oogpunt gesien is die wedywering tussen die onderskeie lande binne hierdie raamwerk op handelsvlak miskien net so intens as die ideologiese wedywering, behalwe dat dit hier om finansiële voordeel gaan met 'n gepaardgaande hoër lewenstandaard. Hierdie onderlinge wedywering bring mee dat die ontwikkeling en ontdekking van nuwe begrippe en produkte van kardinale belang is en ook sal bly: ontwikkelings en ontdekkings wat tot voordeel van elke wêreldbewoner kan wees, maar, realisties gesien, wat ook die ondergang van nasies en volkere kan beteken.

Alhoewel nuwe ontdekkings nog altyd die lewenspatroon van die mens gekenmerk het, het hierdie faset beslis 'n hoogkonjunktuur na die tweede wêreldoorlog bereik, 'n hoogkonjunktuur wat nog altyd aangevuur word om meer en beter resultate te verkry. Tesame met die wetenskaplike vooruitgang wat ons oor die afgelope paar dekades ondervind het, het kommunikasie in die breër sin ook met rasse skrede vooruitgegaan. Nuwe ontdekkings kan binne sekondes op 'n wêreldwye grondslag bekend gemaak word, maar belangriker, nuwe uitvindings kan tegnies gesproke binne enkele ure ook wêreld-wyd gebruik of beskikbaar gestel word. Dit is dus vir my logies dat die vooruitgang wat ons bestaan kenmerk noodgedwonge ook 'n massa wetgewing nasionaal asook internasionaal tot gevolg moes hê. Die hoofdoel van hierdie wetgewing is tweeledig, naamlik beveiliging van mens, dier en plant, en neerlê van effektiewe standaarde. Ons kry dus vandag die posisie dat daar van owerheidsweë in Suid-Afrika verskeie wette binne hierdie raamwerk geformuleer is waarin die private sektor nog sy bestaansreg moet verseker.

Weens die breë owerheidsadministrasie kan wetgewing oor 'n bepaalde faset dus nie in een saamgevatte wet opgeneem word nie, omdat verskillende staatsdepartemente seggenskap in verskillende rigtings moet uitoefen. Somtyds kan hierdie uitoefening van gesag klein maar tog irriterende elemente meebring wat frustrasie in die hand werk en groot onkoste meebring. Dit is dus noodsaaklik dat hierdie uitgelese gehoor, naamlik die veeartse-in-bedryf, hulself op hoogte moet hou oor die wye reeks wetgewing wat op hul van toepassing is.

Om hierdie rede wil ek my vandag op twee bestaande wette en 'n wetgewing wat nog in konsepvorm is toespits. Dit beteken nie dat die ander wetsbepalings onbelangrik is nie soos byvoorbeeld die Wet op Voedingsmiddels, Skoonheidsmiddels en Ontsmettingsmiddels 1972 (Wet Nr. 54 van 1972), die Wet op die Misbruik van Afhanklikheidsvormende Stowwe en Rehabilitasiesentrums, 1971 (Wet Nr. 41 van 1971) of die Landbouprodukte-Uitvoerwet (Wet Nr. 10 van 1959), om maar 'n paar voorbeelde te noem. Die tydsbestek bepaal dus ons prioriteite en die verskillende wetsbepalings wat vandag kortliks behandel kan word. Om dieselfde rede is dit ook nie moontlik om in besonderhede te onderskei tussen die produkte wat u bedryf vervaardig en bemark nie.

Die eerste asook die oudste wetgewing waaroor kommentaar gelewer moet word, is natuurlik die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels (Wet Nr. 36 van 1947).

In breë trekke maak hierdie Wet voorsiening vir die registrasie soos omskryf in Artikel 3, die verkoop en adverteer in terme van Artikel 7 van alle geregistreerde stowwe, veevoer, landboumiddels en veemiddels en magtig ook 'n stelsel van kontrole, asook die oplê van strawwe vir oortredings. Saam met die Wet is daar ook 'n hele reeks regulasies wat voorskryf hoe sekere fasette wat nie in die Wet as sodanig in besonderhede omskryf is nie, uitgevoer moet word. In terme van die Wet is die registrasiebeampte ook bevoeg om sekere besluite per omsendbrief afdwingbaar te maak.

Die hoofdoel van hierdie Wet volgens my inligting is om beheer uit te oefen oor die aanwending van chemiese en ander stowwe, die bepaling van standaarde en veiligheidsvereistes en die breë beginsel van beskerming van die publiek wat in kontak met hierdie stowwe kom. Die bepalings en praktiese toepassing van hierdie Wet is aan u almal goed bekend en daar hoef dus nie vandag verder in besonderhede

* Referaat gelewer tydens die Tweejaarse Wetenskapkongres van die Suid-Afrikaanse Veterinêre Vereniging, Afdeling Veeartse-in-Industrie, Pretoria, 18 Oktober, 1973.

** Direkteur: Noord-Transvaalse Kamer van Nywerhede

oor hierdie Wet uitgewei te word nie. 'n Paar algemene indrukke word later egter opgesom.

'n Meer onlangse Wet, naamlik die Wet op Gevaarhoudende Stowwe, 1973 (Wet Nr. 15 van 1973) is ook vir die nywerheid van groot belang. Hierdie Wet is 'n magtigingswet en die toepassing daarvan word hoofsaaklik deur regulasies bepaal. Die lang titel van die Wet omskryf die funksies soos volg:

> ,,Om voorsiening te maak vir beheer oor stowwe wat vanweë die toksiese, bytende, irriterende, sterk sensitiserende of ontvlambare aard daarvan of die ontwikkeling daardeur van druk onder sekere omstandighede, besering, siekte of die dood van die mens mag veroorsaak, en vir beheer oor sekere elektroniese produkte; om voorsiening te maak vir die indeling van sodanige stowwe of produkte in groepe ooreenkomstig die graad van gevaar; om voorsiening te maak vir 'n verbod op en beheer oor die invoer, vervaardiging, verkoop, gebruik, bediening, aanwending, verandering, wegmaak of storting van daardie stowwe en produkte; en om voorsiening te maak vir aangeleenthede wat daarmee in verband staan."

Die verantwoordelike staatsdepartement wat hierdie Wet administreer, is die Departement van Gesondheid en nie soos in die vorige Wet die Departement Landbou-tegniese Dienste nie. Die lang titel van die Wet toon egter duidelik aan dat 'n groot reeks produkte geregistreer onder Wet 36 van 1947, naamlik die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels, ook binne die raamwerk van die Wet op Gevaarhoudende Stowwe kan ressorteer. Die indeling van sodanige stowwe en produkte in groepe ooreenkomstig die graad van gevaar is nie in die Wet as sodanig omskryf nie, in die sin dat onder Artikel 1 ,,Woordomskrywing", die Wet soos volg voorsiening maak: ,,gegroepeerde gevaarhoudende stof: 'n stof, mengsel van stowwe, produk of materiaal wat ingevolge artikel 2(1) tot die een of ander soort gevaarhoudende stof verklaar is".

Artikel 2(1)(a) handel oor die verklaring van stowwe tot gegroepeerde gevaarhoudende stowwe soos volg:

> ,,Behoudens die bepalings van subartikels (2) en (3) kan die Minister by kennisgewing in die Staatskoerant (a) 'n stof of mengsel van stowwe wat, in die loop van gebruiklike of redelike hantering of gebruik, met inbegrip van inname, vanweë die toksiese, bytende, irriterende, sterk sensitiserende of ontvlambare aard daarvan of omdat dit druk ontwikkel as gevolg van ontbinding, hitte of 'n ander oorsaak, besering, siekte of dood van die mens mag veroorsaak, tot 'n Groep I- of Groep II-gevaarhoudende stof verklaar."

Artikel 2(a) en (b) omskryf die prosedure wat gevolg moet word deur die Minister om sy voorneme bekend te maak om 'n stof tot 'n gegroepeerde gevaarhoudende stof te verklaar:

> ,,(2) (a) Indien die Minister van voorneme is om 'n stof of mengsel van stowwe tot 'n Groep I- of Groep II-gevaarhoudende stof te verklaar of 'n elektroniese produk tot 'n Groep III-gevaarhoudende stof te verklaar of die een of ander radio-aktiewe materiaal tot 'n Groep IV-gevaarhoudende stof te verklaar, moet hy in die Staatskoerant 'n kennisgewing laat publiseer van sy voorneme om dit te doen, en in dié kennisgewing belanghebbendes vra om kommentaar en vertoë wat hulle in verband daarmee wil lewer of rig, aan die Sekretaris voor te lê.
>
> (b) 'n Tydperk van minstens drie maande moet verloop tussen die publikasie van so 'n kennisgewing en 'n betrokke verklaring kragtens subartikel (1)".

Voorsiening word egter in terme van Artikel 3(b) gemaak dat die Minister nie die voorgeskrewe prosedure hoef te volg indien hy van mening is ,,dat die openbare belang vereis dat dit sonder versuim gedoen word".

Artikel 3(1)(a) bepaal dat persone wat Groep I-gevaarhoudende stowwe verkoop in besit van 'n lisensie moet wees en hierdie lisensie word deur die Sekretaris van Gesondheid uitgereik in terme van Artikel 4 van die Wet; met die uitreiking kan die Sekretaris voorgeskrewe voorwaardes stel.

Artikel 7 van die Wet bepaal ook ,, . . . die Minister kan ter enige tyd 'n lisensie of 'n registrasie kragtens Artikel 4 intrek of opskort indien 'n voorwaarde waaraan die lisensie of registrasie onderworpe is, nie nagekom is nie".

Die Sekretaris van Gesondheid is ook by magte om 'n aansoek om 'n lisensie of die hernuwing van 'n lisensie te weier. In so 'n geval bestaan daar 'n reg van appél aan die Minister van Gesondheid.

Soos u weet is daar onlangs 'n konsepwet gepubliseer ten opsigte van die Wet op die Beheer van Medisyne. U is ook bewus van die feit dat tot hede die Wet op Geneeshere, Tandartse en Aptekers (Wet Nr. 13 van 1928) sekere beperkings gestel het ten opsigte van geskeduleerde ,,vergifte". Die Wet op Geneeshere, Tandartse en Aptekers sal met die 1974-Parlementsitting verdwyn en die skedulering van stowwe sal nou die verantwoordelikheid van die Medisynebeheerraad word. Die konsepskedules wat saam met die konsepwetgewing oor die beheer van medisyne gepubliseer is, toon duidelik dat dit blykbaar die gedagte is om ,,vergifte" wat nie 'n medisinale gebruik het nie, in die nuwe wetgewing uit te sluit.

Dit onderskryf my stelling vroeër dat die ou vergifte-skedules in alle waarskynlikheid deel gaan uitmaak van die Groep I- of II-gevaarhoudende stowwe onder Wet Nr. 15 van 1973, naamlik die Wet op Gevaarhoudende Stowwe; dienooreenkomstig sal hierdie stowwe dan ook aan 'n nuwe reeks beperkings onderhewig moet wees. Ek is ook van mening dat binne die omvang van die Wet op Gevaarhoudende Stowwe ander produkte en stowwe wat vandag nie onder beheermaatreëls is nie, wel ook ingesluit sal word vanweë die onderliggende motief van die Wet, naamlik om die mens te beskerm.

Dit blyk dus noodsaaklik te wees dat lede van u Vereniging die ontwikkeling van regulasies onder die Wet op Gevaarhoudende Stowwe deeglik sal moet bestudeer, omdat die benadering van die Departement van Gesondheid nie noodwendig dieselfde sal wees as dié van die Departement van Landbou-tegniese Dienste en veral van die Registrasiebeampte en sy adviseurs nie.

The Medicines Control Bill referred to previously was published in the Government Gazette on 10th August, 1973, soliciting comment from interested parties. I have tabled here today a copy of Section 23 of the bill together with the schedules referred to in the

draft bill†. To have this document in print I think would facilitate our discussion. As indicated, the new Medicines Control Council will retain its principal function in terms of the Drugs Control Act (Act No. 101 of 1965), namely to register medicines intended for human use. The Council, however, will now have the additional responsibility to control scheduled substances. It is in this respect that the new Medicines Control Act is of interest to the veterinarians and particularly to the veterinarians in industry.

At the outset it should be indicated that there is a vast difference in the function of the Medicines Control Council, because it registers medicines intended for human use and controls scheduled substances. Therefore, it must be quite clear that the Medicines Control Council would in no way be involved in the registration of scheduled substances for veterinary use. It is for this reason that the profession and industry you represent must at all times be completely *au fait* with the scheduling recommendations of the Medicines Control Council.

