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TYDSKRIF VAN DIE SUID-AFRIKAANSE VETERINÊRE VERENIGING

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CHANGE OF EDITORIAL POLICY

Will intending contributors please note that henceforth all **references** must:
(a) be listed in **alphabetical order** according to the surname of the first author. (The superscript numeral system is retained, but the references must no longer be numbered in order of appearance in the text, but according to their alphabetical order);
(b) give the **full title** of the article to which reference is made.

WYSIGING VAN REDAKSIONELE BELEID

Sal alle voornemende bydraers asseblief kennis neem dat voortaan alle **verwysings**—
(a) in **alfabetiese volgorde** moet verskyn, volgens die eerste outeur se van. (Die boskrifnumereringstelsel word behou, maar verwysings word nie meer genommer volgens orde van aanhaling in die teks nie, maar volgens alfabetiese volgorde);
(b) die **volle titel** van die artikel, waarna verwys, moet dra.

CORRIGENDA

1. On page 372 of Volume 4 of this Journal (December 1972 issue), tenth line in column one, read: "Kupffer cells, bile ducts and interstitium are", for: "Kupffer cell mobilization and proliferation".

2. On page 391 of the same issue, footnotes 3 and 5, read: "Personal communication", for "In press".

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EDITORIAL

PROFESSIONAL RESPONSIBILITY

Considering the recent editorials in retrospect, one is struck by the attention given to two important facets: firstly, abuse of drugs and, secondly, problems of internal and external relationships in the rapidly diversifying and specializing veterinary profession that has to maintain a fundamental unity in harmony with its "environment", meanwhile adapting itself to the country's needs. The latter aspect has been subjected to close scrutiny by a committee of the Council of the S.A.V.A.; the committee's report has been sent to all members with the newsletter of 11 October, 1972. It is a bulky document, which, on account of its fearless and honest approach and critical analysis in depth, will be considered in the future as a beacon in the history of the profession in South Africa, as well as a guide to its further evolution. If the aforementioned developments — signs of a healthy tendency, countering the disconcerting trends of the present time — are examined more closely, it becomes clear that the essence of the matter is one of professional responsibility.

Strict observance of the laws and regulations controlling the actions of the veterinarian in exercising his calling is a prerequisite *sine qua non* and is taken for granted for the purposes of this discussion. The letter of law may be complied with, the spirit thereof often disregarded. Anyone concerned with the formulation of laws and regulations will realize how impossible it is to foresee all eventualities. The number of verdicts of "Not guilty" and of repeal of sentences in South African courts of law, with their high international reputation, bears evidence of this practically unavoidable dichotomy.

True professional responsibility implies much more than mere compliance with the Veterinary Act, the Medical, Dental and Pharmacy Act, the Ethical Code of Professional Conduct and with the law in general. It includes responsibility such as can be expected from every citizen but at a much higher level. In our courts of law, as elsewhere, the status an individual occupies in society is always taken into account. Of the professional man

REDAKSIONEEL

PROFESSIONELE VERANTWOORDELIKHEID

By terugblik op die redaksionele stukke van die afgelope tyd is dit opvallend hoe aandag toegespits is op twee belangrike fasette: eerstens, misbruik van artsenymiddels en tweedens interne en eksterne verhoudingsprobleme van die veeartsenykundige professie, wat 'n basiese eenheid, in harmonie met sy „omgewing" moet bewaar in die aangesig van versnelde diversifikasie en spesialisasie en in aanpassing by landseise. Laasgenoemde aspek is deeglik deur 'n komitee van die Raad van die S.A.V.V. deurvors en die komitee se verslag is met die nuusbrief van 11 Oktober 1972 aan alle lede gestuur. Dit is 'n lywige dokument wat, vanweë sy vreeslose en eerlike benadering en kritiese diepteontleding, in die toekoms as 'n baken in die geskiedenis van die professie in Suid-Afrika gereken sal word, sowel as 'n rigsnoer vir toekomstige ontwikkeling. Beskou 'n mens bovermelde gebeure — kentekens van 'n gesonde neiging, stroom-op teen die ontstellende gees van die tyd — van naderby, dan is dit duidelik dat die kernpunt waarom alles draai een is van professionele verantwoordelikheid.

Stiptelike nakoming van die wette en regulasies wat die optrede van die veearts in die uitoefening van sy beroep beheer, is natuurlik 'n vereiste *sine qua non* en word vir die doel van hierdie bespreking as vanselfsprekend aanvaar. Die letter van die wet kan egter nagekom word sonder nakoming van die gees daarvan. Enigeen wat iets te doen gehad het met opstel en uitvoer van wette en regulasies sal al te goed besef dat dit feitlik onmoontlik is om in sodanige opstelling vir alle gebeurlikhede te voorsien. Die reeks onskuldigbevindings en tersydestellings van vonnisse in ons regspraak, met sy hoë internasionale aansien, getuig ook van hierdie prakties onvermydelike dichotomie.

Ware professionele verantwoordelikheid impliseer veel meer as blote nakoming van die Veeartswet, die Wet op Geneeshere, Tandartse en Aptekers, die Etiese Gedragskode en van die landswette oor die algemeen. Dit sluit in die verantwoordelikheid soos van enige landsburger verwag kan word, maar

a stricter compliance is demanded to the generally accepted code of ethics valid in Western society, a pattern so laboriously evolved and today more than ever in jeopardy. A measure of selfdiscipline far above the average is simply expected of him.

In this respect undesirable behavioural traits, evidence of professional irresponsibility, are mentioned and analysed by the Committee, without pulling punches. It concerns undesirable characteristics not unique to the profession as such, traits which have typified man since his emergence, but which, at a professional level, are all the more iniquitous and despicable; jealousy, spite, hypocritical flattery and stabbing-in-the-back. Soberly the Committee draws the line between egoistic empire-building and laudable ambition, idealism and competence, between false pride and conceit and healthy self-respect and self-esteem. For the individual to accomplish this, wisdom, deep insight and absolute honesty towards one's self and one's fellow-men is demanded. Everyone can bear witness how many commendable efforts have come to naught or have been marred by internecine strife, how many controversial issues have degenerated into personal dispute, with division into camps, each with its followers, the underlying principles disregarded and no longer serving as basis for calm, honest discussion and analysis but merely as the proverbial "red herring". Worse still, how many promising, professional careers have been thwarted or handicapped by jealousy, by fear of the senior for the emerging capabilities of his junior, in a set hierarchy. Let him whom the shoe fits put it on: in the final analysis no one is entirely without guilt.

Let us not falter to give public praise in all honesty to those who deserve it, and let us never fail to encourage those who have need of it. And where a reprimand is necessary, let us not fear to reprimand, but always in a spirit of honest desire to be of assistance — and then preferably in privacy. These principles are valid within the profession as well as outwardly so.

Fear justly has been incriminated as the source of the above-mentioned evils, fear of loss of material gain, fear of loss of prestige and position, fear of creating a scene. The answer lies in self-confidence, in development of competence to sustain self-confidence.

op 'n veel hoër vlak. Trouens, ook in ons regspraak word die status wat 'n individu in die maatskappy beklee altyd terdeë in ag geneem. Van die professionele persoon word strenger nakoming vereis van die algemeen geldende gedragskode wat in ons westerse beskawing geld, 'n patroon wat so moeisaam deur die eeue bereik en vandag meer as ooit ernstig in die gedrang is. 'n Selfgedissiplineerdheid van ver bo die gemiddelde word eenvoudig van hom verwag.

In hierdie verband word 'n paar ongewenste gedragaspekte, wat van professionele onverantwoordelikheid getuig, kaalkop deur die komitee genoem en ontleed. Dis onhebbelikhede wat nie eie aan die beroep as sodanig is nie, wat die mensheid van sy ontstaan aankleef, maar wat op professionele vlak soveel groter skade aanrig en des te verfoeiliker is: afguns, nyd, huigelagtige mooipratery en agteraf in-die-rug-stekery. Nugter word die lyn getrek tussen selfsugtige „empaaierbouery" en lofwaardige ambisie, idealisme en bekwaamheid, tussen valse trots en opgeblasenheid en gesonde selfrespek en eiewaardigheid. Om dit te kan doen vereis wysheid, diepe insig en absolute eerlikheid teenoor self en naaste. Elkeen kan van eie ervaring getuig hoeveel lofwaardige pogings op niks uitgeloop het of ontsier is deur onderlinge struwelinge, hoeveel strydpunte om bepaalde beginsels ontaard het in persoonlike twis, met verdeling in kampe, elk met sy volgelinge; die werklike beginsel het dan onontleed gebly, en dien nie meer as onderwerp vir eerlike, kalme analise nie, maar slegs as die spreekwoordelike „rooi lap vir die bul". Nog erger, hoeveel belowende professionele loopbane is nie gefnuik en benadeel deur afguns nie, deur vrees van die senior vir die ontluikende bekwaamhede van sy junior in 'n bepaalde hierargie nie. Laat die wat die skoen pas dit aantrek: in die finale instansie is niemand van ons heeltemal onskuldig nie.

Laat ons nie skroom om diegene wat lof toekom, in die openbaar opreg lof te gee nie, en laat ons nooit nalaat om aan te moedig waar aanmoediging nodig is nie. En waar teregwysing nodig is, laat ons nie skroom om tereg te wys nie, maar altyd in 'n gees van eerlike hulpaanbieding sonder aantasting van die ander se menswaardigheid — en dan liefs privaat! Hierdie beginsels geld binne die geledere van die professie, sowel as na buite.

When it comes to contractual relationship between colleagues, however, *recognized business practice must* be followed with properly drawn-up — and signed! — deeds. Good faith must not be relied upon unduly: the S.A.V.A. and the Veterinary Board cannot be expected to play the rôle of mothers separating scrapping little boys.

In the veterinary profession there is ample "Lebensraum" for many types of personality, each with its unique qualities, provided these are applied to the good. In the promotion of human and animal welfare there is ample "Lebensraum" for those of other calling. From each so much energy is required to fill his position properly that there is none left to waste on futile strife.

The mere concept of "Professional Status" may be a handicap. It can so easily lead to conceit, to looking askance at others, to the "trade union mentality", instead of being conducive to a higher sense of responsibility and calling.

"Loyalty" equally may be interpreted in different ways. Loyalty *is* expected of the individual towards his profession, of the employee towards his employer or employing organisation. But loyalty by no means implies slavish obedience. Loyalty in its truest sense implies *inter alia* continual questioning by the individual whether the body to which he belongs is efficiently performing its function; above all, it implies the identification, diagnosis and correction of its short-comings. This, too, is professional responsibility. An organisation that exists as an end in itself is a doomed organisation.

In all fairness the veterinary profession in South Africa should be given the honour due to it. When all the stumbling blocks and handicaps are considered, when its numerical strength is considered in historical perspective, one wonders whether it would be not too presumptuous to apply Churchill's words here as well: "Never . . . was so much owed by so many to so few."

The fact that the profession has opened its doors in responsible manner to overseas colleagues to come and practise in this country has already deserved ministerial praise in public.

Then there is another aspect. It has developed so spontaneously and so naturally, it is taken so absolutely for granted that one almost hesitantly dares mention it: through

Vrees is heel juis aangestip as die bron van bovermelde kwaad; vrees vir verlies van materiële gewin, vrees vir verlies van aansien en posisie, vrees vir 'n „scêne". Die antwoord lê in selfvertroue, in selfbekwaming om die selfvertroue te onderskraag. As dit egter kom tot kontraktuele verbintenisse tussen kollega's, dan *moet volgens erkende besigheidspraktyk opgetree* word, met behoorlik opgestelde — en ondertekende! — kontrakte. Goeie trou moet darem nie te kwaai onder druk kan kom nie: die S.A.V.V. en die Veeartsraad is nie mamma's wat bakleiende seuntjies uitmekaar moet hou nie.

In die veeartsenykundige beroep is daar „Lebensraum" genoeg vir baie soorte persoonlikhede, elkeen met sy eie eienaardighede, mits die enkeling sy sterk punte ten goede aanwend. In die dierewetenskap is daar „Lebensraum" genoeg vir baie benewens veeartsenykundige wetenskaplikes. In die bevordering van diere- en menslike welsyn is daar hope „Lebensraum" vir ander beroepe. Dit verg soveel energie van elkeen om sy eie plek na behore vol te staan dat daar niks oor is om op futiele twis te verspil nie.

Bloot die konsep van „professionele status" kan 'n struikelblok wees. Dit kan so maklik tot opgeblasenheid, tot „neersien op andere", tot die „vakbondmentaliteit" lei in plaas van tot hoëre verantwoordelikheidsin en geroepenheid.

„Lojaliteit" is insgelyks vir verskillende vertolkings vatbaar. Lojaliteit *word* verwag van die indiwidu teenoor sy professie, van die werknemer teenoor sy werkgewer of werkgewerorganisasie. Maar lojaliteit beteken allermins slaafse gehoorsaamheid. Lojaliteit in sy ware sin beteken o.a. ook gedurige bevraagtekening deur die enkele lid of die liggaam waaraan hy behoort steeds doeltreffend aan sy bestaansrede voldoen, daarbenewens en veral, opsporing, diagnosering *en regstelling* van wat skort. Ook dit is professionele verantwoordelikheid. 'n Organisasie wat bestaan bloot terwille van homself is 'n gedoemde organisasie.

In alle regverdigheid moet die veeartsenykundige professie in Suid-Afrika die eer toegeken word wat hom toekom. As al die struikelblokke en hindernisse in ag geneem word, as die numeriese sterkte van sy geledere in historiese perspektief gesien word, as sy prestasies dan in oënskou geneem word, dan wonder 'n mens of dit wel te aan-

all the years considerations of a party-political nature have never played the slightest rôle in veterinary politics. The slightest tendency in this direction has always been smothered immediately by supporters of the same party, and that in a country in which party politics have left deep scars. It is true, the S.A.V.A. on more than one occasion has been called to take a firm stand on matters of principle against the government of the day. But this has always been done with dignity and with responsible and scientifically justified motivation. The Association has at all times and at all cost kept open the channels of communication with the authorities.

Professional responsibility thus also has a positive aspect, in fact this aspect far surpasses and is infinitely more important than the negative interdict. It also demands so much more from the individual. It is easier to keep oneself apart and adhere strictly to the letter of the ethical code than to discuss matters open-heartedly with one's competitor, to obviate hitches that can reasonably be foreseen and to clear up misunderstandings. (How much time is wasted by the Disciplinary Committee of the S.A.V.A. and by the Veterinary Board on matters that ultimately prove to be mere trivialities which could have been settled satisfactorily by mutual discussion.)

Professional sense of responsibility also demands a fair attitude to members of the public, even if it costs the patience of a Job and sometimes, in special cases, individual modification of the scale of minimum fees. It is true that the demands made by the public sometimes may be utterly unreasonable but this is no excuse for tactless action.

Another demand within the compass of professional responsibility concerns activity with regard to professional bodies and organisations of which a person is a member. Too often members allow matters to slide and leave the spadework to the handful of office-bearers. Questionnaires and circulars requesting opinions are conveniently ignored with the excuse of "no time". The executive body is then accused of dragging its feet, or, if it is forced to take unilateral action, a stream of indignant protests is released with

matigend sou wees om Churchill se woorde ook hier van toepassing te maak: „Never... was so much owed by so many to so few."

Die feit dat die professie sy deure op verantwoordelike wyse oopgemaak het vir oorsese kollega's om hier te praktiseer het in die openbaar ministeriële lof verdien.

Dan is daar nog 'n aspek. Dit het so spontaan, so natuurlik gekom, dit word so absoluut vanselfsprekend deur almal aanvaar dat 'n mens dit byna met huiwering noem: deur al die jare het partypolitieke oorwegings nog nooit die geringste rol in die veterinêre politiek gespeel nie. Die geringste neiging is altyd en onmiddellik deur voorstanders van dieselfde party in die kiem gesmoor — en dit in 'n land waar partypolitiek diep wonde geslaan het. Die S.A.V.V. was weliswaar meer as eens geroepe om oor professionele beginselsake sterk standpunt by die regering van die dag in te neem. Maar dit is altyd met waardigheid gedoen, en met volle, wetenskaplik verantwoorde motivering. Steeds het die Vereniging ten alle koste die kanale vir openhartige dialoog met die owerheid oopgehou.

Professionele verantwoordelikheid het dus ook 'n positiewe kant, trouens, die positiewe kant oortref en is eindeloos belangriker as die negatiewe verbod. Dit eis ook soveel meer van die enkeling. Dit is makliker om jou afsydiglik streng by die letter van die etiese kode teenoor jou mededinger te hou as om openhartig sake met hom te bespreek en voorsienbare knelpunte by voorbaat uit die weg te ruim of misverstande op te klaar. (Hoeveel tyd word nie deur die Tugkomitee van die S.A.V.V. en van die Veeartsraad op sake verspil wat later beuselagtighede blyk te wees wat bevredigend deur onderlinge gesprek uit die weg kon geruim gewees het nie).

Professionele verantwoordelikheidsin eis ook regverdige optrede teenoor lede van die publiek, al kos dit ook dikwels Jobsgeduld en soms individuele aanpassing, in spesiale gevalle, van die skaal van minimumgelde. Dit is heeltemal waar dat die eise van die publiek soms uiters onredelik is, maar dit is geen verskoning vir taktlose optrede nie.

Nog 'n positiewe vereiste binne die kader van professionele verantwoordelikheid hou verband met optrede ten opsigte van professionele organisasies en liggame waarvan die enkeling 'n lid is. Maar al te dikwels word agteroor geleun en die spitwerk aan 'n handjievol ampsdraers oorgelaat. Kom daar

objections of "not being consulted". It must be remembered that the democratic machine is of necessity a slow one. The constitution of the S.A.V.A. with its Groups and geographically widely distributed Branches does not simplify matters. Undoubtedly, better chronological spacing of respective annual general meetings would smooth the course of matters. Problems concerning veterinary politics are frequently not easy to solve: considerable fact-finding and consultations with other bodies may be required, bodies saddled with similar slow democratic procedures. Finally it must be realized that a council usually has to devote so much of its time attending to current affairs that unfortunately little time is left to deliberate upon matters of policy. This remains the responsibility of the individual, whether he be office-bearer or not. So often one hears colleagues vehemently holding forth in private discussions — sometimes offering very sound ideas — but no trouble is taken to lay matters before the governing body. Or action is taken but all interest is lost if developments do not concur with individual wishes.

Everyone should from time to time demand account from himself in terms of our Association's motto: "PRISTINAE VIRTUTIS MEMORES".

omsendvraagbriewe, versoeke om menings, e.d.m., dan word dit gerieflik genegeer met die verskoning van „geen tyd nie". Die bestuursliggaam word dan beskuldig dat hy veels te lank met 'n saak sloer, of, as hy noodgedwonge sy taak afhandel, stroom die verontwaardigde besware van „nie in 'n saak geken word nie" in. Dit moet onthou word dat die demokratiese masjien uiteraard 'n langsame masjien is. Die samestelling van die S.A.V.V. met sy Groepe en geografies wydverspreide Streekstakke vereenvoudig sake nou nie juis nie. Ongetwyfeld sal beter kronologiese spasiëring van onderskeie jaarvergaderings die goeie gang van sake baie opknap. Daarby is baie vraagstukke rakende veterinêre politiek uiters netelig en vereis dit aansienlike navorsing en konsultasies met ander instansies, wat op hul beurt met dieselfde langsame demokratiese masjinerie opgeskeep sit. Ten slotte moet besef word dat die bestuursliggaam meesal soveel tyd moet bestee aan lopende sake, dat daar helaas bitter min geleentheid oorbly om oor beleidsaksies te besin. Dit bly dan die verantwoordelikheid van die lid, of hy nou ampsdraer is of nie. Dikwels hoor 'n mens kollega's in private gesprekke vuriglik betoog, soms met baie goeie basiese idees, maar sover as om dit voor die bestuursliggaam te lê, kom hulle nie. Of hulle doen dit wel, maar verloor belangstelling sodra sake nie na hulle eie sin verloop nie.