Before dealing with the mechanics and the obligations of scheduling or a scheduled substance it is important to review briefly the definitions of the Medicines Control Bill.

The first definition of importance is 'medicinal purpose' which is defined as follows:

> ' "medicinal purpose" in relation to a scheduled substance means for the purpose of treatment or prevention of a disease or some other definite curative or therapeutic purpose, but does not include the satisfaction or relief of a habit or craving for the substance used or for any other substance except where the substance is administered or used in a hospital or similar institution maintained wholly or partly by the Government or a Provincial Administration or the Administration of South West Africa, or approved for this purpose by the Minister: Provided that the Minister may grant authority, subject to compliance with such conditions or requirements as may be stated in such authority, for the administration outside a hospital or institution as aforesaid of a substance for the satisfaction or relief of a habit or craving for the substance administered or for any other substance, to the particular person referred to in such authority'.

This definition should be read in conjunction with the requirements of the Abuse of Dependence-Producing Substances and Rehabilitation Centres Act, 1971.

Prescription is defined as 'a direction or formula issued by a medical practitioner, dentist or veterinarian for the composition and use of a medicine or scheduled substance'.

Prescription book is defined as 'a prescribed record of prescriptions as referred to in section 23'.

Because the Medicines Control Bill is an enabling Act, the definition of scheduled substance is merely defined as 'any substance included in the schedules to this Act'.

Section 22 of the Act empowers the Minister of Health to amend the schedules and for record purposes I quote Section 22:

> 'The Minister may from time to time, on the recommendation of the council, classify by notice in the Gazette any medicine or substance in one of the schedules to this Act and may add any medicine or substance to such schedules or delete any medicine or substance referred to in the schedules or otherwise amend the said schedules and any such amendment to the schedules shall come into operation on a date to be specified in such notice'.

Schedule A substance is defined as 'any medicine not included in schedules B, C, D, F, G, H, I or J of this Act'. Please note that in this respect reference is only made to the term medicine and not scheduled substance. The other 9 schedules, namely B to J are merely defined as being any substance included in the particular schedule.

To cover the new operations the definition of 'sell' was appropriately amended by the deletion of 'for human use' and to cover the more restrictive elements applicable to scheduled items under schedules G, H and I.

The definition of 'sell' is now defined as 'sell by wholesale or retail and includes offer, advertise, keep, expose, transmit, consign, convey or deliver for sale or authorise, direct or allow a sale or prepare or possess for purposes of sale, and barter or exchange or supply or dispose of to any person whether for a consideration or otherwise and except in the case of schedule G, H and I substances, also includes import and export, and "sale" and "sold" have corresponding meanings'.

Also in terms of the previous Drugs Control Act a veterinarian was not defined but in view of the provisions of Section 23 of the draft bill a veterinarian is now defined as 'a person registered as such under the Veterinary Act, 1933, as amended'.

The last definition under Section 1 of importance is 'written' which is defined as 'written in the person's own handwriting and does not include the use of any other means of reproducing words'.

The definitions quoted are important in this respect that these definitions are in fact the key operative words under Section 23 of the Act.

Some brief comments on the schedules are also necessary.

The restrictions applicable to scheduled substances become more restrictive in each of the schedules: for instance, scheduled substances included in schedule J can only be acquired by the Secretary for Health under very restrictive conditions.

The most important principle of the new draft bill, if Section 23 is read in conjunction with the schedules, is the authorisation of possession of any scheduled medicine or substance in the course of the lawful exercise of his profession as a medical practitioner, dentist, pharmacist or veterinarian. These professional groups are now exempted from the prohibitive provisions of the Abuse of Dependence-Producing Substances and Rehabilitation Centres Act. This is an important principle, especially as far as veterinarians are concerned.

It is again important to repeat that many of the functional operations of this draft bill can only be formulated after it has been enacted and the power of the Medicines Control Council to make regulations is clearly set out under Section 37 of the draft bill.

One of the main provisions of Section 23(1) is that no person can sell any medicine or scheduled substance unless he is a holder of a licence issued to him

† As these can be consulted in the relevant Government Gazette, they have not been included in this article.

in terms of a provincial ordinance under the prescribed conditions. A provision, however, is included to exempt medical practitioners, dentists, pharmacists and veterinarians from acquiring such a licence.

The conditions under which such a licence shall be issued are still a matter to be finalized under the powers of regulations.

I have specifically mentioned this particular requirement, because, as you will recall in the Hazardous Substances Act, the issuing of such a licence and the conditions attached thereto will be the responsibility of the Secretary for Health. You will also recall that under the Hazardous Substances Act, the Minister is empowered to withdraw any licence if conditions under which such a licence was issued are not fulfilled. In the case of the person who has been licensed to sell scheduled substances under the Medicines Control Act, the licensing authority which in this instance is a provincial body 'shall on the recommendation of the Council at any time withdraw or suspend a licence in terms of a provincial ordinance if any condition to which such licence is subject has not been complied with'.

We now come to the cardinal operational effect of Section 23 of the draft bill read in conjunction with the schedules, particularly as it relates to registrations under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947).

My interpretation is that if registration under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act is not specifically referred to in the schedules concerned, then the appropriate restrictive requirements prescribed by Section 23 are applicable to that scheduled substance. This means that all conditions applicable under Section 23 will apply without exemption.

The exemption referred to above is applicable in the following instances in the draft schedules.

Schedule E

'Antimicrobial substances (chemotherapeutic substances) synthesised in nature or laboratory, being substances used in the specific treatment of infections: Preparations and admixtures containing them, except the following when intended for topical application to the epidermis:
bacitracin
tyrothricin
nystatin
polymixin B
framycetin
neomycin
gentamycin
gramicidin
and except when intended to be used as germicides and antiseptics, and except those substances, preparations or admixtures registered and sold under the provisions of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947)'.

'Hormones (natural or synthetic): Preparations and admixtures thereof except those preparations and admixtures intended solely for topical application to the epidermis and except preparations for vaginal use, and except those registered and sold under provisions of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947, (Act 36 of 1947), and except insulin and epinephrine (adrenaline)'.

'Sulfonamides: Substances, preparations or admixtures thereof except those substances, preparations or admixtures intended for external use, and except those substances, preparations and admixtures registered and sold under the provisions of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947)'.

Schedule F

'Phenothiazine, its derivatives and their salts: Preparations and admixtures thereof except preparations containing promethazine or its salts when specially intended for the treatment of travel sickness or local application to the epidermis, and except those registered and sold under the provisions of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947).'

Therefore, all other substances scheduled in the present proposed schedules are subject to the conditions of Section 23.

I think it is also correct to assume that the Minister of Health will at this stage not consider any amendment to the Medicines Control Bill, mainly because of South Africa's international obligations under treaties. Nevertheless, the present Drugs Control Council is still in a position to receive comment from interested parties to possible amendments to the schedules and as indicated earlier, these schedules can be amended at any time by the Minister of Health on recommendation of the new Medicines Control Council.

I think, therefore, that it is obligatory on a specialist group like members of your Association to review these schedules carefully and to come forward with recommendations where substances may have been registered under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act but where the exemption has not been incorporated under the present schedules being part of the Medicines Control Bill.

Om op te som wil ek graag die volgende algemene gedagtes uitspreek.

Die twee wette en die voorgestelde wetsontwerp wat die basis van hierdie referaat gevorm het, het myns insiens veel in gemeen. Die hoofdoel van al drie hierdie wette is om mens, dier en plant te beskerm. Die Wet op Gevaarhoudende Stowwe is egter meer daarop gemik om die mens en sy omgewing te beskerm as byvoorbeeld die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels en die voorgestelde Wetsontwerp op die Beheer van Medisyne. Laasgenoemde twee wette het ook egter 'n sterk verband in die sin dat aansprake vir eise van die verskillende stowwe eers wetenskaplik bewys moet word voordat registrasie verkry kan word.

Dit is logies om te beweer dat met soveel gemeenskaplike faktore die uitgangspunt tussen die verskillende beheerliggame koördinasie moet wees. Hierdie verantwoordelikheid berus hoofsaaklik by die Sekretaris van Gesondheid, die Medisynebeheerraad en die Registrasiebeampte soos in die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels omskryf is. Indien hierdie drie liggame nie effektief met mekaar skakel nie en elk maar in sy waterdigte

binnekring optree, kan die nywerheid, die professies, verkoper en verbruiker hulself vasgestrik vind – 'n situasie wat Suid-Afrika en sy jong maar kragtige ekonomie, en veral sy vervaardigingsbedryf, nie kan bekostig nie.

Ons is bewus van die feit dat daar by verskeie geleenthede pogings aangewend is om koördinasie tussen departemente te bewerkstellig, maar ek is van mening dat daar nog op die oomblik kommunikasiegapings bestaan wat tot nadeel van die algemene verbruiker strek. Om hierdie probleem te oorkom sal daar aandag geskenk moet word om die betrokke partye op 'n meer permanente en doeltreffende grondslag te plaas. As eerste stap sou ek aanbeveel dat 'n veearts wat gemoeid is met registrasie onder die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels, verteenwoordiging verkry op die skeduleringskomitee van die Medisynebeheerraad. Verder dat die Registrateur onder Wet 36 van 1947 en sy ampsgenoot die Registrateur van Medisyne gereeld ontmoet.

Ek wil graag ook 'n verdere gedagte vir oorweging by u laat. Alhoewel die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels oor die jare aangepas is om met moderne ontwikkelings tred te hou, het die tyd moontlik aangebreek dat aandag geskenk moet word aan die hersiening van hierdie Wet om dit by ander bestaande wetgewing aan te pas. Dit behoort nie 'n moeilike taak te wees nie en ek sou persoonlik graag sien dat die Wet op Misstowwe, Veevoedsel, Landboumiddels en Veemiddels ten opsigte van sy registrasiebeleid op 'n soortgelyke grondslag geplaas word as byvoorbeeld die Medisynebeheerraad met sy verskillende gespesialiseerde komitees.

INFORMATION — INLIGTING

MORE ON BLOAT

In Lambs

Experiments by the Agriculture Canada Research Station at Fredericton (New Brunswick) show that abomasal bloat in lambs can be prevented by adding formalin to milk replacer.

The addition of formalin did not adversely affect milk replacer intake or growth of the lambs, confirming results reported from the University of California and the U.S. Department of Agriculture in experiments using formalin to prevent milk replacer from becoming sour when fed free-choice at room temperature.

In the Canada experiments, three groups of lambs were fed all the warm milk replacer they would eat, twice a day. One group (eight lambs) received no formalin in their replacer. Of this group, five bloated severely one or more times during the 3 weeks in which they received the milk replacer and two died from bloating.

The second group received milk replacer to which had been added 0,05% of commercial formalin containing 37% formaldehyde at the level of 0,6 cubic centimetres per litre of liquid milk replacer. Three of the eight lambs bloated and one died.

The remaining group of eight lambs received milk replacer with 0,1% formalin added. (This level equals 1,2 m*l* per litre of liquid milk replacer). At no time was there any evidence of bloating in these lambs.

In Cattle

Agriculture Canada Research Station at Kamloops (British Columbia) reports a novel way of reducing the problem of bloat in cattle eating fresh legumes.

As the animal walks through a chute each day, 0,22kg of neatsfoot and mineral oils are automatically applied in a thin strip from the shoulder to the rear flank. Results obtained by this method of oil ingestion are reported to have been more successful than those obtained by adding oils to cattle feed.

NEWS & FEATURES No. 1568, March 22, 1974, Agriculture Canada, Ottawa K1A-OC7; *Crops & Soils Magazine*, March, 1974, 677 South Segoe Road, Madison, Wisconsin 53711 *Agricultural Report No. 122* Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, N.W., Washington D.C. 20008, USA. Published by the Department of Agricultural Technical Services, Pretoria.

INFORMATION – PHARMACEUTICAL — INLIGTING – FARMASEUTIKA

BRITISH VETERINARY CODEX

The Council of the Pharmaceutical Society of Great Britain has authorised the publication of the following amendment which is effective immediately.