Elkeen kan gerus van tyd tot tyd van homself rekenskap vra in terme van ons Vereniging se slagspreuk: "PRISTINAE VIRTUTIS MEMORES".

Jl S. Afr. vet. Ass. 44 (1): 11—19 1973

INTREEREDE

INAUGURAL ADDRESS

DIE ROL VAN DIE FISIOLOGIESE WETENSKAPPE AS DEEL VAN DIE VETERINÊRE LEERPLAN

THE ROLE OF THE PHYSIOLOGICAL SCIENCES AS PART OF THE VETERINARY CURRICULUM

WILLIAM L. JENKINS

This public inaugural address delivered by Prof. William L. Jenkins on 24 April, 1972, at the acceptance of the Chair of Physiology of the Faculty of Veterinary Science of the University of Pretoria, is reproduced here by the kind permission of the Research and Publications Committee of the University. It constitutes No. 71 of the New Series of the Committee's publications.

Hierdie intreerede, gelewer deur prof. dr. William L. Jenkins op 24 April 1972 by aanvaarding van die Leerstoel in Fisiologie van die Fakulteit Veeartsenykunde van die Universiteit van Pretoria, word hier weergegee met die goedgunstige toestemming van die Navorsings- en Publikasieskomitee van die Universiteit. Dit vorm nr. 71 van die Nuwe Reeks van die Komitee se publikasies.

DIE ROL VAN DIE FISIOLOGIESE WETENSKAPPE AS DEEL VAN DIE VETERINÊRE LEERPLAN

W. L. JENKINS

Inleiding

Gedurende 'n lewensloop van 'n verwagte sewentig jaar is daar vir die enkeling in die moderne gemeenskap blykbaar bitter weinig tyd beskikbaar om **sy** fundamentele bydrae tot die ontwikkeling van die mens op hierdie planeet te bepeins. So 'n altruïstiese oorweging is nie noodwendig so vrugteloos as wat dit by die eerste oogopslag lyk nie. Die feit bly dat ons nog geseën is met 'n Godgegewe geleentheid om te kan bydra tot die oprig van die gebou van kennis en van begrip van alle vlakke van menslike strewe. Hoe klein ook al die baksteen, die klip, hoe gering die sement of sand wat die enkeling mag byvoeg, dit bly steeds 'n positiewe bydrae. Maar al te dikwels, helaas, word die eerste kans tot moontlike wysigings in die benadering van die gholfbaan van die lewe eers dán gebied wanneer 'n mens reeds die volle baan afgelê het en 'n goeie, 'n middelmatige of selfs 'n swak telling aangeteken het. Die redes vir die uitslag kan moontlik baie duidelik wees, maar dan is die spel onherroeplik verby. Al wat oorbly, is die dikwels so moeilike en delikate taak om aan ander spelers wat volg, te wys waar die verraderlike hindernisse lê en om hulle aan te raai watter stokke om te gebruik.

Dit is in hierdie gees dat ek met dank en ootmoed gebruik maak van die seldsame geleentheid om my in 'n oopte in die bos te bevind en in 'n posisie om met u, ten opsigte van my besondere deel van die baan, my aanskouing van die bome, die takke, en bes moontlik selfs die blare, te deel. Nog in 'n groot mate in die aanvanklike opwinding van die spel sal my gedagtes hoofsaaklik toegepits word op, ten eerste, die verwagte struikelblokke en, ten tweede, die hantering van onvoorsiene ontwikkelings en die vermyding van verlies van koers en doel.

Socrates het tydens sy verhoor in die jaar 399 v.C. aangevoer dat die rede waarom hy gefilosofeer het daarin geleë was dat „die onbepeinsde lewe nie die moeite werd was nie". Sedertdien is daar oor die jare inderdaad vele lewensdieptes gepeil deur die opvolgers van die ou Griekse filosowe.

Die volgende is hierdie basiese konsepte:

1. Die put van lewensgenot.
2. Die inspan van die rede.
3. Die stukrag van vooruitgang.
4. Die strewe na die ideaal.

Hierdie vier bakens dien as basiese riglyne van my aanbieding vanaand, naamlik die put van lewensgenot uit 'n realistiese en redelike voortgang na die ideaal in terme van die rol wat die fisiologiese wetenskappe in die veeartsenykundige leerplan speel.

Wat is die fisiologiese wetenskappe?

'n Omskrywing van die fisiologiese wetenskappe is 'n noodsaaklike uitgangspunt vir verdere bespreking. Vereenvoudigde en breë stellings sal hierdie doel dien. Ek beskou Fisiologie as die studie van die normale liggaamsfunksies, en Biochemie (of Fisiologiese Chemie) as die studie van die chemiese samestelling van liggaamsweefsels en van die chemiese reaksies wat in hierdie weefsels plaasvind. Die skouspelagtige sukses waarmee fisiologiese reaksies in terme van biochemiese prosesse verklaar kon word, het daartoe gelei dat die basiese dissiplines van Fisiologie, enersyds, en Biochemie, andersyds, op vele gebiede feitlik onlosmaaklik van mekaar geword het en op andere weer in groot mate oorvleuel het. Hierdie noue verbintenis deurdrenk die biologiese wetenskappe: enige studie van een van hierdie twee gebiede sonder 'n heldere begrip van die ander moet vandag as reine ydelheid beskou word. By hierdie noodwendige en ooglopende verband tussen Fisiologie en Biochemie kan 'n mens ook Farmakologie insluit. Farmakologie, wat die studie van die werkinge en gebruike van middels omvat, is 'n spildissipline wat twee duidelik afgebakende maar nouverwante aspekte saamsnoer, naamlik dié van 'n basiese wetenskap en dié van 'n toegepaste of kliniese wetenskap. Basiese Farmakologie verteenwoordig inderwaarheid fasette van toegepaste Fisiologie en Biochemie, wat geïnduseer word wanneer stowwe van eksogene oorsprong aan die liggaam toegedien word. Hierdie bewering

word onderskraag deur die besef dat middels geen nuwe organiese funksies kan skep nie, maar slegs in staat is om alreeds bestaande funksies te modifiseer.

Ten slotte dien daarop gelet te word dat sekere fasette van op die oog af onverwante dissiplines ook binne die raamwerk van hierdie diskoers ingesluit kan word. So vind ons dan dat aspekte van Voedingsleer en Toksikologie op fundamentele fisiologiese en biochemiese konsepte gebaseer is.

Doelstellings vir die toekoms en verwagte ontwikkelings in Veeartsenykunde

Francis Bacon het opgemerk dat dit nie moontlik is om 'n vaste koers in te slaan as die doel self nie presies beplan is nie. Dit is dus op hierdie tydstip gepas om die bydraes wat vandag deur veeartse gemaak word, te evalueer en, nog belangriker, om te voorspel wat die rol van toekomstige gegraduëerde veeartse sal moet wees in die volgehoue evolusie van die menslike ras en van die diereryk. Die volle betekenis van laasgenoemde oorweging blyk wanneer daar rekening gehou word met die feit dat meeste van ons huidige veeartsenykundige graduandi teen die jaar 2012 waarskynlik nog aktief, en die leiers in die beroep, sal wees. Laat ons dan kortliks 'n blik op die toekoms werp voordat ons tot die hooftema terugkeer.

Die Fakulteit Veeartsenykunde het verlede jaar sy goue jubileum gevier; gedurende hierdie tyd is die luisterryke loopbaan van ons eerste dekaan, die beroemde sir Arnold Theiler, dikwels aangehaal. Loftuigings was op hierdie tydstip baie gepas, maar die beklemmende besef het my beetgepak dat ons die punt bereik het waarop skeiding gemaak moet word tussen een era en 'n nuwe fase van ontwikkeling — 'n periode waarin dit gebiedend sal wees om nie op die louere van vergange prestasies te rus nie, maar om alles in die stryd te werp vir die volgende vyftig jaar. Dit het deur my gedagtes geflits dat, as dr. Theiler vandag hier was, hy die eerste sou gewees het om te erken dat dit wel die geval is; bowendien, siende die groot en dinamiese figuur wat hy was, sou hy waarskynlik die uitdagings wat ons nou konfronteer, erken het as van 'n ander aard en seer sekerlik van wyer omvang as dié wat hom in die eerste deel van die eeu in die gesig gestaar het. Stanislavsky het opgemerk: „Aan die einde van elke antwoord is daar 'n vraag". In die geskiedenis van die veeartsenykundige wetenskap in Suid-Afrika het sir Arnold Theiler en baie ander, waaronder ek twee van my voortreflike voorgangers moet noem, naamlik professor J. I. Quin en professor R. Clark, baie antwoorde verskaf: hul erfenis aan ons is om ons besig te hou met baie van die daaruit voortspruitende vrae.

Laat ons probeer peil hoe ons wêreld moontlik in die jaar 2 000 sal lyk, mits geen natuurlike of mensgemaakte rampe die wêreld tref nie. Statistiek is gewoonlik interessant, indien nie prikkelend nie, maar dié wat geprojekteer is vir die einde van die eeu en wat Veeartsenykunde, hetsy direk, hetsy indirek, raak, is eenvoudig ontstellend. Die wêreldbevolking sal teen daardie tyd waarskynlik 6 000 miljoen, en die verwagte bevolking van die Republiek van Suid-Afrika vyftig miljoen, beloop. Dit beteken dat die bevolking op aarde binne dertig jaar soveel keer sal vermeerder as wat oor die afgelope dertig duisend jaar die geval was. 'n Paar maande gelede het White-Stevens hierdie fenomeen in die volgende woorde beskrywe: „Hierdie fantastiese aanwas van die mensdom is die betekenisvolste biologiese gebeurtenis sedert lewe die eerste keer op aarde verskyn het. Dit is 'n kataklisma van reusagtige omvang en vereis die ten volle toegewyde pogings van alle intelligente mense oral op die aardbol indien dit effektief versag moet word".

Vandag sterf meer as twintig miljoen mense jaarliks 'n hongerdood en die Paddock-broers het voorspel dat hierdie syfer, slegs as gevolg van hongersnood, moontlik tienvoudig tot 200 miljoen per jaar kan vermeerder in die nie al te verre toekoms nie. Daarby lewe 'n groot deel van die mensdom, in die lande met 'n voedseltekort, op 'n ongebalanseerde dieët en is hulle dus ondervoed. In die verbygaan dien daarop gelet te word dat daar geen werklike hoop is vir die oortollige hoeveelheid mense van hierdie aarde om na ander planete te emigreer nie. Daar is bereken dat dit meer energie vereis om 'n man van 80 kilogram uit die aarde se aantrekkingskrag te lig as om hom 2 000 kalorië per dag vir tien jaar te voer en hom teen 20°C vir sy lewens-

duur te huisves. Dit sal ook meer kos as die wêreld se huidige bruto produk om van die oortollige bevolking van een lopende dag, t.w. 200 duisend, op hierdie manier ontslae te raak. Ons moet die waarheid in die gesig kyk dat, tensy menslike voortplanting verminder en buitengewone pogings aangewend word om voldoende voedsel te verskaf, die mens gedoem sal wees, soos Thomas Malthus reeds amper 200 jaar gelede voorspel het. Die betekenisvolle feit moet onderstreep word dat die bevolkingsontploffing homself hoofsaaklik in die ontwikkelende lande voltrek, terwyl bevolkingsgrootte in die gevorderde gemeenskappe van die wêreld geneig is om te stabiliseer. Die deurslaggewende rol van opvoeding en die noodsaak vir sosiale verandering onder die onontwikkelde volkere is dus vanselfsprekend.

Tekort aan eiwit is die grootste probleem van ondervoeding. Die minimum eiwitvereistes van die mens en sy plaasvee is alreeds kwalitatief en kwantitatief bepaal en daar kan geredelik aanvaar word dat die hedendaagse tegnologie in landbou en voedselwetenskap in die behoeftes van die bevolking in hoogs ontwikkelde lande tot die jaar 2025 sal kan voorsien. Die vooruitsig bly dus uiters skraal, ten spyte van die moderne vordering in die gebruik van natuurlike koolwaterstowwe, om genoegsame verteerbare aminosure en polipeptiede te produseer.

Daar is geweldige uiterstes in die gebruik van dierlike eiwit in die wêreld vandag. 'n Lid van 'n welvarende gemeenskap verbruik tot sewe keer die minimum hoeveelheid dierlike eiwit wat vir sy onderhoud nodig is. As sodanig word hierdie dierlike eiwit van plantaardige eiwit geproduseer teen 'n verlies van ongeveer 7:1. Daar is dus 'n oormaat verbruik van plantaardige eiwit deur die mens, veral in die westerse lande, wat tot 50 keer bo sy minimum vereistes kan beloop. Ons is maar al te bewus van die teenoorgestelde uiterste en die gevolge daarvan. Op een of ander manier moet hierdie wantoestand reggestel word.

Ons moet ook aandag skenk aan die toekomstige rol van die huisdier-herkouer. Daar is 'n moderne neiging om hoëenergierantsoene aan herkouers te voer wat tot 'n gewisse mate van kompetisie met die mens lei. Dit skyn asof die volste voordeel nie uit die inherente vermoë van die herkouer getrek word om lae-energieruvoer te benut nie.

Die veearts het 'n onontkombare verpligting in hierdie lewensbelangrike poging om voedselproduksie te verhoog. Nog nooit tevore in die geskiedenis is dié beroep met 'n taak van so 'n omvang gekonfronteer nie: die veearts moet meehelp om die produksie van dierlike eiwit te verseker, om hongersnood te bestry en om die gesondheid van die mensdom oor die hele wêreld te verbeter. Aandag sal aan etlike aspekte van die veeartsenykundige wetenskap gegee moet word ten einde produktiwiteit te verhoog. Die vernaamste hiervan is: die bestryding van diersiektes; die ontwikkeling van middels en biologiese agense vir die onderhoud van dieregesondheid en vir moontlike versnelling van groei; die studie van parasitologie en kunsmatige inseminasie; die vermindering van steriliteit; en die fisiologie van voeding en reproduksie. Professor Robert Ornduff het in 'n lesing voor die 1970-kongres van die Suid-Afrikaanse Vereniging vir die Bevordering van die Wetenskap gesê: „Die toekoms van **Homo sapiens** op aarde is nie hopeloos nie. Watter toekoms ons het, lê in die hande van die wetenskaplikes; hoe gouer dit algemeen deur die gemeenskap erken word, hoe groter is die kans dat ons iets van waarde vir die nageslag kan red". Professor Meiring Naudé het 'n soortgelyke voorspelling gemaak en daaraan toegevoeg: „Ons moet wetenskaplike navorsing 'n honderd jaar vooruit beplan". Hierdie woorde het 'n gewigtige betekenis.

Benewens die swaar verpligtings van die veearts wat hom op voedseldiere toespits, moet ons ook voorspel watter ander loopbane vir veeartsenykundige graduandi beskikbaar sal wees namate die menseras na 'n periode van krisis snel. Die huidige opleiding van 'n student verskaf 'n akademiese basis wat hom in staat stel om tot 'n aantal beroepsfere toe te tree. Hieronder kan ons ten minste die volgende insluit: grootdierpraktyk, opgedeel in voedseldierpraktyk en perdepraktyk; kleindierpraktyk; proefdiergeneeskunde; beherende veeartsekundige geneeskunde; veeartsenykundige openbare gesondheid; insluitend vleis- en

voedselinspeksie; militêre veeartsenykunde; diergeneeskunde toegepas op wildbewaring en dieretuin- veeartsenykundige praktyk; basiese en toegepaste veeartsenykundige en mediese navorsing; en, ten slotte, onderwys, insluitende veeartsenykundige, mediese en biologiese onderwys.

Ek glo dat relatiewe klemverskuiwings met die verloop van tyd op al hierdie gebiede sal plaasvind, alhoewel elkeen op sigself sal ontwikkel.

Dit skyn tog of baie meer veeartse hulle op voedseldierproduksie sal moet toespits en of spesialisasie in hierdie, net soos in al die ander moontlike aktiwiteite, in beide vakrigting en in 'n betrokke spesie onvermydelik sal moet plaasvind. Dit is 'n feit wat ons sal moet erken.

Ek verwag ook dat al hoe meer veeartse hul loopbane sal vind op die terrein van navorsing in die menslike geneeskunde, veral in die basiese wetenskappe, waartoe hul opleiding hulle in staat stel. Na my mening sal veeartsenykunde altyd aan beide die mediese en die landbouwetenskappe verbonde bly; dit vorm inderdaad 'n baie geskikte skakel tussen hierdie twee gebiede. Laboratoriumdiergeneeskunde is 'n terrein wat vinnig uitbrei en waarop daar vandag slegs 'n paar spesialiste in die Republiek is. Hierdie toestand sal reggestel moet word. Eweneens is moderne militêre veeartsenykunde in Suid-Afrika nog in 'n vroeë stadium van ontwikkeling.

Dit is te hope dat die aantal veeartse wat 'n rol in wildbewaring speel, sal toeneem, indien daar aangeneem word dat die wildreservate die druk van buite waaraan hulle onderhewig is, sal kan weerstaan en sal aanhou om te floreer. Na my mening is die toekoms van wildboerdery nog baie vaag, en ek sou nie graag voorspellings hieroor wou waag nie.

Die praktiserende veearts van die toekoms sal moontlik geroepe wees om werkdiere soos waghonde, speurhonde, gidshonde en trek- en patrollieperde, eerder as troeteldiere, te versorg. Nogtans sal die mededinging om voedsel 'n groot vermindering in die aantal geselskapsdiere teweegbring, veral wat die karnivore betref.

Ten slotte voorsien ek, wat opvoeding betref, baie nouer interdissiplinêre skakeling op die basiese en selfs op die toegepaste vlakke. Trouens, in dié opsig, waar sir William Osler die stelling gemaak het: „Daar is slegs een geneeskunde", is dit moontlik nader aan die waarheid om te sê: „Daar is slegs een biologie".

The role of the Physiological Sciences in future Veterinary education

Having initially presented and examined our arrows — the physiological sciences — and having outlined a series of targets — the potential veterinary careers of the future — we must now evaluate how best we can utilize our bow — the veterinary curriculum — to speed the arrows on their way.

In 1962, Dr. George Berry, a physician associated with a medical school in the United States, made the following observations: "What are the enemies that we as teachers face as we work to improve medical education? Surely our enemies include: habit and simple inertia, contentment with the **status quo** and self-satisfaction, fear of change, slavish adherence to orthodox and conventional habits and procedures, failure to understand the significance of social evolution and the consequent expansion of the responsibilities of and opportunities to the physician". These remarks are equally appropriate to veterinary education, and we must investigate some of the possible measures to overcome these factors hostile to the objective teaching of both undergraduate and postgraduate students.

Today we are confronted in almost every academic sphere with a prodigious expansion of knowledge, which is rapidly approaching an exponential rate. This holds particularly true for the field of biology, as applied to the medical and veterinary sciences. An additional problem is that the complexity of the interrelationships in biology are much greater than those between the various branches of the pure sciences. Furthermore, because of the dependence of biology on the pure sciences, advances in the latter invariably have an effect on the former. Regular visits to the library bear ample testimony to this phenomenon. We are now well and truly beyond the point of being able to transfer this knowledge in its entirety to students. About **60 years ago** Welch stated: "It is impossible to impart the entire content of medical and surgical science to the student . . . or even

to impart the content of a single subject of the curriculum. The utmost to be expected is to give the student a fair knowledge of the principles of the fundamental subjects of medicine and a power to use the instruments of his profession . . . and above all to put him in a position to carry on the education which he has only begun in medical school". How infinitely worse is the situation today!

The final phrase of the above quotation is of profound importance, namely, "to carry on the education which he has only begun". It was mentioned earlier that our 1972 graduates will be the senior men of the profession in 2012. What proportion of the basic factual knowledge acquired during their veterinary course will these students recall in forty years' time? It may well be very limited, if not infinitesimally small; but what is far more significant is how much of this "factual knowledge" will still be valid or have any bearing whatsoever at that time. Thus, as teachers, we are obligated to cultivate fertile and receptive minds which will be able to accept and adjust to the radical sociological changes which we anticipate within their professional lifespans. We must be conscious of this duty at all times and must avoid any tendency to curb or impair these inherent mental abilities — they represent our hope for the difficult times to come. Moreover, it is not only **what** a student is taught but **how** he is taught which exercises a tremendous influence on the development of his preparedness for his future career. A paragraph in an address of the late Dr. Stokes perhaps best illustrates the pith of my remarks: "Let us emancipate the student, and give him time and opportunity for the cultivation of his mind, so that in his pupilage he shall not be a puppet in the hands of others, but rather a self-relying and reflecting being".

As with any discipline, in Physiology and its related subjects there is a need to impart basic facts, and of necessity in some detail. This knowledge can only be built up by careful and logically consistent progression. It must commence not only with an introduction to biology in high school and the first year spent at university but, of even greater importance, must also commence with an understanding of the mathematical, chemical and physical sciences. The reason for my emphasis on the pure sciences is simply that biological concepts are dependent upon the pure sciences. Furthermore, applied biological facts are constantly reinforced throughout the veterinary curriculum, whereas the pure sciences hardly receive any attention during the balance of the undergraduate course. This may well be no loss to the veterinarian who will remain engaged in a practising career. Nevertheless, modern research is rapidly closing the gap between the pure sciences and the biological sciences and the graduate veterinarian who becomes involved in basic research will soon recognize his shortcomings in the former disciplines.

I should like to illustrate this point with examples encountered in Physiology, Biochemistry and Pharmacology.

In the study of biological membrane function, it is frequently possible to represent physiological phenomena by the use of mathematical models. This is particularly true of transport mechanisms. The validity of these models is often confirmed following appropriate and well controlled investigations both **in vitro** and **in vivo.** Furthermore, the interpretation of this type of study requires considerable mathematical acumen.

The tremendous strides made during recent years in the technology of analytical instrumentation has permitted detailed investigation into the absorption, distribution, biotransformation and excretion of foreign compounds in the body. The results of these studies have indicated that the majority of the interactions which occur between the relatively small drug molecules and the intracorporeal macromolecular systems are based entirely on well-defined physicochemical concepts.

Similarly, many of the mechanisms involved in enzyme-mediated biochemical reactions have been elucidated. Thus the electron shifts, dipole and induced dipole moments, and the ionization processes which are responsible for the creation of the electrostatic forces which lead to ideal enzyme-substrate "fit" have come under close scrutiny, and their contributions in specific reactions have been defined. Furthermore, the energy requirements or the

energy release associated with the subsequent formation or cleavage, respectively, of the chemical bonds have also been determined in many cases. The forces involved and the laws governing these reactions, for example the laws of thermodynamics, are identical to those encountered in the study of Physical Chemistry. This is not really surprising when one considers that all biological systems simply represent aggregates of atomic particles whose behaviour is governed by universal principles.

These three examples emphasize how important it is to maintain the link between the physiological sciences and Mathematics (especially the Calculus), Chemistry and Physics. Although this link tarnishes during the course of undergraduate training, it is often an essential facet which must be revived and developed at the postgraduate level. In fact, if significant advances in many aspects of basic veterinary research are to continue, it is vital to retain a sound foundation in the pure sciences — the chasm which has developed must be regarded as a threat to future progress.

This dissociation between disciplines has also become a problem of increasing magnitude even within limited biological fields. Many current research areas have originated as offshoots of broader disciplines and ultimately have developed into specialized fields in their own right. This in itself is natural and healthy progress but there has been an unfortunate consequence, namely, that the parent and offspring no longer communicate with each other and, what is more, often no longer speak the same language. Let us take the study of the single cell as an example. What used to be a relatively small section within the province of Histology and Physiology is today the realm of a number of dynamic emergent research fields such as Cytology, Cellular Physiology, Biochemistry, Biophysics, Biochemical Pharmacology, Molecular Biology and Electronmicroscopy. All study the structure and function of cells but each has its own scientific journal, its own scientific society with its own meetings, and each has developed its own terminology. Unfortunately, with the passage of time, dialogue between the different groups is lost as is the synergistic effect of close co-operation. Needless to say, a student has very little chance of fruitfully correlating and understanding the advances in such closely related fields without the assistance of discriminative interpretation by his mentor — a difficult but essential task!

It is convenient, when teaching Physiology and Biochemistry, to commence with simple basic cellular concepts and from these to develop the principles of multicellular or tissue function, and then finally to integrate and interrelate the organic functions of the body. The **modus operandi** should ideally be based on:

1. Information transfer — generally by formal lectures.
2. Information reinforcement — by practical and demonstration classes, discussion sessions, and seminars.
3. Information utilization — by practical usage, discussion sessions based on theoretical and practical problems, and investigation of clinical cases and herd problems.

The ultimate standard attained by students in the physiological sciences should permit them to answer confidently the challenging question: "Why?", with regards to a particular physiological phenomenon or response. Such a reply should commence with a discussion of grossly interrelated physiological effects and then, by reasonable and logical steps, should incorporate the relevant explanations at the cellular, subcellular and even molecular levels. An excellent illustration of this approach is encountered in the field of Endocrinology. The elucidation of the biological role of cyclic-AMP now permits one to relate the physiological and biochemical effects of a number of polypeptide and other hormones with these agents' subcellular activity, namely the activation of the enzyme adenyl cyclase and the formation of cyclic-AMP, the so-called second messenger, which mediates the alterations in cell function.

Besides an appreciation of all aspects of normal body function, the physiological sciences should fulfil other important roles. Amongst these one may include an understanding of the methods by which scientific knowledge is acquired; the assessment of scientific literature; an appreciation of

experimental design; the formulation of hypotheses; and the statistical approach to data analysis. Specific areas within the different disciplines should be utilized in this respect.

Perhaps the most important of these ancillary tasks is the evaluation of hypotheses. This is particularly true at the postgraduate level, but even the undergraduate should be made aware that in many instances it is simply the explanation which is based on the most creditable evidence which is accepted but should not necessarily be regarded as absolute fact. This approach permits a student some mental freedom of choice based on his own contemplation of the pertinent problem. Far from undermining his confidence, such meditation may be very beneficial for a student as he perceives the difficulties involved and the reasons for these obstacles. It may also be due to the joy of discovering that he is not the only one who simply does not know all the answers!

The foundation acquired by studying Physiology, Biochemistry and Pharmacology is rarely utilized **per se,** except by those graduates working in these particular fields. The majority of veterinarians require this knowledge to be in a position to understand and interpret deviations from the normal which are encountered in practical situations. Michell has recently proposed that this vitally important field of study be known as "Clinical Physiology".

Thus, in medicine, the clinical signs of disease represent the result of disturbed physiological functions and these signs should be interpreted by reference to the physiological state and by asking the question: "Why is there a deviation from the normal?". Similarly, a series of chemical pathological results which contain abnormally low or high values should be scrutinized in terms of the possible reasons for such alterations. The derangement of biochemical systems or the disruption of cellular function which could possibly be responsible for such aberrations should then be evaluated with reference to the normal physiological and biochemical patterns. In addition, many surgical conditions may best be controlled in a similar fashion — shock, anaesthetic emergencies, healing of tissues and impaired organ function represent examples in which a sound physiological and biochemical understanding is imperative for proper management.

A pathologist should not be content simply to investigate the gross lesions discovered at necropsy and then to study the histological changes associated with these lesions. In reality what he is observing in many cases are the final results of disturbed physiological and biochemical mechanisms which have led to particular structural alterations. He would be in a much better position to appreciate the entire pathogenesis by having an understanding of the physiological sciences.

The above tenets have just as much bearing when dealing with a herd or flock problem.

Pharmacotherapeutics is based upon the correction of physiological and biochemical deviations by making use of exogenously derived drugs to control the adverse effects of the disease process. Today we are often able to explain entirely many favourable responses to drug therapy. This was not always the case only a few years ago. An excellent example to illustrate this point is to be found in the modern approach to the treatment of endotoxaemic shock in which each adverse reaction may be rationally and effectively counteracted by the administration of appropriate therapeutic agents.

Michell considers the importance of the contribution of Clinical Physiology to the veterinary curriculum to be threefold, namely: "Intellectually, it provides the stimulus to form a critical and imaginative attitude towards disease processes; perhaps that is the same as saying a scientific attitude. Academically, it dispatches the dragon of "symptom lists" in favour of an understanding of common syndromes. Practically, it seems evident . . . that when treatment is frequently symptomatic, the fullest possible understanding of the physiological derangements must be beneficial".

In addition to the clinical fields, however, the physiological sciences will form an indispensable part in our armamentarium to meet the challenges of the future. Consider for

one the Physiology of Production and its ramifications: Reproductive Physiology, Physiology of Nutrition, Ruminant Physiology, and the Physiology of Stress, Environmental Physiology and the problem of pollution, Behavioural Physiology, and, finally, Comparative Physiology and the interdisciplinary integration of all these fields.

We have reached a stage in the development of the veterinary course at which intracurricular integration must be regarded as absolutely essential. Many aspects of Anatomy and Physiology should be presented in an integrated fashion for the student to obtain optimal understanding of the particular system — an excellent example being Neurology. Similarly, compartmentalization between the disciplines of Nutrition and Biochemistry, as regards the biological role of nutrients, is undesirable. Once again, integrated courses would allow the student to appreciate the full significance of the dietetic requirements of the body. Amongst the numerous other possible illustrations of potentially useful integration of subjects or facets of subjects, one must mention Toxicology, Pharmacology, Physiology and Biochemistry. There are a number of aspects encountered in these four fields which lend themselves admirably to integrated presentation and study, which would permit fuller understanding and desirable reinforcement of knowledge.

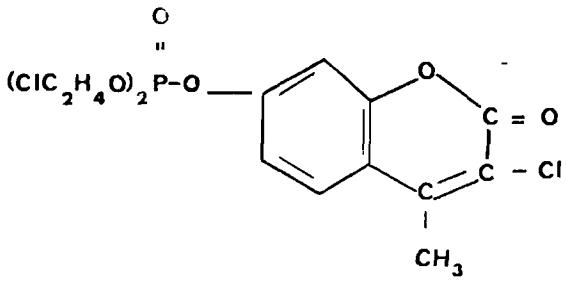
I should like to make mention, **en passant**, of the very significant role of the postgraduate student within a scientific sphere and, in our particular case, within the physiological sciences. The strength of many Western nations' research programs revolves around the contributions being made by the postgraduate students working in those countries. The incentive for a postgraduate student is personal achievement and gain — both very strong motivating forces which, if carefully directed, can be of great benefit to all concerned. Moreover, it is during postgraduate training that interdisciplinary links can be forged and cultivated. This is best exemplified by considering the ideal course for a postgraduate student in Pharmacology. Besides all the biologically orientated courses, he would be expected to pursue studies in Organic and Physical Chemistry, Electronics, Calculus and Statistical Analysis.

There remains one final but worrying aspect of our theme which I should like to discuss. Of necessity one tends to orientate a curriculum in a professional faculty towards the requirements of the majority of the graduates or, more precisely, towards the occupations in which the majority of graduates will eventually engage themselves. Although this seems to be logical, there is a singularly important shortcoming inherent in the approach. One may become so engaged in preparing "relevant" courses that one may fail to stimulate the interest of a potential Claude Bernard within a group of students. By spending a little more time on the exciting and intriguing wonders of the physiological sciences, there would be a greater probability of attracting interested and enthusiastic students back to the various fields soon after graduation. One could then possibly establish a fertile lineage which would continue to produce both valuable scientific contributions and competent scientists in the mould of the great pharmacologists who were associated with the University of Dorpat in Esthonia during the last century and the early part of this century.

In summary then, the physiological sciences are vital to our understanding of normal body function and the factors which may disrupt this function. As a group they represent pivotal subjects which readily allow intra- and interdisciplinary liaison and co-operation. The physiological sciences should develop close associations with the pure sciences, on the one hand, and must play an important role in the global biological problems confronting the world, on the other.

If I have created the impression that the physiological sciences are the most important courses in our veterinary curriculum, I hasten to confirm my belief. I hope that I have provided sufficient evidence to substantiate my point of view.

HALOXON



is 'n

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Dit is 'n OXON van 'n

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is onoplosbaar in water, verwek net 'n onbeduidende maat van cholienesterase-vermindering in die bloed, is baie veilig.

LOXON

is 'n hoogsdoeltreffende en veilige middel veral teen perde-, skaap-, bok-, en bees-rondewurms met 'n terapeutiese indeks van 4 tot 25 afhangende van die dieresoort.

J. 4790

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TOESPRAAK ADDRESS

VEEARTSENYKUNDE IN SUID-AFRIKA, *QUO VADIS?**

B. C. JANSEN**

SUMMARY

The evolution from relatively simple farming practice to one of highly sophisticated agrarian business, in which the importance of the individual animal is superseded by the importance of the herd or flock as a whole, significantly alters the demands placed on the veterinarian. In view of the more highly specialized scientific knowledge required, the author pleads for a modified training course in which the veterinary student is awarded credits for the basic subjects, augmented by credits for elective courses determined by the species approach. Continued training after graduation and the institution of a specialist register are essential. Better and more use should be made of paraveterinary auxiliaries.

The responsibility for proper handling of potentially dangerous drugs will continue to become greater and should be borne adequately.

Research will demand increased background knowledge and an interdisciplinary approach.

The profession, especially as represented by the SAVA, should come to clarity on these matters to be able to direct its future strategy and guide young entrants to the profession correctly.

Die veeartsenykundige professie in die Republiek van Suid-Afrika kan terugkyk op 'n glorieryke verlede waarin 'n beperkte aantal toegewyde manne berge versit het en 'n ryke tradisie opgebou het. Meeste van die episoötiese siektes is onder die knie gekry — hoe dit bereik is, is by ons almal bekend en het geen herhaling nodig nie. Ons het nou egter by 'n keerpunt gekom en sal diep en konstruktief aan ons toekoms moet dink. In talle ander lande waar daar minder beperkende invloede ervaar is, kon die professie al lank reeds duidelike riglyne vir die toekoms uitwerk en het ook goeie vordering in verskillende rigtings gemaak. Dit is vir ons al laat, maar seker nog nie te laat nie, om ons optrede aan te pas by moderne wetenskaplike vereistes. Graag wil ek dan in dié opsig 'n stuiwer in die armbeurs gooi.

Die wêreld is vasgevang in 'n dreigende toekoms van oorbevolking en orals word planne beraam om meer voedsel te produseer. Laat ons nie vergeet nie dat die kwaliteit van die landboupraktyke, waarby diereproduksie ingesluit is, in enige land die vlak van die volk se voedingspeil bepaal. Die veearts het 'n groot verantwoordelikheid in dié opsig en kan hom nie losskeur van hierdie werklikheid nie. Sir Alexander Robertson het beweer: „The place of the modern veterinarian is in the midstream of agricultural activity and not on its banks; events will not stand still and we must take good care to keep up with them."

In Suid-Afrika bestaan alreeds 'n sterk neiging om enkele veebedrywe om erkende bedryfsekonomiese redes groter te maak. Daar ontstaan dus 'n kleiner aantal groter bedrywe en hulle spesialiseer in die produksie van enkele diersoorte. Hiermee gaan gepaard grootskaalse tegniese ontwikkeling. Die boer word al hoe meer 'n agrariese ondernemer wat op die presiese bestuur van sy hele bedryf gesteld is. Met die groter aantal diere op een houding op intensiewe stelsels, vermeerder die siekteprobleme en neem sommige siektes nuwe vorms aan. Die individuele dier neem by die groot bedrywe in belangrikheid af en 'n kuddebenadering kom al hoe meer op die voorgrond. Waar die veearts in die verlede nog tot 'n groot mate as die geneesheer van individuele diere beskou kon word, moet hy nou ingestel wees op geprogrammeerde siektevoorkomende skemas, higiëniese maatreëls, vervoer van diere, diereversorging, dierevoeding, dieregedrag, behuisingskemas en arbeidsmetodieke ter wille van beter produksie. Hy sal natuurlik nog aandag skenk aan individuele diere ook, maar

*Voordrag gelewer vir die Tak Pretoria van die Suid-Afrikaanse Veterinêre Vereniging tydens die Algemene Jaarvergadering op 26 April 1972.

**Hoofdirekteur van Veeartsenydiens. Pk. Onderstepoort.

moet sorg vir die toepassing van 'n funksionele kennis van voorbehoedende siektebestryding. Die veearts sal soos 'n besigheidsman of bedryfsondernemer moet begin dink en die nouste samewerking met ander deskundiges wat verbonde is aan boerdery, bv. voedingsdeskundiges, handhaaf.

Die moderne boer met sy meerdere kennis sal met groter omsigtigheid deur die veearts behandel moet word. Indien die veearts in die verlede bloot vanweë sy status nog 'n gesagsposisie beklee het, het dit nou verval, aangesien die vooruitstrewende boer net beindruk word deur kundige optrede.

Op die groot bedrywe word die risiko vir die boer groter maar ook vir die veearts. 'n Foutiewe diagnose en foutiewe terapie kan vir die boer 'n groot verlies beteken en sal tegelykertyd afbreuk doen aan die veearts se reputasie. Nooit moet daar by laasgenoemde enige twyfel bestaan oor die inroep van wetenskaplikes met deskundige kennis nie, want deur bv. 'n patoloog of toksikoloog op 'n vroeë stadium in te roep kan die boer groot verliese gespaar word en die veearts se reputasie baie baat. Beter boere dring aan op spesialiste-opinies. Tensy die professie homself kan dissiplineer om hierdie diens effektief te lewer, kan ons nie die boer blameer as hy na andersoortige konsultante soek nie. Wat hierbo gesê is, is des te meer waar met die krimpende winsgrens wat veroorsaak word deur verhoogde produksiekostes. Wanneer ekonomiese voorspoed heers, is die waarde van die veearts 'n bietjie op die agtergrond, maar dit sal definitief nie die geval wees in die tyd wat voorlê nie.

Oor die afgelope twintig jaar het die kliniese wetenskap met rasse skrede gevorder, met die gevolg dat die hoeveelheid kennis oor die siektetoestande van individuele soorte diere eksponensiëel toegeneem het. Verder het die begrip van wat die onderskeie diersoorte vir optimale produksie nodig het, tot dieselfde mate uitgebrei. Dit is dus baie duidelik dat veeartse, as hulle reg wil laat geskied aan die beoefening van hulle professie, in die toekoms 'n spesies-benadering sal moet handhaaf. Die logiese stap is spesialisasie rondom enkele spesies soos wat dit alreeds dwarsdeur die wêreld met groot sukses gedoen word in die geval van hoenders en varke en ook tot 'n groot mate al reeds by perde.

Daar bestaan min twyfel dat kleindierpraktyk in stede ook sy plek in die toekoms sal behou. Daar is alreeds talle praktisyns wat hulle slegs daarby bepaal en dit tot 'n hoogs gevorderde peil ontwikkel het. Huisdiere beklee 'n besliste plek in die kulturele ontwikkeling van die mens, en die veeartsprofessie moet sorg dat hulle vry is van siektes en die regte behandeling ontvang. Ek wil egter in alle erns vra of ons nie in baie gevalle die sentiment van die kleindiereienaar uitbuit ter wille van geldelike gewin nie. Word die beoefening van kleindierpraktyk nie in sommige gevalle 'n kuns instede van 'n wetenskap nie? Is daar nie te veel lede van ons professie daarmee besig nie? Ons sal oor die toekoms hiervan moet besin.

Weens die breë basis van veeartsenykundige opleiding is die graduandi ideaal geskik vir toetrede tot verskeie rigtings en is daar ook alreeds ver hiermee gevorder. Veeartse tree suksesvol op as adviseurs vir die veemiddelbedryf, menslike gesondheidsdienste, produksie en versorging van eksperimentele diere en neem deel aan basiese mediese navorsing. Veeartse sal ten alle koste hulle self in dié rigtings moet handhaaf en tred moet hou met die snelle vordering in wetenskaplike kennis op hierdie gebiede.