BRITISH VETERINARY CODEX 1965: SUPPLEMENT 1970

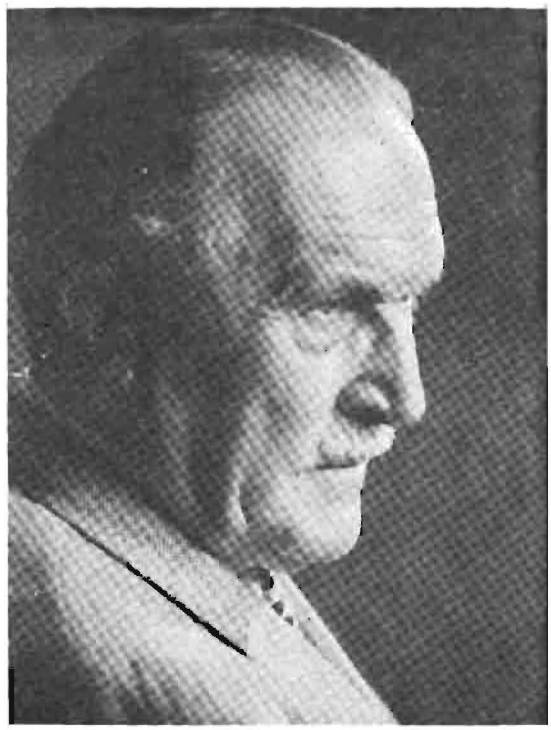
Page 162

(Pasteurella Multocida Vaccine) – *Potency*
Delete this paragraph

Secretary, British Veterinary Codex Committee. The Pharmaceutical Society of Great Britain, 17 Bloomsbury Square, London WC1A 2NN

IN MEMORIAM

KARL FRIEDRICH MEYER
19.5.1884 – 27.4.1974.



With the passing of 'K.F.' the last link with Onderstepoort's beginnings - in those days giants strode the earth of South Africa – has fallen away.

Karl Friedrich Meyer was born on May 19th, 1884 in Basle, Switzerland, the son of Theodor and Sophie (Lichtenhahn) Meyer. Educated at the University of Zürich, he received the Dr.med.vet. from the University of München in 1905.

In 1908 he was appointed pathologist to the Veterinary Bacteriological Laboratory of the Transvaal. In 1910 he left to take the post of Assistant Professor of Pathology and Bacteriology at the School of Veterinary Medicine, University of Pennsylvania, USA, Onderstepoort, according to anecdotal history, being 'too small for two giants." (A difference of opinion had arisen between him and Theiler about K.F.'s wisdom in publishing certain experimental results without a repeat check). In the brief two years his local publications alone included experimental studies on a specific purulent nephritis of equidae, experimental and epidemiological observations and the pathology of contagious pleuropneumonia, notes on the nature of Koch's bodies and their rôle in the pathogenesis of East Coast fever, notes on the chemotherapeutic treatment of biliary fever in dogs, and on complement deviation in the sero-diagnosis of glanders.

In 1914 'K.F.' went to the University of California as Professor of Bacteriology and Experimental Pathology, where he 'divided his time quite evenly between San Francisco, Berkeley, Davis, and the rest of the world.' In 1924 he became Director of the George Williams Hooper Foundation for Medical Research at the University of California, San Francisco, where he remained for the rest of his professional career.

In the same year he presented his doctoral thesis on botulism at the University of Zürich. He had defined the rôle of *C.botulinum* in nature and in the aetiology, distribution and control of botulism; and had been instrumental in establishing standards for the canning industry. In about 1926 he turned his attention to plague and demonstrated that sylvatic plague persisted in numerous wild rodent species as reservoirs. During World War II he developed a plague vaccine – one of his outstanding contributions to medicine. The control of ornithosis and encephalitis were further milestones, apart from the development of public health standards and practices. He aided in many research problems involving tropical diseases, mussel poisoning, dental caries and disturbance of hearing. His publications exceeded the three hundred mark. Many honours and honorary degrees were bestowed on him including an honorary MD by his first University. He headed many scientific societies.

He visited Onderstepoort again in March 1963 where everyone came under his dynamic spell. He was equally appreciative of this Institute. In 1966 he wrote as follows: 'As the years pass by . . . I appreciate more than ever the privilege of having been introduced into the realm of bacterial, protozoan and viral diseases of animals and man. The opportunities to search, to test in model experiments the pathways of infection and to elucidate in field studies the epidemiology of the infections were unique and unsurpassed by the institution in the world. A dynamic, adventurous spirit permeated the establishment. It still prevails on the centennial of the birth of Arnold Theiler to whose guidance I acknowledge my indebtedness . . . in making me a lifelong student of the diseases of animals transmissible to man.'

K.F. was an avid philatelist concentrating on stamps relating to physicians, veterinarians and scientists and disinfected mail.

In 1913 he married Mary Elizabeth Lindsay, who died in 1958, leaving a daughter. In 1960 he married Marion Lewis who survives him on his death on 27 April 1974.

With his wife, daughter of his first marriage, her children and grand-children and his colleagues we share in grateful memory of one of the greats."

EDITORIAL NOTE: We are indebted to Dr. Julius Schackter, Assistant Director of the Hooper Foundation, for kindly sending the Association a copy to the Memorial Service Programme, which was used as a source of information. Information was further obtained from the U.S. Department of Health, Education and Welfare publication CDC Veterinary Public Health notes of March 1974. The assistance of Dr. G. Theiler is also gratefully acknowledged.

BASIESE BEGINSELS VAN BESKERMING TEEN IONISERENDE STRALING*

P.R. LE ROUX**

SUMMARY

The author, Chief of the Section Radiation Control of the Government Department of Public Health, briefly outlines the background to the Public Health Amendment Act (Act 42 of 1971), under regulations of which certain information has to be provided on official forms (G6/1, G6/2 and G6/6) concerning details of the user of electronic apparatus producing ionizing radiation, of the apparatus itself and of safety measures taken, consequent upon which a licence is issued. A survey of all persons working in the field of radiation is proposed by the Department of Public Health. The basic principles of protection against the effects of ionizing radiation simply consist of distance, time and screening. The SEX (Safe Effective X-Rays) programme, consisting of slides and tape recording, was shown.

Sedert die ontstaan van radiologie was daar besorgdheid oor die daarmee gepaardgaande stralingsgevare. Ook in Suid-Afrika het die aangeleentheid nie uitgebly nie en reeds in 1959 het die destydse Goewerneur-Generaal 'n Kommissie benoem om ondersoek in te stel na die gebruike van ioniserende straling en die gesondheidsgevare daaraan verbonde. In sy verslag het die Kommissie onder andere aanbeveel dat wetgewing by die eerste geleentheid ingedien behoort te word om voorsiening te maak vir behoorlike statutêre beheer oor die gebruik van Roentgen-strale. Lede van die Kommissie het ook 'n aantal veeartsenykundige praktyke waar Roentgenstrale gebruik word besoek: 30 persent hiervan was na hulle mening bevredigend en 70 persent onbevredigend.

Dit is dan die agtergrond waarteen eers die Wysigingswet op Volksgesondheid van 1971 (Wet 42 van 1971) en in terme daarvan die genoemde regulasies ontstaan het.

Vir die behoorlike administrasie van hierdie wetgewing was dit vir die Departement van Gesondheid nodig om by wyse van regulasies antwoorde op die volgende vrae te verkry.

1. Eerstens, wie is die persone of instansies in beheer van elektroniese produkte wat ioniserende straling produseer; word daar oor voldoende kennis beskik vir veilige gebruik van die apparaat? Vir die doel word u gevra om vorm G6/1 † te voltooi.
2. Voorts is dit noodsaaklik om te weet watter tipe apparaat gebruik word en vir watter doel dit gebruik word. In u eie geval is dit uitsluitlik Roentgen-straaleenhede wat vir diagnostiese doeleindes gebruik word en daarom word u gevra om as aansoek vir 'n produklisensie vorm G6/2† te voltooi.
3. 'n Ander belangrike vraag is waar en met welke mate van afskerming en ander veiligheidsmaatreëls die apparaat gebruik word. Om hierdie rede moet 'n aansoek vir 'n perseellisensie (vorm G6/6†) deur alle applikante ingedien word.

Lisensiëring van stralingsprodukte en persele is dan die eerste fase; as tweede fase van beheer beoog die Departement ook 'n opname van alle persone wat vanweë hulle beroep aan straling blootgestel word: dit wil sê, die registrasie van stralingswerkers.

Dit in kort is die belangrikste beginsels wat in die regulasies vervat is. U sal egter saamstem dat dit in sigself nog geensins die veilige gebruik van straling verseker nie. Vanwee die wyd uiteenlopende gebruike was dit ook geensins moontlik om veilige prosedures en tegnieke by wyse van regulasies voor te skryf nie. In hierdie verband lees regulasie III.3(b) egter soos volg:

> „Die houer van 'n lisensie is aanpreeklik vir die volledige omvang van stralingsbeskerming met betrekking tot 'n gelyste elektroniese produk of perseel waarvoor hy oor 'n lisensie beskik. Sodanige aanpreeklikheid het betrekking op enige aspekte wat redelikerwys onder stralingsbeskerming ingesluit kan word".

Die basiese metodes van beskerming soos van toepassing by die gebruik van straling is baie eenvoudig en presies identies aan die wat ons sonder nadenke ten opsigte van enige ander gevaar sal toepas, te wete: dié van afstand, tyd en afskerming.

Sorg dat u te alle tye die maksimum afstand tussen u en die stralingbron handhaaf. Afstand is nie alleen 'n goedkoop metode van beskerming nie, maar dit is ook veral ten opsigte van straling 'n baie effektiewe een, want hier geld die sg. omgekeerde kwadraatwet, met ander woorde, indien die afstand vanaf die stralingsbron met 'n faktor 2 vergroot, verminder die hoeveelheid bestraling met 'n faktor 4.

Indien u in 'n gevaarsone moet ingaan (wat waarskynlik wel in u beroep gebeur) sal u ongetwyfeld die tydsduur en die aantal herhalings van die proses tot 'n minimum wil beperk. Soortgelyk sal 'n mens onnodig langdurige en herhaaldelike gebruik van Roentgenstrale wil uitskakel.

As afstand en tyd nie voldoende beskerming verleen nie, is die enigste alternatief dié van afskerming; hiervan word daar heel dikwels in stralingswerk gebruik gemaak. In diagnostiese werk veral geskied dit in die vorm van loodskerms, voorskote en handskoene.

Die vraag ontstaan egter nou hoe moet hierdie basiese beginsels verder, byvoorbeeld in u eie professie, toegepas word: dit bring ons by die be-

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* Gekondenseerde weergawe van referaat gelewer by die Twee-Jaarse Weskapkongres van die Suid-Afrikaanse Veterinêre Vereniging, Pretoria, 16 Oktober, 1973.

** Hoof: Afdeling Stralingsbeheer, Dept. Gesondheid.

† Hierdie vorms is verkrybaar van die Departement Gesondheid, Privaatsak X88, Pretoria, 0001.

loofde SEX (Safe Effective X-rays) -opname††. Dit mag vir u voorkom asof die opname, veral waar dit oor die pasiënt gaan, nie altyd direk van toepassing op u professie is nie, te meer aangesien die regulasies 'n pasiënt definieer as 'n menslike wese. Maar u sal daarop let dat beskermingsmaatreëls, wat ter wille van die pasiënt getref word, inderdaad ook die operateur beskerm. Alhoewel die regulasies opgestel is met die uitsluitlike doel om die mens teen straling te beskerm, moet die dierlike pasiënt ook in ag geneem word. Ek verwys u na die NCRP-verslag Nr. 36 „Radiation Protection in Veterinary Medince[1]" waarvan die inleidende paragraaf soos volg lees:

> „The objective of veterinary use of radiation is to obtain optimum diagnostic information or therapeutic effect with minimum exposure of the radiological personnel concerned and the general public, and to reduce to the minimum all unnecessary irradiation of the animal patient'.

†† Die opname bestaan uit 'n stel skuifies en bygaande band-opname wat onlangs deur die outeur uit die VSA gebring is, en wat die genoemde stralingsbeginsels duidelik illustreer.

VERWYSING

1. National Council on Radiation Protection and Measurements. Report No. 36. *Radiation Protection in Veterinary Medcine.* NCRP Publications, P.O. Box 4867, Washington D.C. 20008, U.S.A.

BOOK REVIEW — BOEKRESENSIE

THE VETERINARY ANNUAL 1973
FOURTIENTH YEAR

C.S.J. GRUNSELL and F.W.J. HILL

Bristol: John Wright & Sons Ltd., 1974 pp. XIV + 331; Figs: 73; Tabs: 28.

Normally it would be difficult to say something new about a book when one has had the responsibility of reviewing it for so many successive years as I have had the pleasure of doing to The Veterinary Annual. But the editors have made my task an easy one by once again improving on the previous year's standard.

The 27 articles on small animals cover a wide range of problems encountered in practice. They are concise, to the point and contain sufficient information without being too technical. One gains the impression that small animal veterinary medicine and surgery are making rapid progress.

The large animal practitioner, by reading the relevant sections, will have no difficulty in acquainting himself with some of the latest developments in animal breeding, husbandry and the treatment of some of the diseases of cattle, sheep, pigs and horses.