Dit is duidelik dat, in 1980, alle vertakkings van die veeartsenykunde op 'n baie meer gesofistikeerde vlak uitgevoer sal word en ons moet nou ons opleiding regstel om aan die toekomstige vereistes te voldoen. Opleiding is uiteraard primêr gemoeid met voorbereiding vir die toekoms. Ek is oortuig dat ons die tradisionele, verstarde benadering tot veeartsenykundige opleiding, waardeur ons algemene klinici geproduseer het, moet laat vaar. Met die eksponensiële toename in kennis kan ons nie meer deesdae hoop om aan alle studente gedurende die kursus alles te leer wat bekend is omtrent veeartsenykunde nie. Dit is verder onrealisties om te glo dat ons maar net die kursus kan verleng namate nuwe kennis versamel word. 'n Oordeelkundige besnoeiing van die kursusinhoud is dringend nodig. Wat oorbly moet herrangskik word in 'n vorm wat vir die dosent en student meer hanteerbaar is. 'n Betekenisvolle gebeurtenis wat hiermee verband hou is die onlangse beslissing van die S.A. Mediese en Tandheelkundige Raad dat die akademiese gedeelte van die mediese opleiding met die nodige rasionalisasie van ses na vyf jaar verminder mag word. Alreeds het som-

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Waarom kan ons as veeartsprofessie nie ook ons probleem op so 'n kreatiewe manier aanpak nie? Wat sou verkeerd wees met die keuring van veeartsenystudente na matriek? Dan sou daar nie so 'n groot getal eerstejaars wees wat in die duister verkeer oor hulle moontlike toelating tot die Fakulteit Veeartsenykunde nie. As dit toegepas word, kan van die vakke van die latere jare, bv. anatomie of fisiologie na die eerste jaar verskuif word en sodoende verligting teweegbring.

Ek meen dat met die nodige herrangskikking, rasionalisasie en integrasie van kursusse daardie kern van inligting wat essensiëel vir elke veearts is, afgesien van sy besondere toekomsrigting, binne die eerste 3½ of 4 jaar by die student tuisgebring kan word. Dié kern moet opgebou word uit die volgende vakke: Anatomie (mikroskopies en makroskopies); Fisiologie en Biochemie; Soötegnologie; Geslagskunde; Patologie; Bakteriese, Protosoïese en Virussiektes; Orgaan- en Metaboliese Siektes; Voedselhigiëne; Interne en Eksterne Parasitologie; Toksikologie; Algemene Chirurgie en Regskennis. Benewens krediete verwerf deur hierdie basiese vakke te voltooi, moet die student 'n sekere hoeveelheid bykomstige krediete verwerf alvorens hy as veearts kan kwalifiseer, deur een of meer van die volgende rigtings oor 1 tot 1½ jaar te voltooi: Spesiale Chirurgie, Kleindierkunde, Pluimveesiektes, Varksiektes, Perdekunde, Skaapkunde, Beeskunde.

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So 'n stelsel sal die student toelaat om sy opleidingsprogram te verander om in te pas by sy talente, belangstelling en strewe vir sy toekomstige loopbaan. Nie alle studente stel bv. belang in hoenders en varke nie. Waarom moet ons hul primêre belangstelling verdun met verpligte studie van hoender- en varksiektes? Baie studente stel intens belang in kleindierpraktyk en het geen voorliefde vir werk met perde en beeste nie. Op die voorgestelde manier sal die student baie meer tyd beskikbaar hê om aan sy spesiale belangstelling te wy.

As die kern van basiese opleiding behou word met addisionele opleiding in keuserigtings, kan 'n veearts aan die einde van die kursus maklik na kwalifikasie die klem van sy opleiding verander deur net weer een van die keuserigtings te loop. Deur die keuserigtings aan die einde van die kursus aan te bied, laat mens die student kies op 'n stadium wanneer hy beter daartoe in staat is.

Sodoende sal ons nie algemene praktisyns kwalifiseer nie (soos wat beweer word dat ons huidig doen) maar veeartsenykundige wetenskaplikes met 'n basis van kliniese opleiding wat na kwalifikasie hulle in staat sal stel om in algemene praktyk of in enige van die vertakkings van nagraadse werk te spesialiseer.

Dit is verblydend om te sien dat voortgesette opleiding in die vorm van opknappingskursusse al posgevat het in ons professie. Met die eksponensiële toename in veeartsenykundige kennis in die besonder en in biologiese kennis in die algemeen sal hierdie praktyk nog 'n wyer inslag en meer georganiseerde vorm moet aanneem. As ons veeartse nie aan voortgesette opleiding deelneem nie, sal hul kennis baie gou verouder: hulle sal nie meer bekwaam wees om hul professie volgens die nuutste metodes te beoefen nie en die agting van die lede van ander beroepe verloor. Die opknapping van wetenskaplike kennis is 'n lewenslange verpligting van 'n professionele mens en dit is die enigste manier waarop die veranderende behoeftes van die boeregemeenskap en kleindiereienaars bevredig kan word.

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Ons professie erken huidig veeartsenykundige spesialiste nog nie formeel nie en die praktisyns onder ons wat hulle by sekere aspekte van die werk bepaal, het hulle tot dusver self gevorm en ontwikkel. Maar die vermeerdering in kennis en hoër eise wat

aan die veearts gestel word, sal ons dwing om te spesialiseer en om gevolglik spesialiste te erken en te registreer. Wanneer 'n veearts homself in sy praktyk beperk tot een diersoort, kan dit egter nog nie aanleiding gee tot sy erkenning as 'n spesialis nie. Alleen wanneer ons die eise aan opleiding, kennis, ervaring en bekwaamheid veel hoër stel, kan ons praat van spesialisasie. Om as spesialis erken te kan word, sal 'n persoon formele nagraadse opleiding moet ondergaan, en om op 'n spesialiste-register te bly sal hy met tussenpose opknappingskursusse moet bywoon of bewys lewer van voortdurende opleiding.

As ons as veeartse in die toekoms op 'n hoër wetenskaplike vlak, wat meer aangepas is by die werklike behoeftes van die veebedryf van die land, wil optree, sal ons noodwendig baie van die roetine-take moet oordra aan opgeleide hulppersoneel of sgn. paraveterinêre personeel. As 'n veearts homself moet besighou met gevorderde werk, konsultasie en beplanning, is dit moeilik om in te sien hoe sy tyd nog in beslag geneem kan word met herhalende roetine-prosedures, soos bv. bloei van beeste vir brucellose-toetse en behandeling van uiers met mastitis. In werklikheid is dit 'n geval van hoe hoër die hulppersoneel opgelei is, hoe meer kan die veearts vrygestel word vir werk waarvoor hy werklik opgelei is. Het ons veeartse nie tot dusver hierdie roetine-take nog te veel gebruik as 'n manier van geld verdien nie? Ons Veeartswet maak alreeds voorsiening vir die registrasie van hulppersoneel onder voorwaardes wat sal verseker dat behoorlike beheer oor hulle kan uitgeoefen word. Ek meen dat dit nou tyd geword het dat ons professie sy sake in hierdie verband in orde bring.

Die ontwikkeling op die gebied van terapeutiese middels oor die afgelope paar jaar is eenvoudig fenomenaal. Baie van die middels is hoogs spesifiek en moet met die grootste sorg en omsigtigheid toegepas word. Indien dit nie die geval is nie, kan daar aanleiding wees tot skadelike gevolge. Enkele voorbeelde kan genoem word om hierdie punt te illustreer. Die antibiotika is magtige middels vir die behandeling van bakteriese siektes van diere, maar as hulle onoordeelkundig toegepas word, kan dit aanleiding gee tot die ontwikkeling van weerstand, en veral oordraagbare weerstand, by bakterieë. Oordraagbare weerstand by organismes van diere stel mense, wat met hulle in aanraking kom, in groot gevaar. Talle middels wat op diere gebruik word, is gewoontevormend by mense. Ons as veeartse is volgens wet gemagtig om hierdie middels in die beoefening van ons professie te gebruik, maar dit plaas 'n swaar verantwoordelikheid op ons skouers. Hierdie verantwoordelikheid sal gestadig groter word. Laat ons die reg om die middels versigtig te gebruik met waardigheid toepas, sodat daar geen bedenkings teen ons betroubaarheid geopper kan word nie.

In die verlede het veeartse sonder verdere opleiding hulle in die navorsing begewe en met groot welslae opgetree. Maar in die toekoms sal veeartsenykundige navorsing, soos die geval is met alle biologiese navorsing, al hoe meer op die interdissiplinêre vlak beweeg en van spanwerk afhanklik wees. Spanne bestaande uit wetenskaplikes met verskillende agtergronde is nodig om dieper in die lewensprosesse van diere en organismes te dring en sodoende 'n beter begrip te kry van die wesenlike veranderings gedurende siektetoestande. Die veearts in navorsing sal dus sy agtergrond vir navorsing moet verbreed deur dieper kennis op te doen van biochemie, biofisika, mikrobiologie en bioingenieurswese. Ons navorsingsorganisasies sal ook moet sorg dat hulle hul regmatige deel trek van die begaafde jongmense wat kwalifiseer.

Ten slotte meen ek dat die tyd aangebreek het dat ons professie, en veral die SAVV, wat die sentrale organisasie van ons professie is, die sake wat hierbo aangehaal is vir homself duidelik moet uitsorteer. Dan sal ons ons toekoms met die nodige strategie in die regte rigting kan stuur en vir die jong mense, wat tot ons beroep toetree, die regte leiding kan gee.

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REVIEW OORSIG

VITAMIN D AND ITS RELATION TO CALCIUM-PHOSPHORUS METABOLISM IN RUMINANTS

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INTRODUCTION

The literature on vitamin D is voluminous and no attempt will be made to summarize it. Only some basic points will be discussed here, in particular the rôle of vitamin D in rickets and osteomalacia caused by phosphorus deficiency and the vitamin D requirements of ruminants with access to sunlight.

RICKETS AND OSTEOMALACIA

There are two important components in bone: the matrix, which is rich in proteins, and the mineral or inorganic component. Ossification involves the precipitation of bone salts in the matrix by means of a physicochemical equilibrium involving Ca^{++}, $HPO_4^{=}$ and $PO_4^{\equiv}$. Inorganic phosphate, liberated by alkaline phosphatase in the osteoblasts of growing bone from organic phosphate esters, reacts with calcium to form insoluble calcium phosphate. Deposition of bone salts in the presence of concentrations of inorganic P and Ca similar to those of normal plasma, however, cannot be explained as simply being due to physiochemical processes: it may also require the expenditure of energy. *In vitro* calcification of cartilage can be blocked by substances which are known to inhibit various enzymes involved in glycolysis, e.g. cyanide or fluoride. Furthermore, deposition of bone salts is preceded by deposition of glycogen in the cartilage cells. These glycogen stores disappear prior to or simultaneously with the appearance of bone salts in the matrix, which suggests that the breakdown of glycogen seems to be necessary for the calcification of cartilage [25].

Like all tissues of the body, the constituents of bone are constantly in exchange with those of the plasma. Insufficient mineralization (rickets) or demineralization (osteomalacia) occurs when intake or utilization of minerals necessary for bone formation is inadequate owing to an insufficient supply or inadequate ratio in the diet, or when their loss is excessive.

Rickets is a disease which particularly affects growing animals. Its main feature is a failure of Ca and P salts to be deposited promptly in the newly formed bone matrix, leading to a defective endochondral mineralization, predominantly in the long bones [34, 47].

In the adult the counterpart of rickets is osteomalacia. Since growth of the bones has terminated, the typical lesions of rickets —defective endochondral mineralization— cannot occur. The disturbance is manifested by a resorption of bone already laid down. Most acute cases occur during pregnancy and lactation, when excessive demands are made upon bones already depleted [47].

The cause of rickets/osteomalacia may be an inadequate supply of calcium, phosphorus, magnesium (accentuating Ca/P imbalances) or of vitamin D, particularly when it occurs with an unphysiological Ca-P-Mg ratio.

Although the pathology of rickets/osteomalacia is similar in all domestic animals, its aetiology varies according to the different types of diet used for the different species of animals. Thus in the bovine and ovine animal it is generally due to an inadequate supply of phosphorus, in pigs of calcium, in horses it is due to inadequate calcium in relation to the phosphorus intake (hyperphosphorosis) and in dogs it is due to avitaminosis (Table 1).

VITAMIN D AND Ca-P HOMEOSTASIS

An understanding of the mechanism of rickets/osteomalacia prevention involves an understanding of the mechanism of Ca and inorganic P homeostasis, since prevention of rickets/osteomalacia depends upon the maintenance of a normal concentration of Ca and

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Table 1: THE EFFECTS OF AN UNBALANCED CALCIUM, PHOSPHORUS SUPPLY [62]

An excess of:	Combined with a low intake of:	Has the following effect:
Calcium	phosphorus (relative hypophosphorosis)	reduced feed utilization, disorders of mineral metabolism (rickets, osteomalacia, hypophosphataemia)
Calcium	magnesium	hypomagnesaemia (tetany), tissue calcification
Phosphorus	calcium (relative hypocalcicosis)	rickets
Phosphorus	magnesium	hypomagnesaemia (tetany)
Calcium and phosphorus		formation of urinary calculi, reduced feed utilization

inorganic P in the plasma. In this connection vitamin D plays an important part: it influences the Ca-P-homeostasis in at least three ways [11, 30, 38, 40, 52].

—By increasing Ca-P-absorption from the gastrointestinal tract;
—by calcification of the bone (antirachitic effect) and
—by regulating renal loss of Ca and P either directly or through its influence on the parathyroid gland.

Transport of Ca and P across the Intestinal Wall

In the absence of vitamin D, less than 20% of the ingested calcium is absorbed from the gastrointestinal tract, whereas in the presence of an adequate vitamin D intake, 50 to 80% may be absorbed [34, 38]. On the one hand, vitamin D seems to increase permeability of all membranes to Ca; on the other hand, Ca absorption must depend on an active energy requiring process, proceeding against an electrical gradient.

A breakthrough in understanding the mechanism of action of vitamin D on Ca absorption was provided by the demonstration that the vitamin D-induced Ca transport is blocked by actinomycin D, which inhibits protein synthesis, more particularly, RNA synthesis [46, 63]. From this it was concluded that the action of vitamin D with regard to Ca absorption is dependent on the presence of functional units of protein nature, i.e. a vitamin D-induced Ca-binding protein [15, 46]. This is supported by the fact that there is always a lag of 10—12 hours in the time between the administration of vitamin D and the response in Ca transport. This time-lag is only 2—3 hours when a metabolite of vitamin D, 25-hydroxycholecalciferol, is administered [29, 40]. In fact, this Ca-binding protein has been isolated from the intestine of chicks and rats [13]. Its time of appearance, however, does not correspond to the stimulation of Ca transport by vitamin D; it lags behind the transport phenomenon [24]. Consequently other model systems must be introduced: one may postulate that vitamin D may increase membrane permeability to calcium, since transfer of Ca across the intestinal wall by a diffusion process is increased markedly by vitamin D [38]. Another vitamin D-stimulated process is the uptake of Ca by the mitochondria [12].

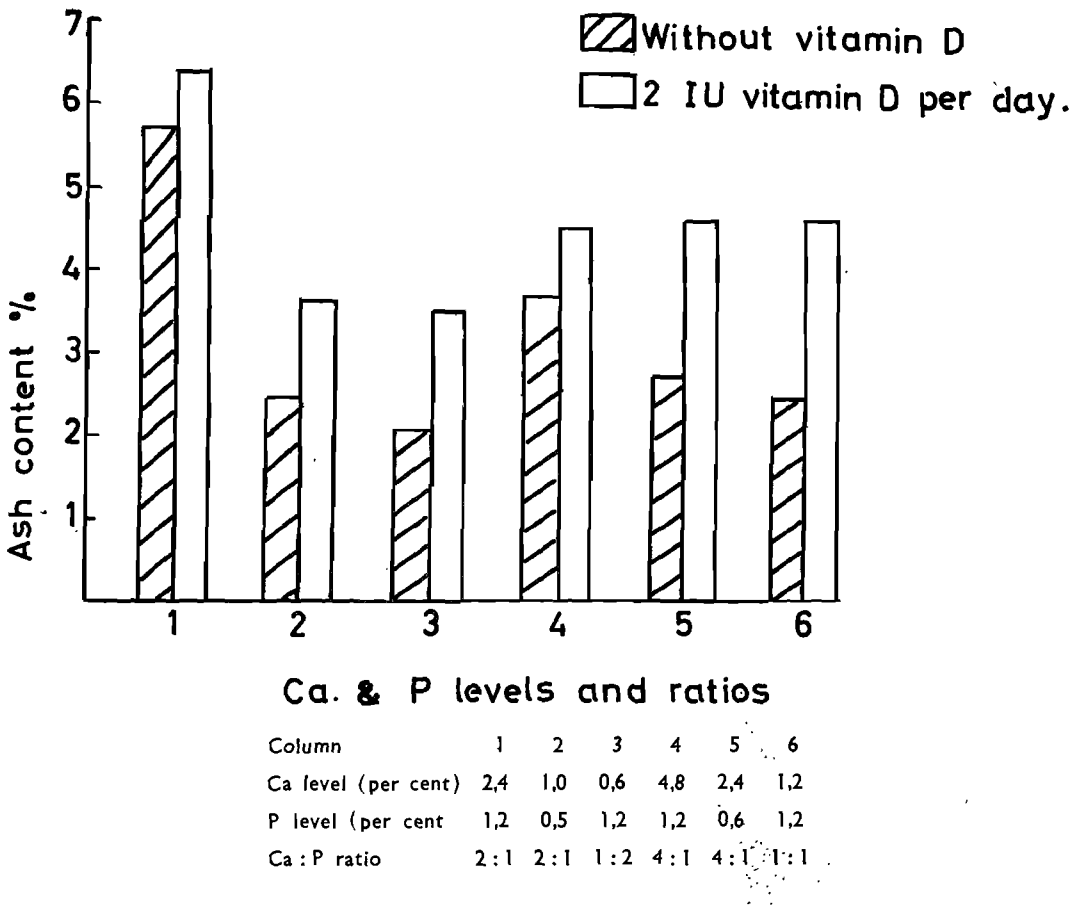
Actinomycin D blocks all the physiological responses to vitamin D, but fails to affect the physiological responses to certain vitamin D metabolites; neither does it inhibit the enhanced intestinal permeability to Ca, nor does it affect the mitochondrial uptake of Ca. These observations lead to the suggestion that the first event in vitamin D action may be an increase in nuclear membrane permeability to Ca. Ca may then induce synthesis (RNA) of a calcium transport component [12].

In the case of *phosphate* the situation is rather more complicated. P absorption is positively influenced by vitamin D [6, 34, 38]. The efficiency of absorption, however, is secondary to the Ca absorption, which means improvement of P absorption by feeding vitamin D must be interpreted as a consequence of the improvement of Ca absorption [38]. By lowering P excretion via the faeces, vitamin D furthermore balances the P metabolism [20]. Table 2 and figure 1 indicates the positive influence of vitamin D on Ca-P retention.

In general it can be said that utilization of Ca and P deteriorates as the animal's age increases. This tendency is more marked in the case of Ca than in that of P [34, 47].

Table 2: INFLUENCE OF VITAMIN D ON Ca AND P RETENTION IN PIGLETS (Ca CONTENT IN THE FEED 0,8%, P CONTENT 0,6%; Ca-P RATIO 1,3 : 1) [34]

Vitamin D2 content in Feed IU/kg	0	100	500	1.000
Feed intake in g/day	383	468	514	456
Ca balance/day				
Ca intake (g)	3,07	3,74	4,11	3,64
excretion in faeces (g)	1,48	0,87	1,05	0,80
excretion in urine (g)	0,01	0,03	0,05	0,05
Ca retention (g)	1,58	2,84	3,01	2,79
Ca retention (%)	52	76	74	76
P balance/day				
P intake (g)	2,30	2,81	3,09	2,74
excretion in faeces (g)	0,90	0,59	0,76	0,51
excretion in urine (g)	0,46	0,36	0,37	0,49
P retention (g)	0,94	1,86	1,96	1,74
P retention (%)	41	66	64	64



Column	1	2	3	4	5	6
Ca level (per cent)	2,4	1,0	0,6	4,8	2,4	1,2
P level (per cent	1,2	0,5	1,2	1,2	0,6	1,2
Ca : P ratio	2 : 1	2 : 1	1 : 2	4 : 1	4 : 1	1 : 1

Fig. 1: Effect of vitamin D, of different Ca and P levels and Ca:P ratios in the feed on the ash content of tibia, femur and patella of the 28 day-old chicken [62].