The eight review articles, although applying mainly to the United Kindom and the European Economic Community, do merit reading from the point of view of gaining knowledge on a rapidly developing sphere in applied veterinary science.

Four out of the six articles classified under miscellaneous are of general interest.

The Veterinary Annual 1973 can be recommended without reservation to any member of the profession who requires up-to-date knowledge on topical subjects without much time at his disposal to do intensive reading.

B.C.J.

INFORMATION — INLIGTING

WHEN TO BREED A COW

Dr Durward Olds of the Animal Science Department and Truman Tipton, a graduate student at the University of Kentucky Experiment Station, have developed an electronic system for detection of oestrus. About 40 days after calving, a cow is hooked up with a harness that includes a transmitter and a pillow switch. The switch, which rides her tailhead, is made of aluminium, metal foil and foam rubber, and is about 30 cm long, 10 cm high and 5 cm wide.

The cow comes into heat and another animal mounts her, squeezing the switch and activating the transmitter. The transmitter sends a message to the barn or headquarters. There, a receiver turns on a device which records the time she is mounted. Herdsmen can tell fairly accurately when the animal first came into heat and can arrange to have her bred as soon as possible.

The system is in the experimental stage but Olds and Tipton see no barriers to developing it for farm use. They have assembled their system for less than $100 and hope that one receiver and one recorder can keep track of several dozen cows. As the size of the system is increased the cost per cow will decrease.

Only 25% to 30% of the herd would wear harnesses at any one time. Olds believes electronic heat detection could increase profits by $500 or more a year in a 100-cow dairy.

Progressive Farmer; Vol. 88, No. 10, P.O. Box 2581, Birmingham, Alabama 35202. *Agricultural Report No. 119.* Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, N.W., Washington D.C. 20008, USA. Published by the Department of Agricultural Technical Services, Pretoria

ANAPLASMA INFECTION IN A GIRAFFE

N.J. AUGUSTYN* AND R.D. BIGALKE**

The purpose of this communication is to record the occurrence of a severe infection with an *Anaplasma* sp. in an immature giraffe *(Giraffa camelopardalis)* that died on board ship in Table Bay harbour on 21st July, 1972. The giraffe was a member of a consignment of wild animals from East Africa bound for Europe.

Post-mortem examination showed that the animal was very anaemic, but icterus was not apparent. No other lesions were seen and internal parasites were not in evidence. Examination of a blood smear stained with Giemsa revealed a fairly severe infection with an *Anaplasma* sp. Approximately 13,3% of the erythrocytes contained one or, more occasionally, two parasites, of which 62% were situated on or close to the margin and 38% well away from the periphery of the cells (Fig.). Since most of the parasites were situated in a marginal position, the parasite concerned is probably *Anaplasma marginale,* although *A. ovis,* which would be difficult to distinguish from the former on purely morphological grounds, must also be borne in mind. No immature red cells were observed in the blood smear. In view of the severe anaemia, a distinct possibility exists that anaplasmosis was either responsible for, or contributed to, the death of this animal.

Infection with *Anaplasma* spp. has been recorded in a wide variety of African antelopes [2 3]. Brocklesby & Vidler [1] refer briefly to the detection of *Anaplasma*-like bodies in blood smears of wild giraffes shot in Kenya for research purposes. These bodies were either rare of very frequent. Löhr & Meyer [2] recently recorded a 26% infection rate with *Anaplasma* organisms indistinguishable from *A. marginale* in a captured giraffe which died from suspected anaplasmosis in Kenya shortly after the infection was diagnosed. The resemblance between this case and the one described above is quite striking.

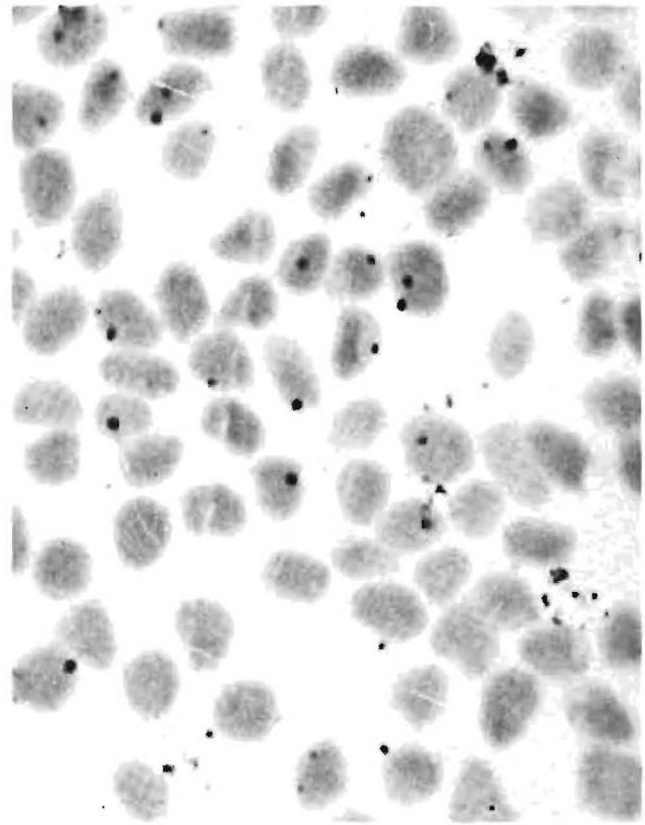

Fig.: Photomicrograph of blood smear of giraffe showing infection with *Anaplasma* sp. x 1200.

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3. NEITZ W.O. 1965 A check-list and host-list of the zoonoses occurring in mammals and birds in South and South West Africa. *Onderstepoort J. vet. Res.* 32:189.

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THE ONDERSTEPOORT JOURNAL OF VETERINARY RESEARCH

VOL.39, NUMBER 1 1972

MARASAS W.F.O. & SMALLEY E.B. Mycoflora, toxicity and nutritive value of mouldy maize. Pp. 1-10.

Large populations of fungi developed in naturally infested mouldy maize stored under conditions that led to self-heating. Mould counts as high as 50 x 10^6 propagules per gram of meal were recorded in mouldy maize meal with a moisture content of 30% stored at 10°C. The fungal population of this meal included several known toxigenic species. Pure cultures on autoclaved maize of some of these fungi isolated from the mouldy meal. *(Aspergillus candidus* Link; *A. clavatus* Desm., *A. fumigatus* Fres., *Fusarium moniliforme* (Sheld.) Snyd. et Hans., *F. tricinctum* (Corda) Snyd. et Hans, and *Trichothecium roseum* Link) were extremely toxic to chicken and rats.

The natural mouldy maize meal caused significant reductions in mass gain and feed efficiency of chickens and pigs without causing mortality or significant pathological changes. Chemical analyses of the meal for aflatoxins *(Aspergillus flavus* Link) and T-2 toxin *(Fusarium tricinctum)* were negative. In some cases chickens fed mouldy diets consumed 1,3 times more feed than the controls per gram of mass gain.

CAMERON C.M. MINNAAR J.L., ENGELBRECHT Maria M. & PURDON, Mary, R. Immune Response of Merino sheep to inactivated *Corynebacterium pseudotuberculosis* vaccine. Pp. 11-24

The brand of yeast extract used for medium production is critical for the cultivation of large numbers of *Corynebacterium pseudotuberculosis.* The agglutination test was used to measure the antibody response which followed the inoculation of various inactivated *C. pseudotuberculosis* vaccines. The best results followed two subcutaneous injections of 5 m*l* vaccine prepared by inactivation with 0,5% formalin and standardized so that each dose contained a total of 0,025 m*l* packed cells.

The addition of adjuvants to the vaccine had a neglible effect on the antibody response, but increasing the interval between the primary and secondary injections from 2 or 4 to 6 weeks resulted in a higher level of agglutinating antibodies. The antibody titres, however, returned to preimmunization levels with in 3 to 4 months.

Freshly prepared vaccine was very toxic, apparently due to incomplete toxoiding of the exotoxin, but older vaccine was shown to be quite safe. A method was devised whereby chronic pulmonary abscesses could be established in experimental animals. Exposure of immunized sheep to artificial infection showed that they were not able to restrict the development of abscesses effectively.

The possible reasons for the disappointing results are discussed in terms of the mechanisms of immunity which may be involved.

COLLINS H. Maria. Cestodes from rodents in the Republic of South Africa. Pp. 25-50

The cestodes recovered from various Muridae and Cricetidae in the Republic of South Africa are recorded.

The following species are described: *Paranoplocephala omphalodes* (Hermann, 1783) Lühe, 1910; *Inermicapsifer congolensis* Mahon, 1954; *Inermicapsifer madagascariensis* (Davaine, 1870) Baer, 1956; *Catenotaenia compacta* Ortlepp, 1962; *Catenotaenia lucida* Ortlepp, 1962; *Railletina (Raillietina) thryonomysi* Ortlepp, 1938; *Railletina (Railletina) trapezoides* (Janicki, 1904) Fuhrmann, 1924; *Hymenolepis diminuta* (Rudolphi, 1819); *Hymenolepis straminea* (Goeze, 1782); *Hymenolepis nana* (von Siebold, 1852); *Catenotaenia lobata* Baer, 1925.

Three new species are desribed; *Paranoplocephala otomyos* from *Otomys irroratus; Hymenolepis microcantha* and *Hymenolepis tatarae* from *Tatera (Tatera) brantsi. Paranoplocephala acanthocirrosa* Baer, 1924 is considered a synonym of *P. omphalodes; Catenotaenia capensis* Ortlepp, 1940 of *C. lobota;* and *Railletina (Raillietina) namaquensis* Mettrick, 1962 of *R. (R) trapezoides.*

Cestodes recovered from the *Myomorpha* in the Ethiopian Region are summarized and a host-parasite list is included.

REINECKE R.K. & BROOKER, Deidré. The recovery of parasitic nematodes from the gastrointestinal tract of a mule at autopsy. Pp. 51-58

An autopsy was carried out on an aged mule and the gastrointestinal nematodes recovered in a modified Baermann apparatus in a waterbath. Ingesta were initially placed on fibreglass gauze (apertures 1,5 x 1,1 mm) and the filtrate subsequently poured on to a double gauze platform in traps. The upper platform had nylon grit gauze with an aperture of 700 micron, while the lower platform had gauze with an aperture of 500 micron. As many as 56,7% *Probstmayria vivipara* and 75,2% of the other nematodes migrated through all three layers of gauze into the filtrate, which constituted less than 5% of the total ingesta. Although 12,9% of the strongyles were washed off the caecocolonic wall, none was recovered when this gut wall was subsequently digested.

JOUBERT J.P.J., BASSON P.A., LUCKS H.J. & BURGER J.H.S. "Grootlamsiekte" a specific syndrome of prolonged gestation in sheep: further investigations. Pp. 59-70

By feeding both leaves and twigs of *Salsola tuberculata* var. *tomentosa* to pregnant ewes, it was established that the daily ingestion of 0,9 kg of this material for at least 10 to 50 days during any stage of gestation could result in post-maturity. The leaves mainly affected the terminal 50 days of pregnancy, whereas the twigs prolonged gestation even when fed during the initial 50 days. The longest gestation period after feeding twigs was 205 days and after leaves 214 days. Many of the lambs born between 150 and 165 days of gestation were either smaller than or equal in size to control lambs; enlarged ones were born mainly after longer periods. The heaviest experimental post-mature lamb mass-measured 9,46 kg.

Normal post-natal development of multiple vesicular follicles was found in the ovaries of lambs born at normal term. This may at least partly explain the presence of ovarian polyfollicularity in post-maturity. Partus was frequently successfully induced by using stilboestrol and oxytocin, especially between 150 and 170 days of gestation. Many dystocias, however, occurred. The shrub is apparently most harmful when the dormant stages are ingested, especially during droughts.

This phenomenon may be related either to an increased intake or to increased toxicity or to both factors.

HURTER L.R., NAUDE T.W., ADELAAR T.F., SMIT J.D. & CODD L.E. Ingestion of the plant *Fadogia monticola* Robyns as an additional cause of gousiekte in ruminants. Pp.71-82

Investigation of outbreaks of gousiekte in cattle in the northern Transvaal revealed that *Fadogia monticola* Robyns is an additional cause of this disease, which is characterized by sudden heart failure without prodromal signs. It results from a chronic lymphocytic myocarditis and death occurs after a latent period of 4 to 8 weeks.

The condition was reproduced in cattle, sheep and goats in feeding and dosing trials.