In practical nutrition the positive effect of vitamin D on P absorption is particularly pronounced when P is adequate in supply and the Ca-P ratio is within the physiological limits, i.e. 1,8 : 1 to 2,5 : 1 [44]. In connection with P utilization the Ca-P ratio in the feed is of importance. By a wide Ca-P ratio 4 : 1 [49] owing to an excess of Ca, the P availability is not only markedly reduced as result of Ca forming insoluble calcium phosphate (Ca_3 $(PO_4)_2$) with P but losses of endogenous P (Ca-phosphate) via the faeces are also increased [4, 14, 31].

Unfortunately feeds for ruminants under range conditions are high in Ca and low in P, which leads to the well-known wide Ca-P ratio (Table 3) with its detrimental consequences (Table 1). In table 3 some typical feedstuffs are classified according to their Ca-P ratios.

—It mobilizes Ca and P from the bone thus increasing the Ca-P level in the blood.

—It increases the Ca turnover (about 30%) in the bone.

—The preferred site of action of vitamin D is in the long bones, e.g. femur, tibia.

Per balance, the vitamin D-induced Ca-P retention over-compensates for the vitamin D-induced mobilization, thus favouring ossification of the bone [20]. As far as Ca-P retention is concerned, vitamin D acts as a synergist to thyrocalcitonin, a hormone from the thyroid gland that blocks release of bone calcium. As far as mobilization of Ca/P from the bone is concerned, vitamin D acts as a synergist to the parathyroid hormone, which increases Ca mobilization from the bone.

Table 3: CALCIUM AND PHOSPHORUS CONTENT OF SOME IMPORTANT FEEDSTUFFS [49]

	Rich in calcium	Poor in calcium
Rich in phosphorus	Ca: P = 1—7,5 : 1	Ca: P = 0,03—0,4 : 1
	Grass of good quality, clover, lucerne, serradella or hay from these plants, maize, milk, colostrum, bone, meat, fish meal	Cereals, middlings, bran, oilcakes, malt culms, peas, vetches, beans, soyabeans
Poor in phosphorus	Ca: P = 4—15 : 1	Ca: P = 0,3—2,0 : 1
	dried sugar beet pulp, beet leaves (incl. silage), molasses, good quality straw, poorer quality grass	turnips, distiller's wash, brewer's grains, chaff, poorer quality hay, straw, whey

BONE METABOLISM

Bone acts as a reservoir for blood Ca and P. It is stated that there is a completely calcified diffusion-locked bone, from which Ca and P are not readily available, and an exchangeable bone with integrated apatite crystals that has Ca and P ions available for rapid exchange [38]. In a three year-old cow, 17—20% of the skeletal Ca and P are exchangeable, which corresponds to an available depot of 1 800 g Ca and 1 000 g P [14, 34]. With increasing age, the capacity of the available bone depot decreases to 2—5% at the age of 13 [4].

The effect of vitamin D on bone metabolism can be characterized as follows [14, 20, 21, 52].

—It increases the Ca and P retention in the bone (up to 30% with Ca and up to 20% with P); this is known as its antirachitic effect.

In the same way as vitamin D, but to a minor extent, the parathyroid increases Ca-absorption from the intestine. It is interesting that, like the Ca transport system across the intestinal wall, the action of vitamin D on bone mobilization can be blocked by the same protein-synthesis-inhibiting substance (inhibition of RNA by actonomycin D) as in the intestine. Presumably the mechanisms are similar, if not identical.

EFFECT OF VITAMIN D ON RENAL *FUNCTION*

Vitamin D influences the handling of P by the kidney. In animals deficient in vitamin D, phosphate excretion is increased owing to decreased tubular reabsorption [39]. The positive effect of vitamin D on tubular reabsorption is presumably a secondary one [40] and may at least be explained partly by the influence of vitamin D on the activity of the parathyroid gland [6, 39]. Vitamin D decreases

urinary P excretion in animals with intact parathyroid glands, but increases clearance of phosphate and promotes lowering of serum phosphate concentration in parathyroidectomized animals [25, 38]. This phenomenon is not fully understood but it proves the close relationship of vitamin D and the parathyroid gland.

The parathyroids must play an important part in the process of rickets, since in experimental rickets these glands are found to be enlarged [19]. Excessive parathyroid activity has a twofold effect: it maintains a normal Ca level by marked mobilization of Ca from the bone, and promotes excessive clearance of inorganic P by the kidneys with resulting hypophosphataemia. So the normal plasma Ca level and the hypophosphataemia in most cases of rickets/osteomalacia can be explained [38], and it can be said that the parathyroid hormone tends to produce rickets rather than prevent it [20].

It is assumed that under physiological conditions, however, the parathyroid hormone requires vitamin D to bring about its effect on the bone, since in the case of a Ca/P-deficiency, Ca/P from the bone can only be mobilized with the aid of vitamin D [21, 40].

It is known that an increasing Ca level in the serum depresses activity of the parathyroid gland, so possibly an adequate intake of vitamin D controls, if not depresses, parathyroid activity [26, 48] by its influence on Ca homeostasis [6, 38]. The positive effect of vitamin D on P reabsorption in the kidney may also be interpreted as an indirect one, i.e. by controlling or depressing activity of the parathyroid gland via its effect on Ca metabolism.

The fact must be stressed that vitamin D promotes P reabsorption only when given in fairly large therapeutic doses. It should also be borne in mind that the ruminant only has a limited ability to compensate for a P deficiency by decreasing P clearance, since it excretes less than 10% (average 0.5—2%) of endogenous P via the kidneys (alkaline urine) [52], in contrast to the pig, which can excrete up to 60% (in the case of P oversupply) of endogenous P in the urine (acid

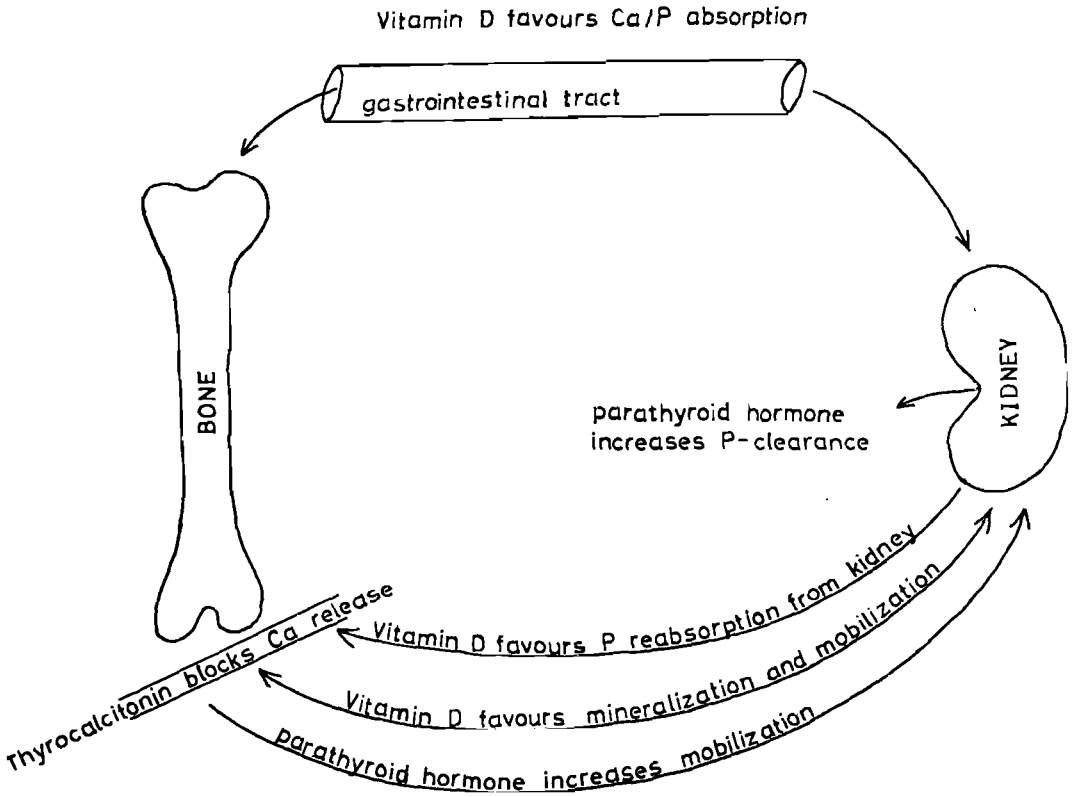


Fig. 2: Schematic representation of the effect of vitamin D, parathyroid hormone and thyrocalcitonin on the movement of Ca and P. Vitamin D and parathyroid hormone act partly as synergists and partly as antagonists[34]. Parathyroid hormone favours Ca/P absorption (of minor importance).

urine). This way of balancing P metabolism is therefore of greater importance for the pig than for the ruminant [4, 14].

VITAMIN D AND ALKALINE PHOSPHATASE

Phosphatases are enzymes capable of hydrolysing organic phosphates (e.g. hexosephosphate, glycerophosphate) with the liberation of inorganic phosphate [25]. Alkaline phosphatases are found in practically all tissues. Apparently the alkaline phosphatase of the osteoblasts has its site of function outside the cells, therefore some of the osteoblastic phosphatase continuously reaches the plasma and circulates in the blood stream. Concentration of serum alkaline phosphatase tends to remain constant. In rickets/osteomalacia, however, its activity increases markedly, a fact which is virtually diagnostic of the disease [29, 30, 31], and can possibly be interpreted as an effort of the organism to supply more phosphate [25]. Treatment of rickets with vitamin D is accompanied by a reduction of phosphatase activity.

VITAMIN D SUPPLY

Many factors influence the requirements for vitamin D, so it is difficult to express quantitatively the needs of animals. Important factors influencing requirements are:

—the amount of sunlight the animal receives;
—amount and ratio of Ca, Mg and P in the diet, as discussed previously;
—availability of Ca and P in the diet, and in connection with this, acidity of the diet.

It is assumed that the average animal synthesizes sufficient vitamin D when exposed continuously to bright sunlight. Whether this is justified or not will be discussed later. The level of Ca and P, the Ca-P ratio, and the acidity of the diet basically belong to the complex question of availability of Ca and P [21, 30, 31, 47], a subject with many questions still to be answered, and one which has been discussed extensively in the literature. It can be stated, however, that with a sufficient supply of P and vitamin D the ruminant tolerates a moderate imbalance of Ca:P (Ca:P ratio=3 : 1) well [28].

The vitamin D active compounds known to date and their relative activities for test animals are given in table 4 [17].

Formation of Vitamin D in the Skin

It has been established that vitamin D_3 (cholecalciferol) can be formed in the skin from sterols. While insects and other organisms, such as crayfish species, require sterols as vitamin D precursor in their diet, fungi, higher plants, birds and mammals are able to synthesize sterols. Ergosterol is the predominant provitamin D in plants. The sterol with provitamin D properties found in the dermis, epidermis and surface lipids of skin in vertebrates is 7-dehydrocholesterol [11, 12]; however there is the possibility that some other precursors of vitamin D exist.

Table 4: COMPOUNDS WITH VITAMIN D ACTIVITY

Compound	Antirachitic activity IU per mg	
	Rat	Chick
Cholecalciferol (D_3)*	40 000	40 000
Ergocalciferol (D_2)*	40 000	4 000
25 - Hydroxycholecalciferol (25-HCC)	60 000	60 000
25 - Hydroxyergocalciferol (25 HEC)	60 000	Low
22, 23 - dihydroxyergocaliciferol (D_4)	30 000	4 000 to 8 000
Dihydrotachysterol$_3$ (DHT_3)*	90 to 180	40 000
Dihydrotachysterol$_2$ (DHT_2)*	90 to 180	40 000
1,25 - Dihydroxycholecalciferol	Very high antirachitic activity	?

*Compounds with primarily mineral-mobilizing action.

It seems that evolution has limited the amount of those sterols that could give rise to vitamin D, since sterols exist in a considerable multiplicity of chemical forms in plants and even more so in the case of invertebrates, while only a small number of sterols exist in higher forms of flora and fauna; in mammals the types are reduced to a few, cholesterol being the most prevalent [45]. The sterol 7-dehydrocholesterol, transformed from lanosterol, a sterol present in wool fat, is an intermediate in cholesterol biosynthesis. This means conversion of lanosterol to cholesterol involves the formation of 7-dehydrocholesterol in the penultimate step [11, 12]. Its site of greatest concentration is the skin [45]. It is also found in the gut and liver of animals (rat, ox, guinea-pig) [3, 39]. It seems clear that the primary or most active site of provitamin D_3 biosynthesis is the epidermis, although the major site of cholesterolgenesis seems to be the gastrointestinal tract and the liver [32]. Provitamin D_3, which has been formed in the small intestine, may be stored in the liver or transported to the skin for transformation to vitamin D_3 [20].

The enzymatic conversion of lanosterol to 7-dehydrocholesterol involves the loss of three methyl groups, isomerisation, reduction of double bonds and dehydrogenation to a double bond [11, 12]. The mechanism of this dehydrogenation is not known in detail, but this process seems to have a key function in as much as it controls the synthesis of provitamin D. Regulation of vitamin D synthesis seems necessary, otherwise bright sunlight could, theoretically, lead to an overproduction of vitamin D with possible detrimental consequences. The main factors involved in this control mechanism seem to be:

—the concentration of the immediate precursor of provitamin D, lanosterol,

—the activity of the dehydrogenase system acting on lanosterol.

Most of the lanosterol in skin tissue appears to be in an esterified form. Esterified lanosterol, however, is presumably not directly accessible to the dehydrogenase system which is involved in producing provitamin D_3. This esterified storage form, however, will be in equilibrium via esterase with the smaller amount of free alcohol form, which can be released and transformed to provitamin D_3. It is thought that this buffering system maintains an adequate but not overabundant supply of the provitamin despite ample sunlight [44].

It is agreed that approximately 30% of ultraviolet light with the decisive wavelength (290—300 nm) [60] penetrates through the epidermis to the dermis [11, 12]. This, of course, must vary with skin pigmentation and other factors. Consequently, it has been suggested that, besides the conversion of lanosterol to provitamin D, the conversion of provitamin D to vitamin D is regulated by the process of pigmentation and keratinization of the overlying stratum corneum and by the haircoat, which only allows regulated amounts of solar ultraviolet radiation to penetrate the outer layer of skin [31]. The different types of skin in man are interpreted as adaptations to maintain the synthesis of vitamin D within physiological limits regardless of the geographical latitude [42].

Also in animals the extent of vitamin synthesis apparently varies with certain characteristics of the skin. It is impaired by thick and dense coats (wool, hair) and by pigmented skin. Some observations from the field of practical animal production prove that vitamin D synthesis may be controlled and direct sunshine is not always of such benefit as is commonly assumed.

Sheep whose fleece is extremely dense are of particular interest. Assays were made to provide information on the vitamin D content in the blood of sheep with different amounts of fleece. The results showed that shearing has a great effect on the blood level of vitamin D. The concentration in shorn sheep was two or three times that in unshorn animals. With the growing of the new fleece the vitamin D level in the blood decreased continuously to the preshearing value [48]. This demonstrates the influence of the coat on vitamin D_3 synthesis quite clearly.

In other experiments dairy cows, previously deprived of vitamin D, showed some improvement when exposed to sunlight, but even this exposure to sunlight failed to normalize the vitamin metabolism in the organism during the summer months. The blood plasma level of vitamin D scarcely rose above levels found in animals with critical deficiencies [61]. This could easily be due to the fact that skin pigmentation screens out ultraviolet light. The thicker the pigmented layer is, the less ultraviolet light passes through it. It follows that excessive pigmentation reduces the amount of vitamin D available from the skin [53].

Exhaustive studies revealed that most of the dairy cows in the northern hemisphere (40° latitude) receive vitamin D via sunshine, equivalent to 4 500 (3 000—6 500) IU daily during the summer months [1]. On the other hand, the daily vitamin D requirements of cows (average bodyweight 500 kg) can be covered by 5 000 IU (10 IU per kg bodyweight) provided that the ration contains sufficient P and the Ca : P ratio does not exceed 2 : 1.

The extent to which vitamin D is synthesized in the animal's skin under subtropical conditions has never been investigated.

VITAMIN D ANTAGONIST IN THE FEED

In the absence of sufficient vitamin D from the skin the animal becomes dependent on dietary sources. On the other hand some substances have been shown to possess antivitamin activity when present in the diet. In New Zealand rickets/osteomalacia-like conditions with a marked hypophosphataemia in sheep on green oats pasture have been described, in spite of adequate Ca and P in-

take, which could not be corrected by supplementation with bone meal [16], whereas vitamin D effectively prevented this disturbance. This problem has been associated with the anti-vitamin D effect of high carotene levels in green oats. The effect of magnesium levels could also be of significance in Ca/P balance. It is also well known that vitamin A, when given in excessive doses over a long period, can also trigger a rickets-like condition, as heavy doses of vitamin A were found to induce rickets in rats, provided the ration is not supplemented with riboflavin, niacin, tryptophan and pantothenic acid. Other anti-vitamins have been detected, though beta-carotene seems the only one of practical importance, but only in those cases where the animal receives marginal vitamin D supply and where the supply of carotene is in excess [18].

VITAMIN D SUPPLEMENTATION

Though it is generally accepted that the vitamin synthesis in the skin is sufficient to meet the requirements of animals, particularly under tropical and subtropical climates, signs of rickets/osteomalacia in sheep and cattle in these regions are not uncommon. A low intake of P possibly complicated by a marginal vitamin D availability during the period of rapid body growth and high milk yield might be responsible for the observed bone lesions. It should be borne in mind that the animal has only a very moderate capacity for storing vitamin D. The calf is born with a small reserve of vitamin D in the liver which seems to be independent of the supply the mother receives. The content in the liver does gradually rise as its age increases: after puberty, female animals are able to accumulate considerably larger reserves than males. For this reason, growing animals, and young bulls in particular, are probably more susceptible to rickets than adult animals and heifers [62].

Extensive P-deficient areas occur throughout the world and there is no doubt that P deficiency is the most widespread and economically important of all the mineral disabilities affecting grazing ruminants [57]. In particular, the low availability of P in tropical and subtropical soils leads to low P contents in the plant [50]. Moreover, P concentration falls markedly with advancing maturity of the plant. This situation is further aggravated by periods of drought. When, initially, the plants are already low in P because of the nature of the soil, and when they remain mature and dry for long periods, low herbage P levels must be taken into account.

In South Africa, where the classical studies on P deficiency in ruminants have been carried out by Theiler [55, 56], P levels of plants [57] fall typically from 0,13—0,18% in a wet summer to 0,05—0,07% in a dry winter. This situation can be complicated by an excess of Ca or paucity of magnesium, hence an extremely unfavourable Ca : P ratio results.

A P deficiency in winter also is associated with a carotene (vitamin A) deficiency. This in turn has a detrimental effect on the morphological structure of the endocrine glands, i.e. the parathyroids [35], which in turn decreases the ability of the organism to adapt its metabolism to this unbalanced nutritional situation. This P deficiency disease, causing considerable economical losses, has been observed in Russia, Australia, New Zealand, South Africa and in North and South America. Synonyms are:

—bog-leg, bog lame, bog crook, crippen, cruban,
—creeps, stiffs,
—styfsiekte, osteophagie, hypophosphorose, aphosphorose,
—peg-leg.

The disease is characterized by a marked depression of blood inorganic phosphate, bone of extremely poor quality, and severe signs of rickets/osteomalacia with loss of body weight, decreased production, sudden onset of lameness, stiffness in gait, swollen and stiff joints, and bent fore and hind legs [30, 31].