This is the first report of gousiekte being caused by a plant of the genus *Fadogia* and brings the total number of plant species incriminated in this syndrome to five, all members of the family Rubiaceae.

NEITZ W.O. The experimental transmission of *Theileria ovis* by *Rhipicephalus evertsi mimeticus* and *R. bursa*. Pp. 83-86

The successful tranmission of *Theileria ovis* Rodhain, 1916, to splenectomized sheep by *Rhipicephalus evertsi mimeticus* Dönitz and *R. bursa* Canestrini and Fanzago is recorded. The protozoon is acquired by the immature stages of these two ticks and transmitted by the ensuing adults. The course of the disease is accompanied by pyrexia and a transitory appearance of schizonts in films prepared from swollen lymph nodes while endoglobular parasites are demonstrable during the reaction and for long periods after recovery.

GIESECKE W.H., van den HEEVER L.W. & du TOIT I.J. Staphylococcal mastitis : phage types and patterns of *S. aureus*. Pp. 87-86

Phage typing of 187 isolates of *S.aureus* showed that a small proportion of udder infections was caused by "human" strains of *S.aureus* and the majority by "bovine" strains. A total of 35 different phage patterns was determined.

The majority of *S.aureus* isolates (78,3%) lyzed by phages were resistant to one or more antibiotics at high test levels.

SCHULTZ R. Anitra., PRETORIUS P.J. & TERBLANCHE M. An electrocardiographic study of normal sheep using a modified technique Pp. 97-106

A technique was developed which allowed a reproducible electrocardiogram to be recorded in normal sheep. Einthoven's triangle was moved to the sagittal plane and the needle electrodes were positioned at fixed points. Six electrocardiographic leads and the phonocardiogram were registered. High amplitudes and reproducible wave configurations were produced.

MARASAS W.F.O., ADELAAR T.F., KELLERMAN T.S., MINNE J.A., van RENSBURG I.B.J.. & BURROUGHS G.W. First report of facial ecxema in sheep in South Africa. Pp. 107-112.

The occurrence of facial eczema in sheep in the Republic of South Africa is reported for the first time. The disease in this country is similar to that described in New Zealand and Australia. To date it has only been diagnosed in Merino sheep on artificial pastures in the Humansdorp area of the Cape Province. The fungus *Pithomyces chartarum* (Berk & Curt) M.B. Ellis was isolated from grass litter in these pastures. One of these isolates was shown to produce sporidesmin and the typical clinical and histopathological sings of facial eczema were reproduced upon dosing this culture to a lamb.

McCONNELL E.E., BASSON P.A., THOMAS, Shan E. & de VOS, V. Oocysts of *Isospora papionis* in the skeletal muscles of chacma baboons. Pp. 113-116

Numerous partially and fully sporulated oocysts of *Isospora papionis* were found in the skeletal muscles of two free-ranging adult male chacma baboons *(Papio ursinus.)* Only one of them had *I. papionis* oocysts in the intestines and then only a few. The oocysts appeared potentially viable and provoked a mild inflammatory response.

The importance of the parasite in this location in regard to its life-cycle is discussed.

NEITZ W.O., BOUGHTON F. & WALTERS H.S. Laboratory investigations on the life-cycle of *Rhipicephalus theileri* Bedford & Hewitt, 1925 (Ixodoidea: Ixodidea) Pp. 117-122

Detailed data on the rearing of the progeny of a single *R. theileri* female for 7 generations at 25 to 26°C and 85 to 90% RH are presented in a series of tables and a figure. The average duration of the lifecycle is 491 days. The reason for the mortality rate of 96% of the immature stages in all batches during the prefeeding, feeding and premoulting stages is obscure.

VERSTER Anna, & BEZUIDENHOUT J.D. *Taenia multiceps* larva from a Gemsbok. P. 123

A case report. No abstract available.

EKSTEEN P.A.L. & HUISMANS, H. Interferon induction by bluetongue virus and bluetongue virus ribonucleic acid. Pp. 125-132

The stimulation of interferon synthesis by bluetongue virus and by bluetongue virus ribonucleic acid was investigated in order to determine if there is a difference in the mechanism of induction. The molecular mass of the interferon formed after the two induction processes was determined using Sephadex gel filtration. A value of 24,000 was found in both cases. These results suggest that the two induction processes are basically similar and that double-stranded ribonucleic acid is the active inducing principle in both stimulating processes.

LECATSAS G. Electron microscopic studies on Simian virus S.A. 11 and the "related" O agent. Pp. 133-138

Electron microscopic and serological studies carried out on Simian virus S.A. 11 and the O agent in MK2 cells have indicated that these viruses differ considerably. While S.A. 11 virus is associated with vesicles of the rough endoplasmic reticulum, with viral inclusion bodies and with membranous elements, O agent shows no such relationships but occurs in vacuoles and in crystalline array in the cytoplasmic matrix. No cross neutralization could be demonstrated.

CAMERON C.M., FULS W.J.P. & van REENEN, Lucille. Characterization of eight rough mutants of *Salmonella gallinarum*. Pp. 139-146

The cultural, serological and immunological properties of eight rough mutants of *S. gallinarum* were compared with the parent smooth strains as well as with a reference rough mutant *(S. gallinarum* strain 9R)

The rough mutants could be readily differentiated from the smooth ones by means of their ability to agglutinate in acriflavine, but they could not be distinguished from each other although they were obviously not identical.

One of these mutants (5503(2)) was selected as a standard vaccine strain on the basis of its excellent immunizing properties and low virulence but some of the other mutants would also have been satisfactory.

The nature of the immunity induced by these mutants is discussed with particular reference to the possible rôle of cellular immunity and cytophilic antibody.

NEVILL E.M. & ANDERSON, Dora. Host preferences of *Culicoides midges* (Diptera; Ceratopogonidae) in South Africa as determined by precipitin tests and light trap catches. Pp. 147-152

The host-preferences of a number of South African Culicoides biting midges were determined by precipitin tests and by analysis

of catches from light traps set near host animals. Results showed *C. pallidipennis* to feed predominantly on cattle and horses and possibly sheep.

C. schultzei mainly on cattle, *C. pycnostictus* chiefly on birds, and *C. milnei* mostly on horses. A further five species gave positive precipitin test reactions to blood of either cattle, horses or birds but too few specimens were available for the significance of these reactions to be evaluated.

These results suggest that *C. pallidipennis* and *C. schultzei* might be involved in the transmission of cattle diseases, *C. pallidipennis* and *C. milnei* of horse diseases, *C. distinctipennis* and *C. pycnostictus* of poultry diseases and *C. pallidipennis* of sheep diseases.

REINECKE R.K. An anthelmintic test for gastro-intestinal nematodes of cattle. Pp. 153-178

Suitable experimental groups of calves for controlled anthelmintic tests were created by repeatedly dosing susceptible worm-free animals orally with infective larvae of *Haemonchus placei, Ostertagia ostertagi, Oesophagostomum radiatum* and *Cooperia* spp. *(C.pectinata* plus *C.punctata.)* and giving a single percutaneous dose of *Bunostomum phlebotomum.* Calves were infested in such a way that at treatment the worms were either present as third stage larvae, fourth stage larvae or fifth and adult stages. Enough calves were infested to enable the data to be interpreted by the non-parametric method.

Optimal results were achieved by testing compounds against a specific stage of development. A combined test was involved where two groups of 11 calves were treated when the worms were at different stages of development but only a single group of 9 control calves was used. For more accurate worm counts delaying the slaughter of calves for 3 to 4 weeks after administering the final dose of infective larvae is advocated. Nylon grit gauze with 500 micron apertures allows worms to migrate more easily into the filtrate of the ingesta than nylon mesh with 225 micron apertures in which they tend to become trapped.

Du PLESSIS J.L. & van WYK J.A. Studies on schistosomiasis. 3. Detection of antibodies against *Schistosoma mattheei* by the indirect immunofluorescent-method. Pp. 179-180

The indirect fluorescent antibody test was employed to determine levels of serum antibodies in cattle and sheep infested with *Schistosoma mattheei.* Using smears of schistosome cercariae as antigen, a high degree of specificity and sensitivity was obtained. High titres were obtained in sera from all the animals infested with schistosomiasis, while those from animals infested with various other helminths gave negative results. The antigen-antibody complex appeared to be localised in the cuticle of the cercaria.

YOUNG E., HEDGER R.S. & HOWELL P.G. Clinical foot-and-mouth disease in the African Buffalo *(Syncerus caffer)* Pp. 181-183

Brief description of clinical signs. No abstract available.

VOL 39, NUMBER 4 1972.

VERWOERD D.W. & HUISMANS H. Studies on the *in vitro* and the *in vivo* transcription of the bluetongue virus genome. Pp. 185-192

Bluetongue virus particles, converted to a high density form by the selective removal of two polypeptides from their protein capsids, possess RNA-dependent RNA polymerase activity. The enzyme, which can be assayed by its ability to incorporate nucleoside triphosphates into RNA in an *in vitro* system, is dependant on magnesium ions, is stimulated by the presence of manganese ions and shows maximal activity at 28°C. The product of the *in vitro* reaction was isolated and shown to consist of ten single-stranded RNA segments which can be hybridized with double-stranded RNA isolated from purified bluetongue virus (BTV). The hybridization product, when analyzed by means of polyacrylamide gel electrophoresis, is indistinguishable from a hybrid obtained using BTV messenger RNA isolated from infected cells. It is therefore deduced that the BTV genome is fully transcribed both *in vitro* and *in vivo* by an enzyme present in the viral capsid.

LECATSAS G. & GORMAN B.M. Visualization of the extracapsid coat in certain bluetongue-type viruses. Pp. 193-196

Electron microscopic studies employing the negative staining technique have demonstrated an extracapsid coat in Corriparta, Eubenangee, D'Aguilar, Warrego, Mitchell R, Wallal and M9/71 viruses. These observations are substantiated by the fact that coated and uncoated virus particles exhibit different diameters.

OELLERMANN R.A., HOOGENHOUT Joan & CARTER P. Phagocytic activity of peritoneal exudate cells from mice. Pp. 197-204

Phagocytic activity of peritoneal exudate cells in mice was stimulated by injection of 0,01 m*l* mineral oil or varying concentrations of lysolecithin. Optimal lysolecithin concentration was found to be 2 to 5 μg per mouse. The phagocytic activity of peritoneal exudate cells from mice was determined by spectral analysis of dioxane extracts of cells after incubation in the presence of polystyrene latex particles. Maximum uptake of latex particles occurred after an incubation period of 1 hour.

Maximum phagocytic activity was observed in cells harvested 3 days after stimulation with mineral oil and approximately 4 days after stimulation with lysolecithin. Electron microscopy of these cells revealed a similar pattern of phagocytic activity.

Latex particles are inert and not metabolized by the cells and their uptake was therefore compared with the phagocytosis of bluetongue virus particles. Electron microscopic studies of the uptake of bluetongue virus showed that although absorption of the virus on the surface membrane occurred, practically no phagocytosis was observed 1 day after stimulation with lysolecithin. Maximum phagocytosis of virus particles occurred 3 to 4 days after stimulation with lysolecithin.

KELLERMAN T.S., MARASAS W.F.O., PIENAAR J.G. & NAUDÉ T.W. A mycotoxicosis of Equidae caused by *Fusarium moniliforme* Sheldon. A preliminary communication. Pp. 205-208.

Fusarium moniliforme Sheldon was isolated from maize suspected of causing field cases of leukoencephalomalacia in horses in South Africa. It was cultured on autoclaved maize and dosed to three horses and three donkeys.

One horse and one donkey did not develop any sign of toxicosis; in another donkey an unexplained transient pruritis was encountered and two horses and one donkey died. Clinical sings observed in those animals that died included subcutaneous oedema and icterus. The gross pathological lesions consisted of severe cardiac haemorrhages; petechia and ecchymoses in various organs; oedema; icterus and liver damage.

Histopathological lessions included diffuse fatty changes in the liver; fibroplasia around the central veins and portal tracts with bile duct proliferation; increased numbers of mitotic figures in the hepatocytes; megalocytosis and biliary stasis. The only brain lesions found were small perivascular haemorrhages.

This is in contrast with previous findings on this fungus where leukoencephalomalacia was the characteristic lesion. The liver damage and haemorrhagic syndrome caused by these isolates of *F. moniliforme* are discussed in the light of the prevalence of this fungus on maize.

SCHULTZ R. Anitra & PRETORIUS P.J. An electrocardiographic study of normal goats and cattle using a modified technique. Pp. 209-224

An electrocardiographic technique, developed in sheep in the standing position, was applied to normal cattle and goats. Recordings were made with Einthoven's triangle in the sagittal plane and with the electrodes in rigidly fixed positions in relation to the heart. Waves of high amplitude and reproducible configurations were obtained in 22 goats and 15 cattle.