This situation can be rectified by supplying P and high doses of vitamin D [7, 10, 13, 28, 41, 49, 51, 55, 56]. Cattle do not regulate P intake according to their needs, and the mineral intake of animals seems to be related to taste rather than need. Furthermore, great individual variations occur among members of a group of cattle consuming a free choice of mineral supplement [9]. Therefore additional vitamin D could be helpful, if not necessary, in balancing mineral metabolism of the phosphate-deficient animal. This is pointed out in table 5 and figure 3.

The increased absorption of P from the digestive tract during and after vitamin D feeding is apparently the main factor in the increased P retention. Undoubtedly vitamin D synthesis in the skin is not sufficient, even with exposure to sunlight, to trigger such a pronounced P retention [43].

Table 5: SOME EFFECTS OF FEEDING 20 000 000 IU VITAMIN D PER DAY ON PHOSPHORUS UTILIZATION BY MATURE STEERS[8]

	Before Vitamin D feeding	During Vitamin D feeding	After Vitamin D feeding
Phosphorus intake (g/day)	30,3	27,9	26,0
Phosphorus retained (g/day)	0,3	3,5	6,5
Percent of intake absorbed from the digestive tract	47,6	54,5	83,5
Phosphorus excretion from the body into the digestive tract (g/day)	13,5	9,4	10,4
Phosphorus excretion from the body into the urine (g/day)	1,2	3,7	4,7

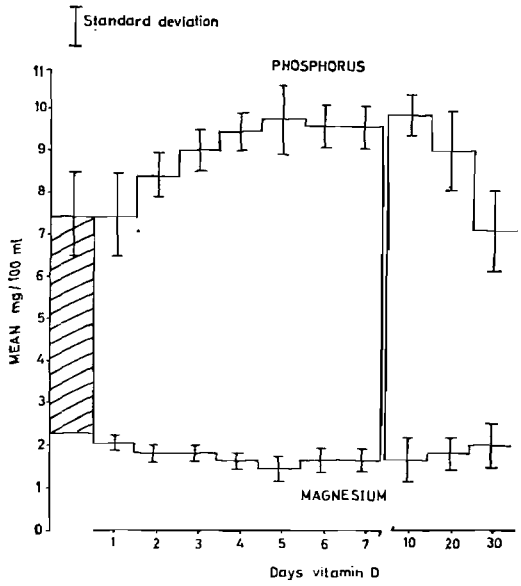


Fig. 3: Serum phosphorus and magnesium levels of cows fed 30×10^3 IU vitamin D for 30 days[6].

EFFECT OF VITAMIN D ON THE INCIDENCE OF MILK FEVER, DOWNER SYNDROME AND FERTILITY

The primary objective in procedures aimed at preventing parturient paresis is the maintenance of normal Ca and P levels in the blood during the parturient and post-parturient period, since a physiological hypocalcaemia and hypophosphataemia develops during this critical phase even in animals with an optimum supply of minerals[51].

The following facts concern the Ca metabolism in the adult cow:

—The ability of cattle to absorb and utilize Ca decreases markedly with age, e.g. calves up to 1 month of age utilize Ca to more than 90% (apparent digestibility), whereas older cows (12—16 years of age)[2] and in particular cows prone to milk fever, sometimes have difficulty in utilizing Ca for about two weeks before calving; this leads to a negative Ca balance and the subsequent development of milk fever.

—Some dairy cattle are particularly susceptible to the downer syndrome, which is characterized by a hypophosphataemia while Ca levels in the blood remain within the normal range[37].

—Massive doses of vitamin D ($10—30 \times 10^3$ IU per day) fed a few days before calving have been shown to improve Ca and P utilization when these minerals are fed at normal levels (Tables 5 and 6; Figure 3).

Table 6 shows the significant effect of vitamin D on Ca retention in lactating dairy cows.

It may be concluded that the feeding of $10—30 \times 10^3$ IU of vitamin D daily for at least 3 days and not more than 7 days prior to parturition offers a safe and effective method for preventing milk fever. Protection against milk fever reaches a peak after 3 days of vitamin D feeding, but this protective effect declines drastically if parturition occurs more than 1 day after vitamin D feeding has been terminated[26]. The prediction of the calving date within these narrow limits is the major problem in the application of this method of prevention.

In trials with lactating cows kept in ample sunlight, a vitamin D supplementation showed a marked effect on fertility: signs of oestrus became more accentuated and the period between birth and the next conception was shortened by about 27 days[2]. Whether this can be attributed directly to the oestrogenic action of vitamin D, or to the effect which the vitamin exerts on mineral metabolism, is unknown. It may be concluded, however, that the high-producing animal could experience a transient suboptimal vitamin D supply during the peak of lactation; this consequently must have an effect on the Ca and P metabolism and fertility.

VITAMIN D REQUIREMENTS OF RUMINANTS

Micro-organisms in the rumen do not appear to require vitamin D for growth, nor are they able to synthesize this vitamin as is the case with water soluble vitamins and vitamin K [7, 13]. The vitamin D requirements of ruminants vary considerably with the supply of P and Ca. In the case of an optimum Ca : P ratio, the minimum quantity of *10 IU per kg bodyweight* is sufficient [33]. In the unfavourable situation of P deficiency or Ca excess, high levels of vitamin D can balance the Ca-P metabolism.

For treatment of rickets in sheep and calves, injections of 50 000—250 000 IU vitamin D_3 are recommended [49]. For treatment of osteomalacia in adult ruminants, the recommendations are injection of 500 000—1×10^3 IU vitamin D [49].

For prophylactic purposes, the fortification of the mineral supplement or of the concentrate is suggested [49], but exact information on the amount of vitamin D necessary for prevention of rickets or osteomalacia is not available. As a guideline, 30 IU per kg body mass per day is suggested where the soil or grazing is known to be deficient in available P.

Morrison [44] recently stated that the NRC requirements of Ca and P for dairy cows are grossly inadequate, especially when no vitamin D is included in the ration. His recommendation for dairy cattle is a Ca : P ratio between 1,8 : 1 and 2,5 : 1 for routine feeding, coupled with vitamin D intake at daily levels between 40—70 000 IU per cow (depending upon levels of milk production). The Ca level should be approximately 2 to 2,5 times those advised by the NRC. Such rations have drastically lowered the incidence of milk fever; similarly, when coupled with a proper dry cow feeding program, the occurrence of ketosis and cases of non-infectious sterility have been reduced. Massive doses of vitamin D ($10—30 \times 10^3$ IU per oral dose) during 3 to 7 days prior to calving prevent milk fever quite effectively [5].

Tabue 6: SOME EFFECTS OF FEEDING 30 000 000 IU VITAMIN D PER DAY ON CALCIUM UTILIZATION BY LACTATING COWS [8]

	Before Vitamin D feeding	During Vitamin D feeding	After Vitamin D feeding
Calcium intake (g/day)	64,8	59,4	54,1
Calcium retained (g/day)	5,8	6,5	11,0
Percent of calcium intake absorbed from digestive tract	44,3	49,6	60,8
Calcium excretion from the body into the digestive tract (g/day)	9,8	8,8	9,3
Calcium excretion from the body into the urine (g/day)	0,2	0,6	0,3

CONCLUSION

In the Republic of South Africa phosphorus deficient pastures are encountered throughout the country. Apart from the phosphorus deficiency, areas of the North Western Cape, Western Transvaal and the northern part of South West Africa are rich in Ca [36, 58]. These parts of the Republic are known as extensive beef ranching areas, where the farmer has to rely on the natural pastures to a great extent. In these areas ruminants are subjected not only to a low phosphorus supply, but also to an extremely wide Ca : P : Mg ratio in their food.

Although it is already common practice to supply additional phosphorus to the animals, farmers still encounter certain skeletal problems amongst their cattle [22, 58, 59]. This situation can at times be alleviated by providing the animals with additional D_3. Owing to extreme Ca : P ratios with low magnesium, the vitamin D requirements are accentuated. The situation is further aggravated when animals with a high growth rate or high milk yield are subjected to conditions which lead to an apparent vitamin D_3 inadequacy.

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PROGESTERONE TREATMENT OF MARES WITH ABNORMAL OESTROUS CYCLES EARLY IN THE BREEDING SEASON†

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SUMMARY

Thirteen mares in extended oestrum, and fourteen mares in anoestrum were treated with progesterone in oil. It was established that 100 mgm was an effective dosage to "break" the aberrant cycles. This dosage was injected daily for 7 days as the treatment regimen. Behavioural oestrum in mares showing extended oestrum was blocked within 2 days. These mares, as well as mares showing anoestrum with active non-cycling ovaries, exhibited post-treatment oestrum within three days of the last injection. The duration of oestrum was 7—8 days with ovulation occurring about 24—48 hours before the end of the oestrous period. A conception rate of 75—80% was obtained. Anoestrum mares showing slight ovarian activity responded to treatment, but came into oestrum 8 days after the last injection. The duration of oestrum was also sligthly longer, being 9 days, ovulation occurring at the anticipated time. A conception rate of 66% was obtained. Progesterone treatment had no effect on the small inactive ovaries of mares in deep anoestrum.

INTRODUCTION

Mares in extended oestrum with active non-cycling ovaries as well as mares in anoestrum with active non-cycling or inactive ovaries upset the breeding program of many studs early in the breeding season [4, 7, 15]. The veterinarian is faced with the problem of "breaking" these abnormal cycles as well as ensuring that ensuing periods of oestrum are normal and fertile.

The mechanism controlling regular cycling and ovulation basically revolves around an intricate interrelationship of, and a delicate balance between the pituitary gonadotrophins and the ovarian hormones [3]. Gonadotrophic hormones have been used to change these non-cycling ovaries without any real success [2, 7, 9]. Several workers have claimed that stilboestrol induced oestrus and ovulation in mares in anoestrum [9, 11, 18]. From the literature and our own experience we must conclude that, as far as the mare is concerned, oestrogens do not appear to offer any solution to the above problems [1, 7].

Progesterone in the negative feedback system has been found to block the release of follicle stimulating hormone (FSH) as well as luteinizing hormone (LH), resulting in the accumulation of FSH and LH in the anterior pituitary [3, 18, 12]. When the progesterone is withdrawn the release of the accumulated FSH results in high blood levels of FSH which stimulates follicular growth.

Work on the synchronization of the oestrous periods of ewes and cows by means of progesterone has demonstrated the importance of either a waning *corpus luteum* or progesterone withdrawal to produce maturing follicles and a normally ovulating oestrous period [5, 10]. In the non-cycling mare in extended oestrum as well as in anoestrum no *corpora lutea* or active luteal tissue could be traced *post mortem* [7, 17, 19]. Smith, Basset & Williams [13] found very low concentrations of progesterone in the peripheral blood of mares during prolonged oestrus. They also found that the mean plasma progesterone of cycling mares remained relatively high for a period of approximately seven days. Van Rensburg & Van Niekerk [19] reported that the progesterone concentration in the *corpora lutea* of cycling mares falls rapidly on day 14 after ovulation. With this background, trials with short-acting progesterone, injected over a period of six to eight days, were designed using mares showing irregular cycles early in the breeding season.

MATERIAL AND METHODS

The experiment was conducted in two stages during August and September of two different years. During Stage I the effective dose and regimen of progesterone treatment that would suppress the extended oestrum period and also "break" the long anoestrum

†The paper on the genital morphology of mares with aberrant cycles should have preceded this article. Owing to technical difficulties in editing the MS. it had to be postponed until the next issue.

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period was determined. In Stage II the effect of this regimen was studied on mares showing varying types of aberrant cycles.

During both stages of the experiment the mares were on veld-grazing which was supplemented with lucerne hay from the beginning of July till the end of each successive stage. All the mares were teased daily by an active stallion, starting at least one month before the experiment, and continuing for the duration of each stage.

Ovarian activity was controlled daily by rectal palpation, the estimated size of the follicles and the day of ovulation being recorded. Where stated, the mares were served by a fertile stallion during the post-treatment oestrous period. A diagnosis of pregnancy as described by Van Niekerk [14] was made on Day 20 and again on Day 40 after ovulation.

Stage I

The thirteen mares used in this phase were divided into two groups. Group A consisted of 8 mares of the light farm type with active but non-cycling ovaries that had shown extended oestrum for at least 21 days prior to the first day of treatment. Group B consisted of 5 mares of the light farm type with active non-cycling ovaries that had been in anoestrum for at least 21 days prior to the onset of treatment. Each mare received intramuscular injections of progesterone in oil (20 mg/ml) according to the regimen set out in table 1.

Stage II

Fourteen mares were used in this phase, three being Percherons, and eleven of the light farm type. The five mares in group C had shown oestrum for at least 22 days prior to the commencement of treatment, and had active but non-cycling ovaries. Group D consisted of nine mares all of which had been in anoestrum for at least 30 days prior to the commencement of treatment. The ovarian status varied from inactive to active but non-cycling. The treatment regimen and breakdown of groups is set out in table 2.

Table 1: EXPERIMENTAL DESIGN TO DETERMINE EFFECTIVE DOSAGE LEVEL AND REGIMEN

Group	Subgroups	No. of Mares	Mare No.	Treatment
A Mares in extended oestrum	A_1	2	P_1 P_2	No treatment
	A_2	1	P_3	50 mg progesterone every alternate day — 5 injections
	A_3	2	P_4 P_5	75 mg progesterone every alternate day — 5 injections
	A_4	2	P_6 P_7	100 mg progesterone every alternate day — 5 injections
	A_5	1	P_8	100 mg progesterone every day — 7 injections
B Mares in Anoestrum	B_1	2	P_9 P_{10}	No treatment
	B_2	1	P_{11}	50 mg progesterone every alternate day — 5 injections
	B_3	1	P_{12}	75 mg progesterone every alternate day — 5 injections
	B_4	1	P_{13}	100 mg progesterone every alternate day — 5 injections

RESULTS: THE EFFECT OF PROGESTERONE TREATMENT ON FOLLICULAR SIZE, OESTRUM AND OVULATION

Stage I: Determination of Effective Dosage

Group A: Mares in Extended Oestrum

The ovarian changes brought about by the different dosage levels used in each subgroup, are shown graphically in figure 1.

At the start of treatment all mares had active ovaries with follicular size ranging from 2,25 to 2,75 cm in diameter. The mares in the control group A_1 maintained a more or less constant follicular size over the 20 day treatment period. Mares receiving 50 mg and

Table 2: EXPERIMENTAL DESIGN TO TEST THE EFFECT OF TREATMENT ON VARIOUS ABNORMAL OVARIAN STATES

Group	Subgroup	No. of mares	Mare no.	Treatment
C Mares in extended oestrum	C 1 Percherons	3	P 14 P 15 P 16	125 mg progesterone for 7 successive days
	C 2 Light farm type	2	P 17 P 18	100 mg progesterone for 7 successive days
D Mares in anoestrum	D 1 — Mares with active non-cycling ovaries with follicles from 1,5—2,5 cm in diameter	4	P 19 P 20 P 21 P 22	100 mg progesterone daily for 7 days
	D 2 — Mares in transitional stage from inactive to active ovaries. Several small follicles of 1 cm in diameter	3	P 23 P 24 P 25	100 mg progesterone daily for 7 days
	D 3 — Mares in deep anoestrum: ovaries very small, smooth with no palpable follicles	2	P 26 P 27	100 mg progesterone daily for 7 days

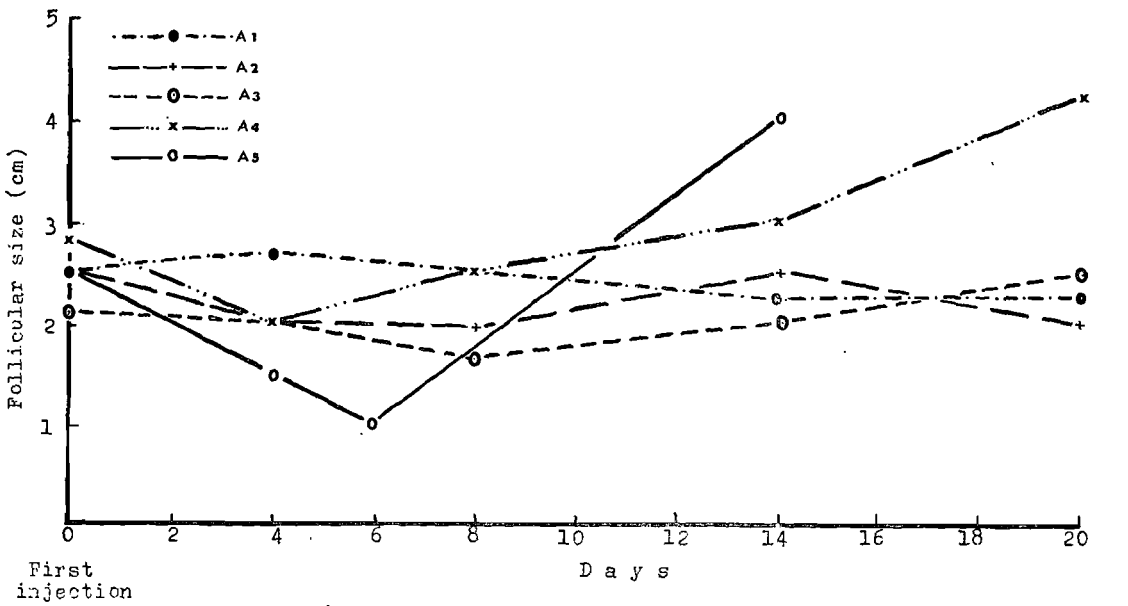

Fig. 1. The effect of progesterone at various dosage levels on the average size of the largest follicle of mares in extended oestrum. Experimental Group A.
A1 = Control.
A2 = 50 mg progesterone every alternate day, 5 ×.
A3 = 75 mg progesterone every alternate day, 5 ×.
A4 = 100 mg progesterone every alternate day, 5 ×.
A5 = 100 mg progesterone every day, 7 ×.

75 mg of progesterone respectively (Group A_2 and A_3), showed little change in follicular size over the same period. Mares on alternate day treatment with 100 mg progesterone (group A_4) showed a decrease in follicular size up to Day 4 after the initiation of treatment, followed by a slow increase in follicular size up to Day 14 and then a rapid increase to Day 20 to reach the size of 4,25 cm. Group A_5, receiving 100 mg progesterone daily for 7 days, showed a decrease in follicular size during the treatment phase. The size of the largest follicle increased rapidly during the post-treatment period to reach a size of 4,0 cm 8 days after the last injection.

The effect of treatment on ovulation and oestrum is set out in figure 2. Mares in the control group, and those receiving 50 mg progesterone (groups A_1 and A_2) remained on heat throughout the experimental period.

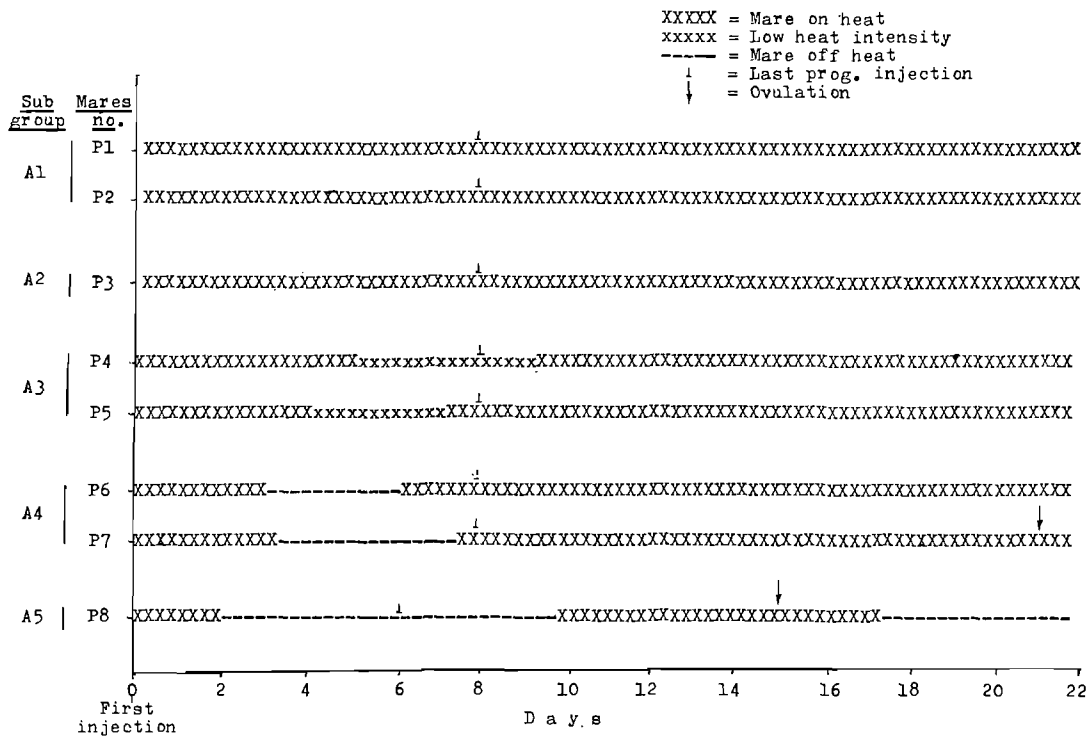

Fig. 2. The effect of three dose levels of progesterone on oestrus and ovulation in mares in extended oestrum. Group A.