ELAND AVOID GIFBLAAR

A.G. NORVAL* AND P.A. BASSON*

A tame year-old eland *(Taurotragus oryx)* heifer, captured as a calf at approximately 2 to 3 months of age and reared in isolated captivity in a small enclosure for about 10 months was used as an experimental animal. During a period of 2 months prior to the experiment the heifer was confined to a small 'kraal' and fed daily mainly with twigs of edible natural bush. This was occasionally supplemented with lucerne hay. No food was offered on the day of the experiment, the last ration being given the previous afternoon.

During very early spring a small area, approximately 3 x 20 meters, of 'gifblaar' *(Dichapetalum venenatum)* along an existing fence was enclosed by using conventional farm gates. The area contained 35 gifblaar plants with a total of 764 leaves. Most of these leaves were young and succulent. Except for a few other unidentified small plants, the gifblaar was the only available green forage. A narrow strip of dry grass and leafless bushes were present along the fence and dry leaves and grass stems were scattered between the gifblaar. In all, available edible material was very scanty and of poor quality. A container with water was placed at the one end.

The eland heifer was released and left in the enclosure one morning for 3 hours and 20 minutes during which she patrolled the enclosure 70 times in search of food. Being tame, the antelope could be watched very closely without disturbing her in any way. After release she was immediately attracted to the green gifblaar and initially many of the plants were sniffed at but never taken at any time. She browsed on the few other green plants, picked up dry leaves and ate a fair share of the dry grass and leafless branches of a few bushes. The considerable amount of dry grass eventually ingested was completely unexpected.

After approximately 2½ hours, twigs of *Lonchocarpus nelsii* ('appelblaar') and *Boscia albitrunca* ('Witgat') were placed within the gifblaar shrubs and these were carefully removed and devoured by the eland without touching a leaf of the gifblaar. Even orange peels, offered to the animal, were eaten. All the gifblaar shrubs and leaves were carefully checked and counted after termination of the experiment and not a single leaflet was missing.

Although conclusions from an experiment with a single animal are hardly permissible, it is amazing that a wild antelope, captured during early calfhood and obviously with limited parental training in distinguishing edible plants, avoided gifblaar even under somewhat forced circumstances and with some degree of starvation. It is also possible that the plant may have a repellent odour to the eland. We know that many domestic stock eventually distinguish between edible and poisonous plants – albeit as result of an offensive taste or odour, or some other disagreeable experience – and that poisoning, more frequently than not, follows a period of scarcity of available food, or occurs in young or newly introduced stock. The above result could possibly indicate that one may successfully farm with eland in gifblaar areas but it needs to be determined whether periods of starvation or scarcity would force them to ingest gifblaar.

* State Veterinary Office, Grootfontein, S.W.A.

IN MEMORIAM

GERHARDUS PETRUS BISHOP
12.7.1917 – 9.1.1974

Gerhardus Petrus Bishop, or 'Bolly' as he was affectionately known to colleagues and a host of friends, was born on the 12th July, 1917, in Marydale, a small town on the North West Cape. He matriculated at Greys in Port Elizabeth, where he excelled on both the academic and sporting fields. After completing his first year at Rhodes University in Grahamstown in 1936, he was admitted to the Veterinary Faculty at Onderstepoort, where dedication and drive brought him many academic awards so much so that his entire education was paid for with prizes and bursaries. On graduation in 1940 he was posted as State Veterinarian to Malmesbury, where he tried repeatedly but unsuccessfully to enlist for World War II; he always regretted having been classified as a key man.

After a short spell at Allerton he was posted to Dundee, where his sense of duty, unselfishness and helpfulness were greatly appreciated by the farming community; his work during those stormy East Coast fever days contributed to the eventual eradication of this disease.

In 1949 he joined the lecturing staff of the Faculty of Agriculture, University of Natal at Pietermaritzburg where he spent the next 15 years. During this time he influenced many students to take up veterinary science. In 1965 he returned to Onderstepoort, where he spent his last six years of service; – handicapped by persistent ill health, he retired at the early age of 55.

He came to live in Pietermaritzburg and died at the Hillcrest Hospital on the 4th January, 1974, after having been paralysed by a severe stroke three months previously; his funeral was attended by several colleagues and a host of professors and lecturers from the University.

'Bolly' was a quiet, unassuming man, sincere, kind and generous; his untimely death came as a shock to his many friends. He leaves two sons, George and John, both of whom live in Pietermaritzburg, his wife having pre-deceased him.

INLIGTING

INFORMATION

GROTER MAGTE VIR VEEARTSRAAD

Die prerogatief om aansoeke om registrasie van veeartse goed te keur wat tans in die amp van die Minister van Landbou gesetel is, sal ingevolge 'n voorgestelde wysiging van die Veeartswet van 1933 aan die Veeartsraad oorgedra word.

In die algemeen word deur hierdie wysigingswetsontwerp elkele bepalings van die hoofwet aangevul om die Veeartsraad se bevoegdhede in 'n groter mate onafhanklik van ministeriële goedkeuring te maak sodat dit in ooreenstemming met die bevoegdhede van ander professionele registrasierade is.

Voorgestelde wysigings is onder meer dat die Veeartsraad veeartsenykundige assistente en verpleegsters kan registreer met 'n eenmalige registrasiefooi van R10 teenoor die R20 van veeartse wat onveranderd bly; dat Suid-Afrikaners wat in die buiteland as veeartse kwalifiseer oor dieselfde kam as nie-Suid-Afrikaners geskeer word wat registrasie betref en dat die Veeartsraad sonder goedkeuring van die Minister ondersoek kan instel na 'n klagte teen 'n geregistreerde persoon en 'n skuldige persoon self kan straf.

In sy tweedelesingtoespraak in die Volksraad het die Minister van Landbou, mnr. Hendrik Schoeman, gesê die toegewyde dienslewering deur veeartse deur die jare heen het vir dramatiese deurbrake in die bestryding van veesiektes gesorg en die hoë professionele standaarde kan in 'n aansienlike mate aan die leiding van die Veeartsraad toegeskryf word. Dié raad se funksie is hoofsaaklik adviserend, maar die stadium is bereik dat die raad groter outonomie behoort te kry.

So is die prerogatief vir die goedkeuring van aansoeke om registrasie van veeartse tans in die amp van die Minister gesetel en daar is geen rede hoekom dit nie, soos in die geval van ander dergelike rade, aan die Veeartsraad oorgedra word nie.

Om dieselfde rede word voorgestel dat weggedoen word met die vereiste dat die Veeartsraad eers ministeriële goedkeuring moet kry voordat hy 'n klagte teen 'n geregistreerde persoon kan ondersoek of 'n straf oplê indien hy so 'n persoon skuldig bevind. Dit sal ook van toepassing wees op 'n besluit van die Veeartsraad om 'n persoon se naam weens 'n oortreding uit die register te skrap of daarna weer te herstel.

Sekere uitsonderings ten gunste van Suid-Afrikaanse burgers wat hul kwalifikasies by nie-erkende inrigtings in die buiteland verwerf sal nou ook teruggetrek word omdat, sê die Minister, ons dit nie durf waag om van die huidige hoë standaarde van veeartsenykundige opleiding af te wyk nie.

Omdat dit kan bydra tot die verdere verbetering van veeartsenykundige dienste wat aan die publiek gelewer word, sal die Veeartsraad ook gemagtig word om veeartsenykundige assistente en verpleegsters te registreer.

Die Veeartsraad bestaan uit een verteenwoordiger van die Fakulteit Veeartsenykunde van die Universiteit van Pretoria, drie verteenwoordigers van die Suid-Afrikaanse Veterinêre Vereniging, een persoon wat vanweë sy regskennis aangestel word en 'n veearts van die Departement van Landbou-tegniese Dienste wat ook die voorsitter van die raad is.

Landbounuus Nr. 8. 1 Maart 1974

COLLOBORATION BETWEEN VETERINARIANS AND BOTANISTS IN SOUTH AFRICA

Sir,

It is pleasing to note that in your editorial (pages 213-214 in the September 1973 issue) you congratulate our sister Institute – The Botanical Research Institute – on obtaining its new building, and wish it well for the future.

But dear me! the close collaboration between the veterinary scientist and the botanist neither began with the secondment of A.O.D. Mogg from Botany to Onderstepoort nor ended with the transfer of the Onderstepoort plant physiologist, Marguerite Henrici, to Botany.

Came the Peace of Vereeniging, leading to the take-over of Transvaal Affairs by Lord Milner, who, in his wisdom, created a Department of Agriculture, with the far-sighted F.B. Smith as its Director; and Stewart Stockman in charge of the Veterinary Division (the present Field Services). Stockman's staff consisted of one assistant veterinarian, three clerks, 16 field veterinarians, including two in Swaziland, and eleven stock inspectors. Arnold Theiler was the Government Veterinary Bacteriologist. He had a staff of five lay assistants, later three more, one at Nelspruit, on East Coast fever experiments. Other members of the Department of Agriculture were: Herbert Ingle – chemist; Joseph Burtt Davy – agrostologist and botanist; Charles E. Legat – conservator of forests; C.B. Simpson – entomologist (presentday Plant Protection Services); R.A. Davis – horticulturist; Capt. Mavrogordato – division of locust destruction; R. Bourlay – poultry; Mr. Kensella – dairying; Wm. MacDonald – publications. Several experimental and stud farms were instituted, the chief of which were: Potchefstroom under Alexander Holm, Ermelo under H. Nicholson, and Springbok Flats under J. de Mestre; and the use of W.H. Struben's farm, near Pretoria, rent-free, for maintaining a herd of pure-bred Afrikander cattle.

Whereas Theiler and Stewart Stockman were *au fait* with Transvaal conditions, Burtt-Davy, who commenced work in a one-roomed office in the Volkstem Building, Vermeulen Street, in May 1903, was new to South Africa and was without any staff until a clerk was appointed in October. In January, 1904, H.C. Sampson was appointed as assistant for seed and plant production. There were experimental camps at Skinner's Court, Pretoria, at Potchefstroom and on the Springbok flats. Not only did J. Burtt-Davy spend much time travelling his territory but he also sent out questionnaires to Resident Magistrates, District Commandants of the South African Constabulary and, through Stewart Stockman, to the field veterinarians; obviously he also consulted with Theiler on his doorstep at Daspoort. Thus was started a friendly association between the botanists and the veterinarians, and association which may have waxed or waned according to prevailing priorities but which never lapsed, and which possibly is on the same personal footing right now as it was in 1903, when Burtt-Davy and Theiler first met to discuss common problems and to exchange material: Theiler donating mounted specimens to the her-