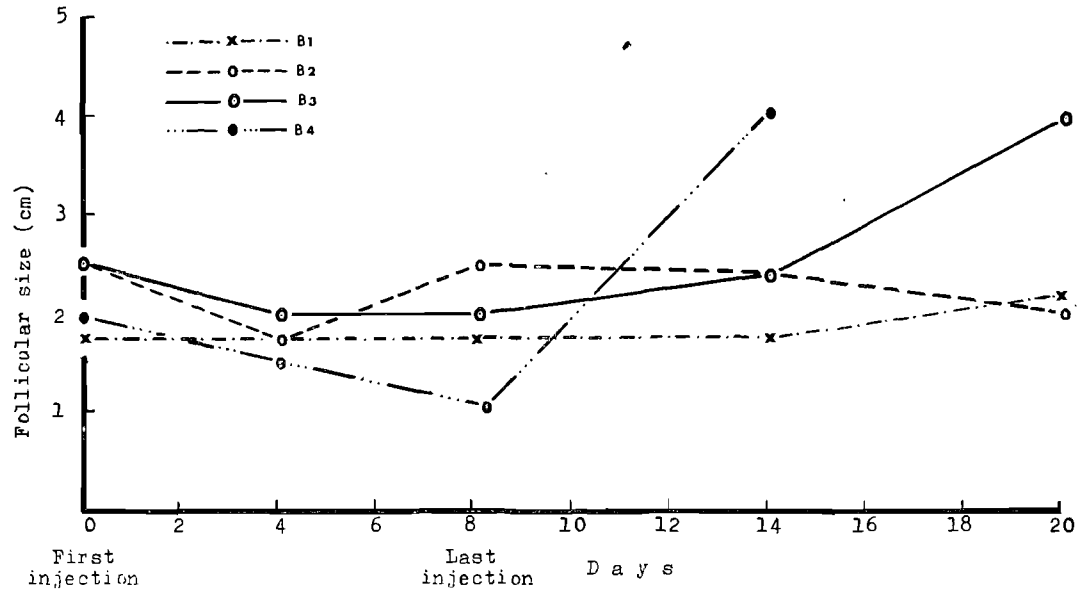

Fig. 3. The effect of progesterone at various dosage levels on the average size of the largest follicle of mares in anoestrum. Experimental Group B.
B1 = Control.
B2 = 50 mg progesterone every alternate day, 5×.
B3 = 75 mg progesterone every alternate day, 5×.
B4 = 100 mg progesterone every alternate day, 5×.

Mares receiving 75 mg progesterone (Group A_3) showed an ephemeral partial depression of heat intensity towards the end of treatment. Both mares on alternate day treatment of 100 mg progesterone showed complete oestrum suppression within 3 days of initiation of treatment, but both were back on heat again before the last injection. Only one

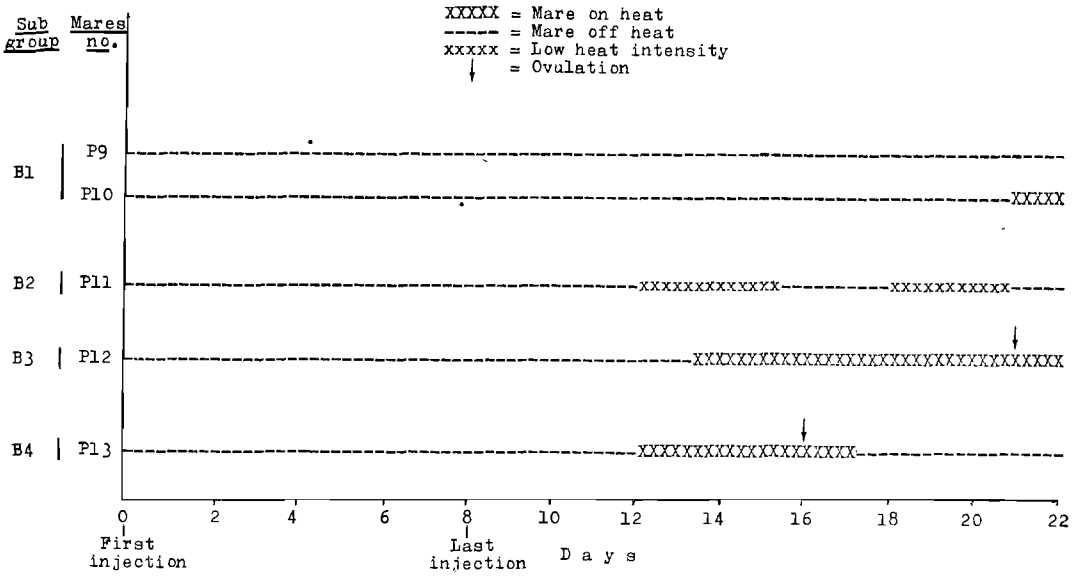

Fig. 4. The effect of three dose levels of progesterone on oestrus and ovulation in mares in anoestrum Group B.

of these mares ovulated. The mare receiving 100 mg progesterone daily for 7 days went off heat within 2 days of the start of treatment, returning to oestrum 4 days after the last treatment. The oestrous period was of six days' duration, ovulation occurring 24 hours before the end of this phase. The mare was served and conceived.

Group B: Mares in Anoestrum

The changes in the average size of the largest follicles in each subgroup during the experimental period are given in figure 3. The effect on oestrum and ovulation is shown in figure 4.

At the start of treatment all ovaries were active with the largest follicles ranging in size from 1,75—2,5 cm in diameter. Follicular size in the control group (B_1) remained more or less constant throughout the trial period, neither mare ovulating. The mare on 50 mg progesterone (group B_2) initially showed a decrease in follicular size, followed by a slight increase immediately after treatment, to decrease again by the end of the trial period. The mare showed short irregular cycles, none, however, culminating in ovulation.

The largest follicle of the mare given 75 mg progesterone every alternate day (group B_3) decreased in size during the first half of treatment, returning to its original size by the end of treatment. After a further quiescent phase, the follicle increased to 4 cm in diameter, ovulating 24 hours before the end of the induced oestrum, some 13 days after the last injection.

The mare on 100 mg progesterone on alternate days (group B_4) showed a considerable decrease in the size of the largest follicle during treatment. During the post-treatment period a follicle increased rapidly to 4 cm, ovulating 8 days after the last injection. The mare was served and conceived.

Stage II: Effect of Treatment on various Abnormal Ovarian States

Group C: Mares in Extended Oestrum

The changes in the average size of the largest follicles of each subgroup during and after treatment are represented in figure 5. The effect of progesterone on oestrum and ovulation is shown in figure 6.

All the mares had active ovaries at the onset of treatment, with the size of the largest follicle ranging between 2,0 and 3,0 cm in diameter. There was a marked decrease in follicular size during the treatment phase. A sharp increase in follicular size occurred shortly after the last injection, reaching a maximum size 8 days after cessation of treatment.

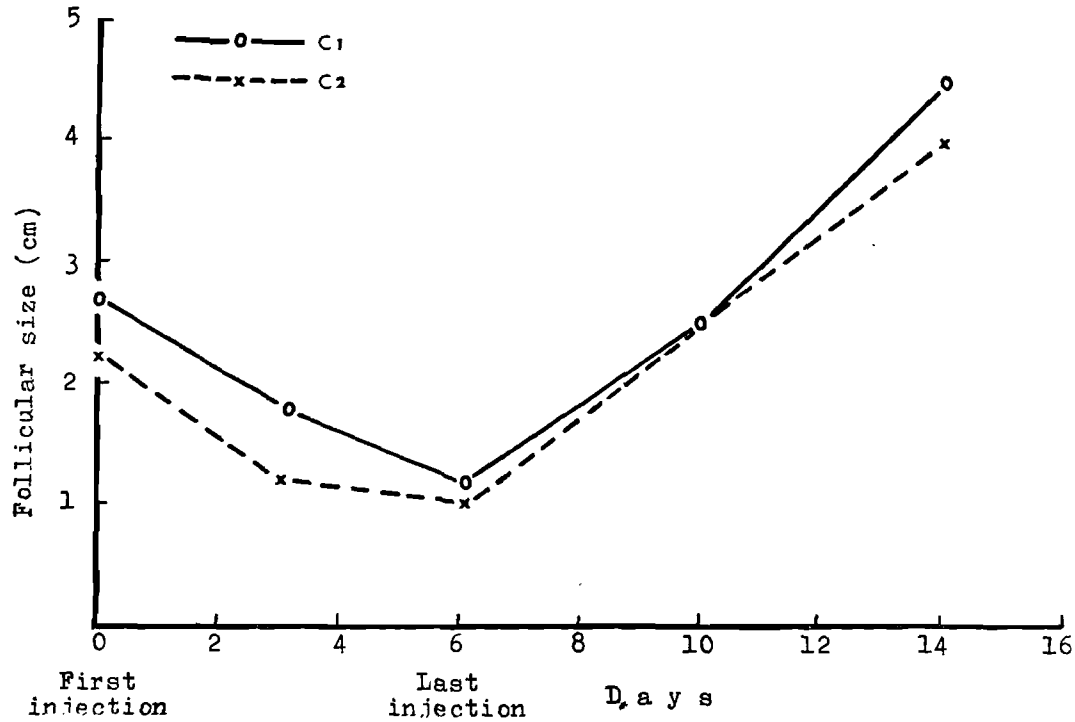

Fig. 5. The effect of progesterone on the average size of the largest follicles of mares in extended oestrum. Experimental Group C.
C1 = Percheron mares receiving 125 mg progesterone for seven successive days.
C2 = Light farm mares receiving 100 mg progesterone for seven successive days.

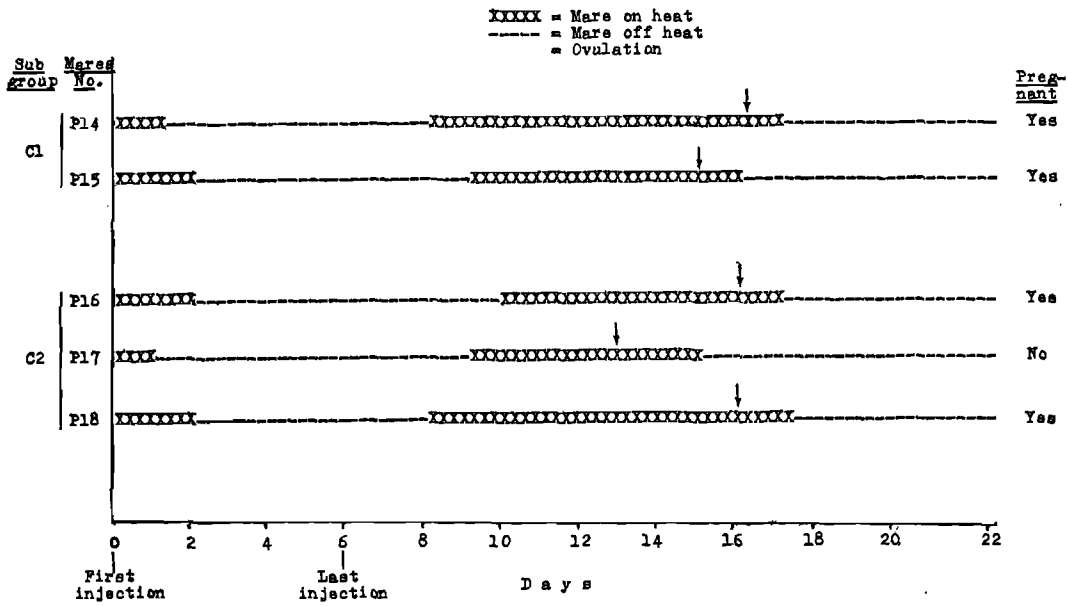

Fig. 6. The effect of progesterone treatment on oestrus and ovulation in mares in extended oestrum. Group C.

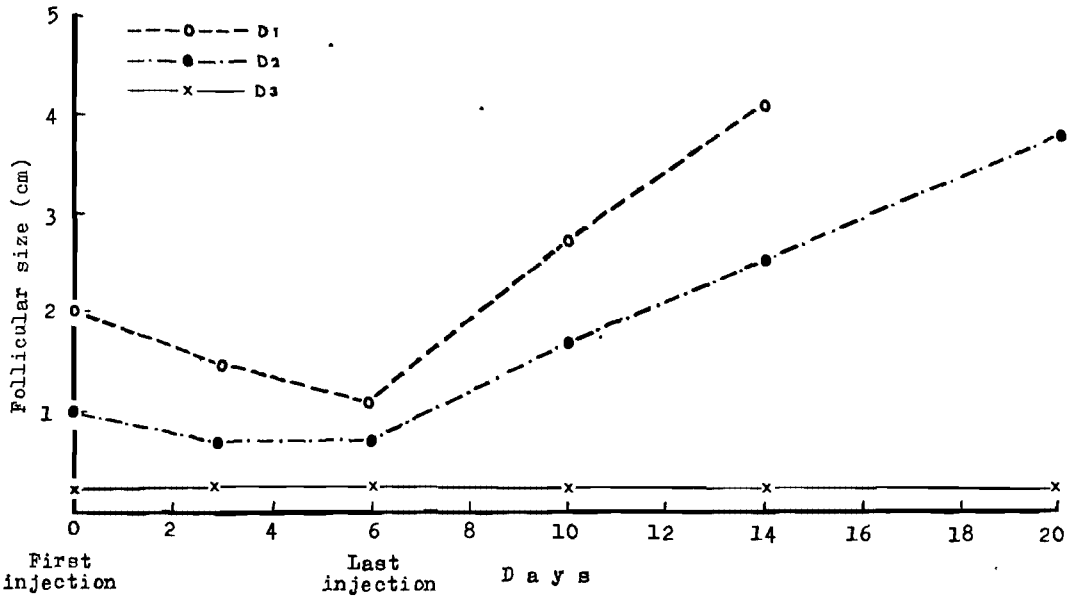

Fig. 7. The effect of 100 mg progesterone daily for seven days on the average size of the largest follicles of mares in anoestrum. Experimental Group D.
D1 = Mares with active, non-cycling ovaries.
D2 = Mares with ovaries in transitional stage (several small follicles of 1 cm).
D3 = Mares in deep anoestrum.

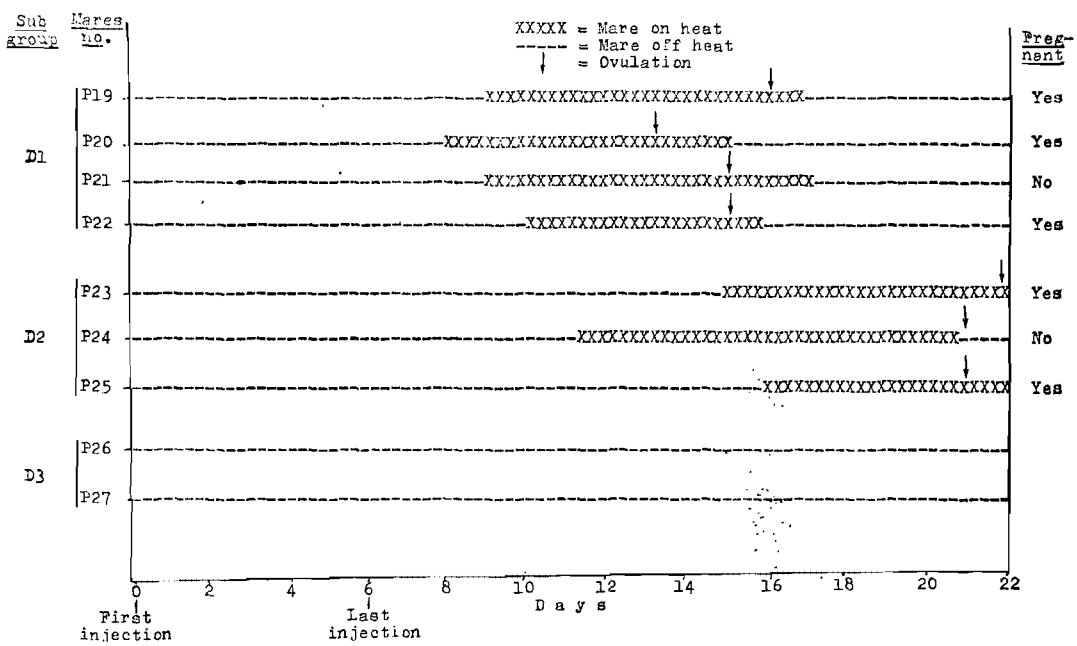

Fig. 8. The effect of progesterone treatment on oestrus and ovulation in mares in anoestrum. Group D.

The extended oestrum of all mares was suppressed within 2 days of the first injection. On an average the mares showed heat again 3 days after treatment, remaining on heat for 8 days and ovulating within 24—48 hours before the end of oestrum. All the mares were served, and 80% conceived.

Group D: Mares in Anoestrum

The changes in the average size of the follicles formed during the experimental period are represented in figure 7, while the effect on oestrum and ovulation is shown in figure 8.

Subgroup D_1: Mares with active, non-cycling ovaries. At the start of treatment all the mares showed active ovaries with follicles from 1,5—2,5 cm in diameter. During treatment the size of the follicles decreased. After the last injection there was a marked increase in ovarian activity with the largest follicle reaching a size of 4 cm within 8 days. All the mares in this group came on heat on an average 3 days after the last progesterone injection. The duration of oestrum was 7 days, with ovulation occurring 24 hours before the end of oestrum in each case. All the mares were served, 75% conceiving.

Subgroup D_2: Mares with non-cycling ovaries on the verge of activity. The ovaries of the mares in this group were in a transition phase from an inactive to an active state. The ovaries were knobbly with several small follicles of up to 1 cm in diameter. During treatment the ovaries became smaller and less knobbly. On cessation of treatment there was a gradual increase in follicular size, a maximum of 3,5—3,75 cm being reached by 14 days after the last injection. The mares took 8 days to come on heat. Oestrum length on an average was nine days. Ovulation occurred in each case between 24 and 48 hours prior to the end of oestrum. Two out of the three mares in this group conceived.

Subgroup D_3: Mares in deep anoestrum. The mares in this group were in deep anoestrum with very small, kidney-shaped ovaries with a smooth surface and no palpable follicles. The progesterone treatment had no effect on ovarian activity during or upon cessation of treatment. Both mares in this group remained in deep anoestrum.

DISCUSSION

Although the number of mares in each subgroup of both the stages of the experiment was small, the over-all trend shown provided adequate clinical evidence to demonstrate the value of progesterone in the treatment of aberrant oestrous cycles in the mare.