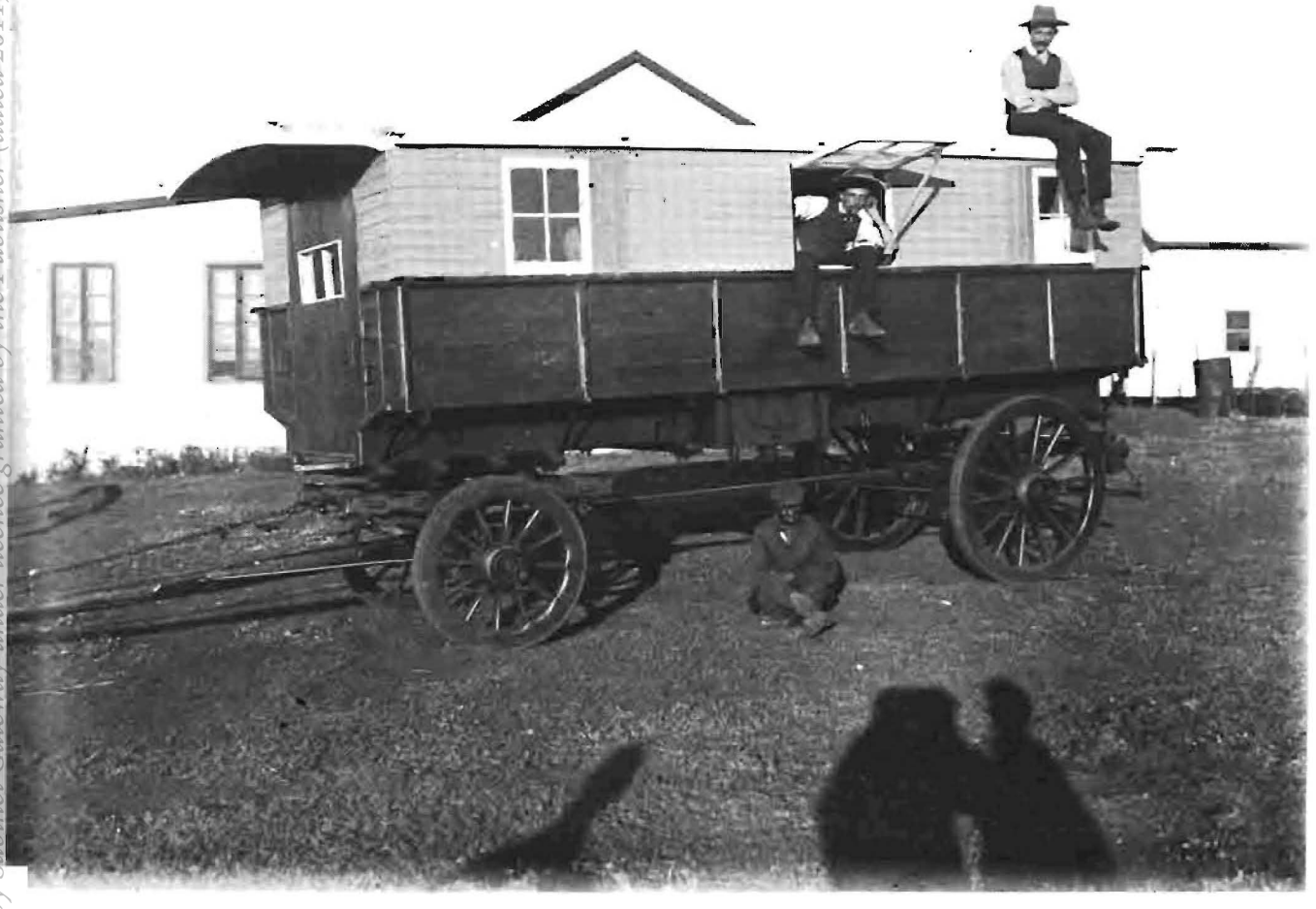

Fig. 1. Mobile Field Laboratory.

barium and Burtt-Davy providing material to feed stock. Before the end of the year lone-handed Burtt-Davy was already publishing on poisonous plants.

The friendly co-operation between colleagues over the course of the years, *as reflected in the veterinary publications,* are summarized more or less chronologically in this brief note of appreciation.

From 1903 to 1913 A. Theiler, J. Walker, J.B. Dunphy (Field Staff), D. Kehoe and D.T. Mitchell on the veterinary side worked on 'gouwziekte', 'stijveziekte', gifblaar, 'jaagziekte' and *Cotyledon orbiculata.* J. Burtt-Davy, until his resignation in 1913, investigated sixty plants – virtually from Muizenberg to Messina – as possible and probable plant causes for 'gallamziekte'. For the next few years 'lamziekte' shared the field with poisonous plants. A joint project was launched on geeldikkop, jaagziekte, dunziekte, acute liver atrophy *(seneciosis)* between Theiler and his staff and I.B. Pole-Evans, Burtt-Davy's successor, and his personnel. At this period fungus diseases were beginning to be a subject for research overseas. At the instigation of Theiler, D.T. Mitchell, aided by the plant pathologist, Dr v.d. Bijl, studied the effect in cattle feeding on maize infected with the *Diplodia zea,* and of feeding the grass *Paspalum dilatatum* infected with the ergot, *Claviceps paspali.* In 1923, A. Theiler, P.J. du Toit and D.T. Michell, summarized the findings on 'gouwziekte' in stock, I.B. Pole-Evans contributing a summary of the 'gouwziekte' veld. Whilst Onderstepoort's work between 1912 – 1916 was centered on lamziekte, much research continued to be done on poisonous plants, the botanist, E.P. Phillips, not only identifying the plants but also supplying the material. W.H. Andrews, H.H. Green (chemist), M.W. Henning and D.T. Mitchell investigated poisoning by *Adenia digitata* and *Matricaria* (Pushing disease) in cattle, as well as 'krimpziekte', and the effects of feeding *Urginea* species. By now the veterinarians were finding that they needed not only the services of the botanists, but also of the chemists (who eventually called themselves toxicologists). Amongst these we find such names as Dr R. Marloth at the Cape during 1909 to 1913, Dr. C.F. Juritz, till 1925 senior analyst to the Cape of Good Hope, and Prof. M. Rindl, pharmacologist to the Orange Free State from 1917 to 1933. The latter not only got wildly exicted about hydrocyanic acid and saponins, etc., but also settled down to long and detailed studies on toxic principles.

The publication of E.P. Phillips' 'List of Poisonous Plants' and 'Genera of Flowering Plants' in 1926 (the same year in which Theiler *et al* published their 540 page report on 'lamziekte') must have been a Godsend to the veterinarians. We find the next crop of Onderstepoort researchers as dependent on the Botany Division as ever before, culminating in Douw G. Steyn's 'The Toxicology of Plants in South Africa' in 1934, which, however, omits the main findings in Dr. Ethel M. Doidge and Averil M. Bottomley's 1931 'List of Plant Diseases occurring in South Africa'. In the meanwhile, though many 'old favourites' were still on the dissecting table, as it were, quite a few new complaints came forward: *Lasiosiphon,* 'vermeerziekte', *Crotalariosis,* inkberry, *Dimorphotheca,* and lumpy wool. At Onderstepoort the old hands were still represented by P.J. du Toit, G. de W. de Kock. H.H. Curson, C.P. Neser and F.J. Dunning (field). New workers were D.G. Steyn (toxicologist), J.I. Quin (physiologist), T.F. Adelaar and J.A. Thorburn (both from Field Services) and Claude Rimington (biochemist). The botanical 'old hands' were Dr. E.P. Phillips, C.A. Smith, Sydney M. Stent and Dr. Ethel M. Doidge (mycologist); the biochemist, Dr. A.C. Leeman, published on hydrocyanic acid in grasses and A.O.D. Mogg continued C.P. Neser's researches on vlei poisoning. J.I. Quinn and Claude Rimington settled to a long series of studies, mainly physiological and biochemical, on Tribulosis (geeldikkop) and the resultant photosensitization. The accent now was to explain the why's and wherefore's of the clinical symptoms noted heretofore. During the next twenty years D.G. Steyn and his collaborators, S.J. van der Walt (Onderstepoort) and the botanists Dr E.P. Phillips, A.O. D. Mogg, C.A. Smith, Dr R.A. Dyer, Inez Verdoorn, Dr H. Schweickerdt, Pauline Kies, Lucy Chippindale and R. Skaife (mycologist) worked on an extensive joint programme, publishing on clinical symptoms under the title 'Recent Investigations

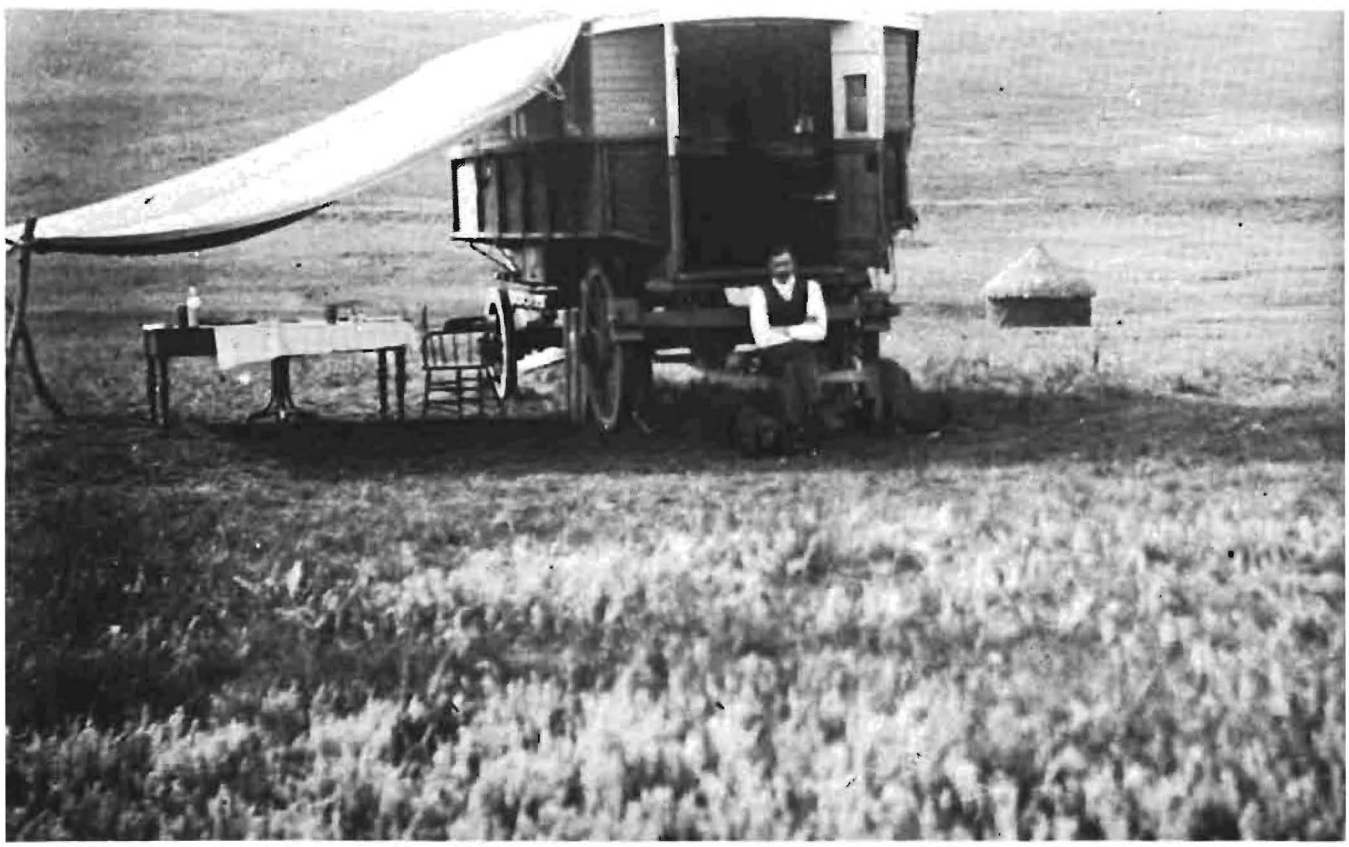

Fig. 2. 'Gouwziekte' Research 1908/9. Billy's Vleÿ, Ermelo district. James Walker on doorstep.

into the Toxicity of Known and Unknown Poisonous Plants in the Union of South Africa'. Although D.G. Steyn had organized a departmental herbarium and a poisonous plant garden, the specialist botanists were still a *sine qua non* – and continued so to this day. The results of the 'lamziekte' studies led to an extended programme on the chemistry of our soils and the feeding value of our natural pastures by the chemists J.G. Louw, A.I. Malan, C.R. Holzapfel and G.C.S. Roets. Samples were collected and analysed from about 1 000 farms from all parts of the Union; they make no special mention, however, of botanical collaborators. Marguerite Henrici, at the Botanical Research Station at Fauresmith, published a few lone papers. During the late 'fifties' and throughout the 'sixties' the chemists took over, identifying poisonous principles.

At this period, also, with the increased amount of supplementary and even stallfeeding, as opposed to the old-time practice of veld-grazing, the danger of feeding mouldy foods was being realized more and more, as also the possible confusion with botulism. Thus we find an entirely new approach to the study of 'poisonous plants': although some of the old die-hards are still with us – geeldikkop appearing in a new guise – the accent is now on fungal infected plants and food. The Onderstepoort team consisted of T.F. Adelaar, T.W. Naudé, M. Terblanche, T.S. Kellerman, N.P.J. Kriek and J.A. Minné of the Toxicology Section; J.D. Smit, R.C. Tustin, P.A. Basson, J.G. Pienaar and I.B.J. van Rensburg of the Pathology Section; others collaborators being *inter alia:* A.M.S. van Straten, L.P. Hurter, W.J. Ehret, C.M. Meldal Johnsen (Natal), W.A. de Klerk, A.E. Fair (farmer) and E.M. van Tonder. The Botanical Research Institute's Collaborators were: Dr R.A. Dyer, Dr L.E.W. Codd, Dr B. de Winter, Dr. B.J. Killick, H. Tolkën, J.H. Vahrmeijer, Wilhelmina A. Welman, Estelle van Hoepen (Wasserfall), Amelia Mauve (Obermeyer), Cecile M. Todd (Lemmer), Mayda de Winter (Henderson). The workers of the Plant Protection Institute were the mycologists K.T. van Warmelo, G.C. A. van der Westhuizen and W.F.O. Marasas, and the Entomologist E. Holm.

Once again, as in other fields of veterinary research, individual workers are being replaced by teams. Lone field workers, however, still offered their little mite, e.g. W.O. van Aardt, 1966, with Mr. Wells, the Senior State Botanist at Grahamstown, publishing on the grass *Hordium murinum.*

In another line of research the Botany Division may be said to have collaborated in that in 1936 I.B. Pole Evans published a 'Vegetation Map of South Africa', which J.P.H. Acocks updated by his publication in 1953 of 'Veld Types of South Africa'. These were to prove two essential tools in the ecological study of ticks, tsetse flies, mosquitoes, etc.

During T.F. Adelaar's era, veterinary students were introduced to the work done at the Botany Division, Sannette Buys (Voorendijk), ex-Onderstepoort staff, acting as cicerone.

The services and the co-operation of the Botany Division will not have been properly acknowledged if we fail to thank Mary Gunn, the 'ready-reference' on botanical bibliography, and if we do not include the illustrations by the artists Alice Burtt-Davy (Bolton), Cythna Letty (Botany Division's gain and our loss, as the first two years of her long career were spent at Onderstepoort); Betty Connell, Lucy K. Landsdell and L. Hill. Onderstepoort is pleased to have lent Gertrude Laurence to assist with the illustrations of D.B.D. Meredith's 1955 'The Grasses and Pastures of South Africa'.

Last but not least, mention must be made of, and thanks given for, the numerous friendly welcomes and refreshing cups of tea in the staff room. In the 'very old days' Onderstepoort provided the men and the Botany Division the ladies for the joint staff parties. Tea was doubly refreshing after the long drive in the official transport: a two-horse four-wheeled surrey, or a four-mule two-wheeled dog cart. The drive took from three quarters of an hour to one-hour-and-a-bit depending on the 'horse-power'. Despite the much greater 'horse-power' of present day transport, that cup of tea still features as a friendly token of the Botany Division's hospitality (provided you have signed your name in the visitors register where you will find many other Onderstepoort names) and willingness to help: it augurs favourably for its future well-being.

G. Theiler.
70 Malan Street
Pretoria

(Editor's Comment: Editorial short-comings do sometimes prove blessings in disguise. Although our correspondent has merely skimmed the surface, a wealth of historical detail is indicated. H.J. de Waal's work on the isolation of senecio alkaloids and their structure, as well as P. Louw's remarkable breakthrough in identifying monofluor-acetic acid as the toxic principle in 'gifblaar' spring to mind. One wishes that someone knowledgeable could make the time to write the full story of this fruitful interdependence.)

INFORMATION — INLIGTING

VACCINE SUCCESSFUL AGAINST WHITE SCOURS

The calf disease *Escherichia coli*, commonly known as white scours, caused serious livestock losses throughout South Africa last year, particularly in dairy herds where hygiene and management were below standard.

In the Winter Rainfall Region, pathogenic strains have become resistant to just about every type of anti-microbial vaccine available. Investigation into this phenomenon was given high priority at the regional veterinary laboratory at Stellenbosch.

Several pathogenic strains, not incorporated in the vaccine issued by Onderstepoort, were found. Pure cultures of these strains were sent to Onderstepoort, and experimental vaccines prepared for use on the specific farms. Vaccination of pregnant cows with these vaccines, coupled with improved hygiene and management, gave excellent results.

IN MEMORIAM

CAREL JACOBUS VAN HEERDEN
17.12.1896 – 16.12.73

Three historical groups of veterinary pioneers may be distinguished in the evolution of the profession in South Africa: those who were born and educated in Europe and the United Kingdom and had come to South Africa as veterinarians; South Africans who perforce had to seek their professional education elsewhere before exercising their profession here; and the first graduates of the Faculty at Onderstepoort. With the passing away of K.F. Meyer and Gilbert May, the last links with the first group fell away. C.J. van Heerden – 'C.J' or 'Paal' so-called because of his tall, lanky stature, belonged to the second category, now a very rapidly dwindling one.

He was born on 17th December, 1896, at Victoria West. The reputation of the Veterinary School at Dublin, drew him as it did many other South Africans. He obtained the M.R.C.V.S. in July 1923, and in the same month married Margaret Stuart Brown. Two daughters and two sons, one of whom was to follow in his father's foot-steps, were born.

From 1923 to 1930 'C.J.' served as Government Veterinary Officer and from 1930 until 1933 as Senior Government Veterinary Officer. His outstanding administrative abilities were to earn him promotion to the post of Sub-Director of Veterinary Services in 1933, to that of Assistant Director in 1937, and to that of Under-Secretary for Agriculture and Forestry in 1944. He represented the Department of Agriculture and was elected chairman of the Meat and Livestock Industries Control Board from August 1945 to December 1947. In 1946 he was appointed member of the Public Service Commission, from which position he retired in August 1951. He then joined the Swaziland Veterinary Services as Veterinary Officer, becoming Principal Veterinary Officer in 1953 and Director of Land Utilization in 1955.

The year 1960 marked his second retirement from a government service, whereupon in 1961 he became Manager of the Mushroom Land Settlement, later known as the Swaziland Settlement Ltd. He remained active until failing health forced him to stop in 1972. He died in Pietermaritzburg on 16th December 1973, the day before his 77th birthday.

Being a man of discipline, it was inevitable that the military side of life had attracted him; his whole bearing was that of a militarist and he served as Lieutenant-Colonel in the S.A. Veterinary Corps during World War II. The Order of the British Empire was awarded to him in 1958.

As member of the South African Veterinary Association since 1924, he also served his profession in distinguished fashion in Association matters; he served on Council for many years and was elected Honorary Life Vice-President in 1947.

In view of his position in the Veterinary Services, he had also lectured in State Veterinary Medicine and Jurisprudence at the Faculty of Veterinary Science.

'Paal' will always be remembered as a calm, collected but strong decision maker, with a clear grasp of practical matters; a born administrator with indefatigable energy.

To his family we extend our sincere sympathy in their loss.

IN MEMORIAM

JOHAN JACOBUS ZWARENSTEIN
20.1.1905 – 2.2.1974

Johan Jacobus Zwarenstein or 'Zwarrie' as he was universally and affectionately known, was born in Lydenburg on the 20th January, 1905, and educated at the Pretoria Boys High School. He was an outstanding sportsman, excelling at swimming, gymnastics and particularly rugby. After matriculating he went to the Transvaal University College (fore-runner of the University of Pretoria) where he graduated in 1929. Whilst at the T.U.C. he regularly represented Transvaal at rugby.

After qualifying he entered the Veterinary Service and was posted to Ixopo and it was in Natal that he spent most of his life, with only a short spell at Onderstepoort. He retired in 1965 with the rank of Sub-Director but was immediately re-appointed as Poultry Pathologist for Natal with headquarters at Allerton. In this capacity he rendered yeoman service to the poultry industry in this Province. He eventually retired for the second time in June 1972 and was then invited to join the Rainbow-Organisation with which he was still associated at the time of his death.

He enlisted at the beginning of World War II and ended a distinguished service record as Major, Officer Commanding S.A. Veterinary Corps.

'Zwarrie' was one of those rare men without enemies, he was loved and respected by all. He was a dedicated Rotarian and was one of the founders of the Seniors Club in Pietermaritzburg, to which he devoted many years of service, bringing happiness to many of our older citizens.

As a keen sportsman it was inevitable that in later years he should take to bowls, in which he excelled; at the time of his death he was the much-loved President of his Club.

'Zwarrie' was a loyal colleague, sincere, honest and dedicated to his work; – he served on the Executive of the Natal Branch of the SAVA for many years. His sudden death in Johannesburg on the 2nd February, 1974 after a short illness came as a distinct shock to his colleagues and many friends who will sorely miss his cheerful presence.

To his beloved wife, Eileen, we extend our deepest sympathy.

UITGEBREIDE INTERSTISIËLE EMFISEEM AS KOMPLIKASIE VAN DRIE-DAE-STYWESIEKTE

Algemene, uitgebreide interstisiële emfiseem as komplikasie van drie-dae-stywesiekte is goed gedokumenteer, maar die voorkoms daarvan word moontlik nie algemeen besef nie. Die bygaande foto's van twee laboratoriumbevestigde gevalle, één met herstel en één met akute dood as uiteinde, dien ter toeligting.

Geval 1: Jerseykoei, 2jr 3m oud, 7 maande laktasie, $5\frac{1}{2}$ maande dragtig.

Feb. 1: T.40°C; agalaktie, anoreksie, styf in al vier pote.

Feb. 2: T.40°C; krakende swelsel verskyn op linker skouerbladstreek, later in die dag ook regs, versprei kraniaal- en koudaalwaarts; hiperpnee en swaar dispnee. Oksitetrasiklien 5g i/v en betametasoon 40mg i/m.

Feb. 3: T.39,3°C; subkutane emfiseem van oksiput tot stertwortel.

Feb. 4: T.39,3°C; emfiseem versprei ventraalwaarts na uier, flanke, nekvlakke; habitus verbeter; begin vreet.

Feb. 5: Emfiseem oor hele liggaam, onderkake en selfs proksimaal oor ledemate; habitus baie verbeter.

Feb. 8: Foto geneem. Kliniese toestand staties tot Feb. 12.

Feb. 13 - 20: Geleidelike verbetering; lugresorpsie in omgekeerde volgorde van ontwikkeling.

Feb. 21: Emfiseem beperk tot blaaie, veral links, asook oor borswerwels.

Maart 1: Feitlik normaal.

Mei 16: Normale kalwing en melkproduksie.

Geval 2: Volwasse Frieskoei in melk. T.39,1°C; melkopbrengs baie verminder; geen beduidende styfheid nie. Begin later kreun met hiperpnee. Onderhuidse emfiseem verskyn oor blaaie, nek en versprei oor feitlik die hele liggaam. Exitus om 04h00 die volgende oggend.

Lykskouing: Uitgebreide, algemene, swaar alveolêre, septale en subpleurale longemfiseem met vorming van groot subpleurale bullae. Emfiseem van mediastinum, hartsak en van perirenale en pelviese los bindweefsel. Vroeë fibrineuse sinovitis en tendovaginitis.

EXTENSIVE INTERSTITIAL EMPHYSEMA AS COMPLICATION OF EPHEMERAL FEVER

General, extensive interstitial emphysema as complication of three days stiff-sickness is well documented, but its appearance is probably not generally appreciated. The accompanying photographs of two laboratory confirmed cases, the first one ending in recovery, the other acutely in death, serve as illustration.

Case 1: Jersey cow, 2 yrs 3 mths old, 7 months lactation, $5\frac{1}{2}$ months pregnant.

Feb. 1.: T.40°C, agalactia, anorexia, stiff in all four legs.

Feb. 2.: T.40°C; crepitating swelling appears on left scapular region; later in the day on the right as well, spreads cranial- and caudalwards; hyperpnoea and severe dyspnoea.
Oxytetracycline 5g i/v and betamethazone 40 mg i/m

Feb. 3.: T.39,3°C, subcutaneous emphysema from occiput to root of tail.

Feb. 4.: T.39,3°C, emphysema spreading ventralward to udder, flanks and sides of neck; habitus improved; beginning to take food.

Feb. 5.: Emphysema over whole body, lower jaws and even proximally over limbs; habitus much improved.

Feb. 8.: Photo taken. Clinical state static till about Feb. 12.

Feb. 13 - 20: Gradual improvement: resoption of air in reverse order of development.

Feb. 21: Emphysema limited to shoulder blades especially left, as well as area of thoracic vertebrae.

March 1: Practically normal

May 16: Calved down normally; normal milk production.

Case 2: Adult Friesland cow in lactation. T. 39,1°C; milk yield much decreased; no evident stiffness. Begins to groan later, with hyperpnoea. Subcutaneous emphysema appears over shoulder, neck and spreads rapidly over virtually the whole body. Died at 04h00 the following morning.

Autopsy: Extensive, generalised, severe alveolar, septal and supleural emphysema of lungs with formation of large subpleural bullae. Emphysema of mediastinum, pericardium and of perirenal and pelvic loose connective tissue. Early fibrinous synovitis and tendovaginitis.

Contributors: *Case 1:* Dr. B.J. Erasmus, Section Virology, Veterinary Research Institute, Onderstepoort.
Case 2: Drs. J.A.W. Coetzer, 31 Coetseest., Lydenburg 1120; A. Theodoridis, Section Reproduction and J.G. Pienaar, Section Pathology, Veterinary Research Institute, Onderstepoort.

Photography: A.M. Du Bruyn