In attempting to find the effective dosage of progesterone required to provide an adequate hypothalamic block, it was clearly shown that doses below 100 mg were too low. Even 100 mg progesterone every alternate day was not sufficient to ensure an adequate hypothalamic FSH-RF threshold level and to avoid "leakage" of the accumulated hypophyseal FSH. This may well have been due to the rapid metabolism of the exogenous progesterone. Where 100 mg of progesterone was given daily for 7 days, however, the threshold was successfully blocked, allowing for an optimal rebound effect on the cessation of treatment. Ovulation occurred within the anticipated period in treated mares, indicating that there was no adverse effect of the progesterone block on subsequent LH release. The dosages of 100 mg and 125 mg progesterone used in stage II on light farm type mares and Percherons respectively were similar to those used by Loy & Swan in cycling mares in the luteal phase [6].

This effective dose of between 100 and 125 mg had favourable results in treating mares in extended oestrum included in stage II of the experiment. The average oestrous period of eight days was much shorter than the average length of thirteen days reported by Van Niekerk [16] for the same time of year for both Percherons and light farm type mares in the Republic of South Africa. All the mares in this group ovulated in contradistinction to an ovulation rate of 35% in untreated mares showing oestrum during the same time of year [16]. The high conception rate of 80% proved that fertile ova were shed during the post-treatment oestrous period.

The effect of progesterone treatment on mares in anoestrum was closely related to the degree of ovarian activity. Where follicular development was pronounced, the mares followed closely the post-treatment pattern shown by the mares in extended oestrum. Mares with ovaries in a transitional phase between non-activity and activity, however, took longer to come on heat, the duration of the oestrum also being longer. This was still considerably shorter than the average of 13 days reported by Van Niekerk [16]. Ovulation was fertile in both these groups.

Where the anoestrous mares had inactive ovaries, however, progesterone treatment failed to produce any response. The necessity of a waning *corpus luteum* in relation to progesterone withdrawal, as shown in cattle and sheep[5, 10], may also be the case in the mare. It may be postulated that this primarily defective negative feedback axis may have lead to reduced FSH formation in the hypophysis with consequent inadequate FSH release, coupled with ovarian insensitivity to the released FSH, as a result of inadequate priming.

CONCLUSION

Although the number of mares in each experimental group was too small for statistical appraisal of the results, the clinical success appears to justify the use of progesterone treatment in mares with aberrant cycles, provided they exhibit some degree of ovarian activity. The effective dose of progesterone in oil was found to be between 100—125 mg daily for 7 days, depending on the mare's size.

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THE RELATIONSHIP BETWEEN PROTEIN POLYMORPHISM AND MASTITIS IN FRIESLAND COWS

D. R. OSTERHOFF*, I. S. WARD-COX* AND W. H. GIESECKE**

SUMMARY

Previous work on inherited polymorphism of milk proteins led to a comparison of milk protein types of Friesland cows with and without mastitis. The protein variants were present in samples of the milk of all four quarters. The milk proteins such as β-lactoglobulin, α-, β- and K-casein differed quantitatively between quarters but never qualitatively.

The protein types were correlated with the diagnosis of mastitis as such, as well as with the presence of mastitogenic micro-organisms in the diseased udders. There is a significant correlation (X^2=7,09+)† between biosynthesis of β-lactoglobulin type AB and a low incidence of mastitis. Data suggest that heterozygous Friesland cows synthesize β-lactoglobulin and are less susceptible to mastitis infections than homozygous cows.

INTRODUCTION

Individual susceptibility or resistance to disease varies greatly. Genetic resistance to disease has rarely been deliberately sought or utilized for the development of superior strains of domestic animals. The reason for this is not the absence of genetic resistance but rather the inability or reluctance on the part of many who are responsible for the official control of disease to recognize its potentialities.

There is no better example of genetic variation which has already been demonstrated[7] but still awaits to be utilized, than that associated with mastitis in cattle. Mastitis is still the most costly disease of dairy cattle not under satisfactory control. Eradication of the various organisms causing septic mastitis is unlikely and hence the condition must be considered as enzoötic. Some cows are genetically able to resist mastitogenic infections. It would seem sensible, therefore, to increase the number of such animals. This has not been done in practice to any extent. The present study was undertaken in an attempt to obtain preliminary information on the possible relationship between milk types and the incidence of mastitis. Early identification of dairy cows that are genetically predisposed to udder infection and the future inclusion of heifers, calves and bulls into such an early identification system is likely to be of major importance to the success of mastitis control measures practised at present.

The advantageous use of clinical data in the search for correlation between certain diseases and genetic constitution of farm animals was recently shown in sheep possessing the Hb^A-allele[11]. These sheep were more likely to survive an episode of geeldikkop/enzootic icterus than those lacking this allele.

The problem of septic bovine mastitis provides an excellent opportunity to establish a similar relationship. Furthermore, several other observations concerning primarily inheritable morphological predisposition to septic mastitis, and the ease with which protein polymorphism can be identified[1], made this study feasible.

MATERIAL AND METHODS

During the course of a mastitis control program, quarter milk samples were obtained from grade Friesland herds. In a preliminary study three herds comprising a total of 196 animals were examined. During the subsequent main investigation three herds with a total of 368 cows were tested. Sample aliquots were subjected to cytological, bacteriological and electrophoretical examination.

The diagnosis of mastitis was established according to international standards[6]. Udders were classified as being affected with septic or aseptic mastitis if one or more quarters of the udder concerned exhibited somatic cell counts in excess of 500 000 cells/ml of milk together with or without mastitogenic bacteria respectively.

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†Statistically significant at the level of P<0,05.

During the pilot test, preliminary study of the α-lactalbumin and β-lactoglobulin types of 196 samples was determined by methods described earlier [12]. Only the B-allele was found for the α-lactalbumin in the freshly collected samples. For the main investigation this technique was replaced by improved techniques [9] which allow simultaneous study of β-lactoglobulin, α_{s1}-casein, β-casein and K-casein in the same gel. With this method all four milk samples of each cow of the first two farms were analysed electrophoretically. Since the quarter samples from the same udder did not differ qualitatively, a single milk sample from each cow in the remaining herd was typed. Although animals with both healthy and mastitic quarters often displayed quantitative differences, typing never yielded equivocal results.

RESULTS

The results presented below emanate from 564 analyses of β-lactoglobulin from the preliminary and the main investigation. Data on the caseins derive only from the 368 cows in the main investigation. Throughout the results are tabulated to indicate mastitis-positive animals (one or more quarters affected) and mastitis-negative animals (udder completely healthy).

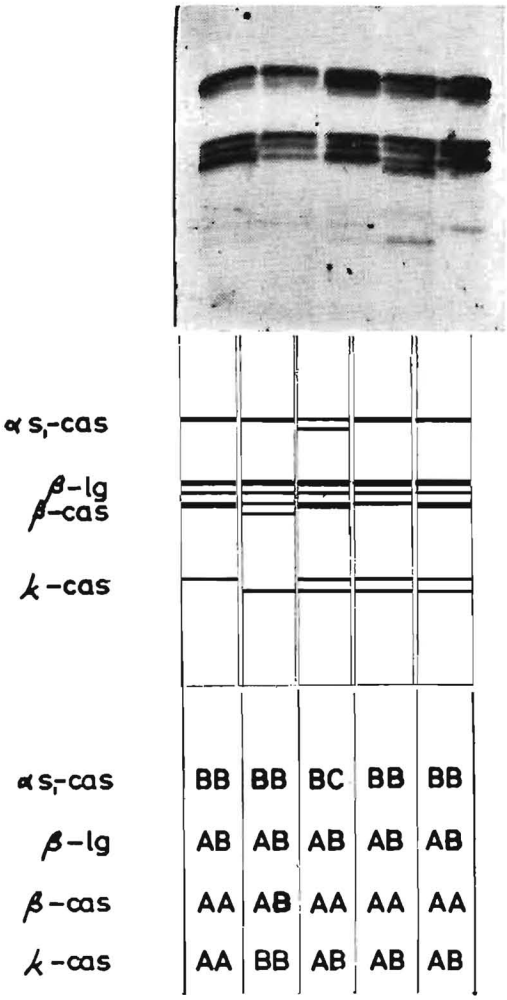
Aseptic mastitis was recorded separately in the tables, since the affected cows were excluded from further analyses.

The figure illustrates the simultaneous separation of the α_{s1}-, β- and K-casein and β-lactoglobulin.

The phenotypes and gene frequencies of 564 β-lactoglobulins derived from the preliminary and main investigations are summarized in table 1.

The relatively large number of mastitis-negative heterozygous animals are apparent. According to the Hardy-Weinberg equilibrium a total of 134 mastitis-negative animals is expected: for the results obtained this gives an over-all X^2-value of 5,98+ at the 0,05 level of statistical significance.

During the preliminary investigation, animals with atrophied quarters without secretion owing to some previous udder damage and only one or two healthy quarters were included in the analysis. To avoid inaccurate classification it became essential to



BOVINE MILK PROTEIN TYPES

Upper part: Photograph of actual gel.

Middle part: Drawing of lines for three casein types and the β-lactoglobulin types.

Lower part: Denominations according to international nomenclature.

Table 1: OCCURRENCE OF β-LACTOGLOBULIN TYPES IN A TOTAL OF 564-MASTITIS POSITIVE OR NEGATIVE FRIESIAN COWS

Mastitis diagnosis	Cows tested	β-lactoglobulin types			Gene frequencies	
		AA	AB	BB	β-Lg^A	β-Lg^B
Positive	199	78	86	35	,608	,392
Negative	269	64	154	51	,524	,476
Over-all	468	142	240	86	,560	,440
Aseptic	96	33	47	16	,588	,412

disregard the data of the preliminary investigation, since the exact history of these cases could not be established, and to consider only the data from cows with four functional quarters examined during the main investigation. The occurrence of β-lacto globulins in the milk of 368 cows during the main investigation is summarized in table 2.

Table 2: OCCURRENCE OF β-LACTOGLOBULIN TYPES IN 368 MASTITIS-POSITIVE OR NEGATIVE FRIESIAN COWS WITH FOUR FUNCTIONAL QUARTERS EACH

Mastitis diagnosis	Cows tested	β-lactoglobulin types			Gene frequencies	
		AA	AB	BB	β-Lg^A	β-Lg^B
Positive	126	53	54	19	,635	,365
Negative	169	44	100	25	,556	,444
Over-all	295	97	154	44	,590	,410
Aseptic	73	24	37	12	,582	,418

From table 2 it is apparent that there is again a larger number of heterozygotes in the mastitis-negative group. According to the Hardy-Weinberg equilibrium a total of 83 mastitis-negative animals is expected in this group: for the results obtained this gives an over-all X^2-value of 7.09+ at the 0,05 level of statistical significance. Results summarized in table 2 strongly suggest that heterozygous Friesian dairy cows are less frequently infected with mastitigenic micro-organisms than homozygous animals.

The relationship between β-lactoglobulin types and various bacteria isolated from mastitic udders is illustrated in table 3.

Table 3 β-LACTOGLOBULIN TYPES AND BACTERIA IN MILK OF UDDERS WITH ONE OR MORE MASTITIC QUARTERS

Species	β-lactoglobulin types		
	AA	AB	BB
Str.* agalactiae	13	11	5
S. epidermidis**	34	34	12
Str. uberis	3	0	2
Str. dysgalactiae	3	8	2
Str. faecalis	1	3	3
S. aureus	35	43	18
	89	99	42

*Str. = Streptococcus
**S. = Staphylococcus

The total number of β-lactoglobulin types presented in table 3 amounts to 230 animals in contrast to 199 mastitis-positive cows in table 1, because several animals were infected with more than one species of bacteria, i.e. mixed infections in the same or different quarters were present.

From table 3 it is clear that no significant difference exists between the incidence of mastitis caused by a specific micro-organism and the β-lactoglobulin type secreted.

The α_{s1}-casein types and gene frequencies are depicted in table 4.

Table 4: OCCURRENCE OF α_{s1}-CASEIN TYPES IN 368 MASTITIS-POSITIVE OR NEGATIVE FRIESIAN COWS

Mastitis diagnosis	Cows tested	α_{s1}-casein types			Gene frequencies	
		BB	BC	CC	α_{s1}-Cn^B	α_{s1}-Cn^C
Positive	126	123	3	—	,988	,012
Negative	169	160	9	—	,973	,027
Over-all	295	283	12	—	,980	,020
Aseptic	73	64	9	—	,938	,062

The small number of animals with α_{s1}-casein type BC precludes the drawing of conclusions as to the relationship between mastitis and biosynthesis of certain α_{s1}-casein types.

The relevant results regarding the relationship between udder health and β-casein types are summarized in table 5. Owing to the small number of cows with β-casein type B the results are inconclusive.

Table 5: OCCURRENCE OF β-CASEIN TYPES IN 368 MASTITIS-POSITIVE OR NEGATIVE FRIESIAN COWS

Mastitis diagnosis	Cows tested	β-casein types			Gene frequencies	
		AA	AB	BB	β-Cn^A	β-Cn^B
Positive	126	100	22	4	,881	,119
Negative	169	137	31	1	,902	,098
Over-all	295	237	53	5	,893	,107
Aseptic	73	65	6	2	,932	,068

The relationship between udder infections and the K-casein types secreted is illustrated by table 6.

Table 6: OCCURRENCE OF K-CASEIN TYPES IN 368 MASTITIS-POSITIVE OR NEGATIVE FRIESIAN COWS

Mastitis diagnosis	Cows tested	K-casein types			Gene frequencies	
		AA	AB	BB	K-Cn^A	K-Cn^B
Positive	126	45	68	13	,627	,373
Negative	169	53	92	24	,586	,414
Over-all	295	98	160	37	,603	,397
Aseptic	73	30	34	9	,643	,356

Although table 6 indicates some relationship between a low incidence of mastitis and heterozygous animals, the difference between the mastitis-negative cows examined and the expected number of such animals is not statistically significant (X^2=2,51).

DISCUSSION

Predisposition to septic mastitis has frequently been related to a wide range of morphological features of the bovine mammary gland. No information is available, however, on predisposition of the gland associated with biological activities such as the synthesis of certain milk proteins by the epithelium. If the udders of cows become infected irrespective of their milk protein types, one would expect an even distribution of these types amongst all animals.

Preliminary investigation of three mastitic dairy herds comprising altogether 196 animals suggested a lower incidence of mastitis in cows secreting β-lactoglobulin type AB than in cows producing β-lactoglobulin types A or B. Herd disposal precluded further investigation.

Data obtained from the 368 Friesland cows in three other herds confirmed that in dairy cows secreting β-lactoglobulin AB there is a significantly lower incidence of septic mastitis (X^2=7,09) than in cows producing β-lactoglobulin types A or B. Analysis of the relationship between udder health and K-casein also suggests a lower incidence amongst heterozygous animals but this was not statistically significant (X^2=2,51). There was no significant correlation between the specific pathogenic micro-organisms isolated from mastitis udders and the type of β-lactoglobulin secreted.

It would thus appear that there is a positive correlation between the biosynthesis of certain milk proteins and susceptibility or resistance to septic mastitis. The investigation also indicates the extremely important rôle which genetic typing of dairy cows could play as a supplementary measure in the control of mastitis and, possibly, other stock diseases. Genetic typing could be put to increased practical use if it were possible to develop a system of typing heifers, calves and bulls to permit early elimination of animals which are genetically predisposed to infectious mastitis.

Since it was the primary objective of these investigations to obtain information on the possible correlation between the function of the bovine mammary gland and its susceptibility to septic mastitis, a wide range of variables has been disregarded. It is intended to examine a larger number of animals from different herds with subdivision into age groups, since mastitis is more likely to occur in succeeding lactations. Because a positive correlation has been shown to exist between high milk production and susceptibility to mastitis[2, 3, 5], production levels should also be taken into account. This correlation, however, does not appear to be constant and other factors such as morphological features of the udder, teats and teat canal have to be considered as well when determining those genetic factors which cause an udder to be more susceptible or resistant towards septic mastitis[4, 8, 10].

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ISOLATION OF *CLOSTRIDIUM BOTULINUM* TYPE C FROM AN OUTBREAK OF BOTULISM IN WILD GEESE

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SUMMARY

An outbreak of botulism amongst wild geese at the Austin Roberts Bird Sanctuary in Pretoria is described. *Cl. botulinum* type Cα toxin was demonstrated in the serum of a paralysed bird, and the organism was isolated from mud and carcase material. Previous outbreaks of this disease in South Africa are reviewed, and a detailed method is given for the isolation of *Cl. botulinum* from mud and carcase material.

INTRODUCTION

Botulism is a major cause of mortality in wild aquatic birds in certain parts of North America, where it is known as western duck disease. It occurs in warm weather in shallow pans which have a slightly alkaline pH and in circumstances where decaying vegetation provides the low oxygen tension necessary for the multiplication of *Cl. botulinum* [12]. This organism and its toxins have been found in the organs of affected birds, mud, decaying vegetation, various fly larvae and the carcases of dead fish, birds, and invertebrates. Paralysis follows the ingestion of toxic water or mud, decaying carcases, or the larvae of *Lucilia caesar* [1]. The disease has also been diagnosed in Australia, Canada, Denmark, England and the Netherlands [3] where *Cl. botulinum* type C was chiefly implicated [1, 3].

In South Africa, as early as 1893, reference was made to a paralytic disease in domestic ducks which had consumed decomposed meat. The disease was also considered to be common in ducks having access to dried-up ponds containing dead fish or snails [4]. In 1928 an outbreak of suspected botulism occurred amongst wild duck species kept at the Pretoria Zoological Gardens, where eighteen birds of various aquatic species died after heavy rains. They showed weakness and inability to stand, and eventually lay with their necks stretched out along the ground [14]. Cultures made from the caecal contents of three of these birds were weakly toxigenic and were later tentatively identified as *Cl. botulinum* type C [15].

In 1967 heavy mortality occurred amongst waterfowl at the Strandfontein sewage works in Cape Town. A heat labile toxin found in the gut contents of paralysed birds was identified as that of *Cl. botulinum* type Cα. The organism was not isolated [2].

HISTORY AND SYMPTOMS

The outbreak of botulism described in this paper took place at the Austin Roberts Bird Sanctuary in Pretoria. This sanctuary consists of approximately 4 ha of fenced land, overgrown with bushes and tall trees, and inhabited by a wide variety of bird life. Two large clay quarry holes form permanent lakes bordered by muddy banks with poplar thickets, willows and papyrus. One of the two lakes contains a large number of kurper, *Tilapia mosambica,* and the water is very murky. This lake is most favoured by waterfowl, which nest on its banks and in trees and bushes at the water's edge. The water is polluted with bird droppings, feathers and other organic detritus. A bloom of algae is present in the shallower, more stagnant water.

During January and February, 1972, mortality in cattle egrets, *Bubulcus ibis,* and sacred ibis, *Threskiornis aethiopicus,* occurred. Analysis of the fat showed a high BHC content; the blood of the ibis contained no cholinesterase, indicating acute organic phosphate poisoning [11]. The birds probably ingested these insecticides while feeding on smallholdings outside the sanctuary.

During May 1972, two dead spurwing geese, *Plectropterus gambensis,* were brought to the Institute. These were only a few of several birds which had died after showing paralysis. In view of the previous mortalities in egrets and ibis, insecticide poisoning was suspected. The livers of these birds were therefore examined for insecticide residues,

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but found to be negative. Examination of the livers for botulinum toxin was also negative. The carcases showed no *post-mortem* lesions other than generalized congestion.

A few days later a live, partially paralysed Egyptian goose, *Alopochen aegyptiacus*, was submitted. It suffered flaccid paralysis of the wings and legs, and offered no resistance when handled. The legs were stretched out backwards and the wings drooped. The breathing was forced. The head of the bird rested between its wings, although it could be raised; mild pecking motions were made in self-defence when handled. The nictitating membranes, particularly of the left eye, were partially paralysed and a mild conjunctivitis was present. The symptoms shown by this goose were typical of those seen in other birds at the sanctuary, the paralysis of the nictitating membranes being particularly noticeable. The bird was bled from the brachial vein and the serum examined for toxicity (see below).

The mortality thereafter ceased, probably owing to the sudden onset of cooler weather. On inspection of the site, several decomposed carcases of ibis and egrets were seen lying about under the trees and in the water. Two spurwing geese carcases were floating amongst the papyrus. Rotting vegetation was evident, particularly around the papyrus and in areas of shallow, stagnant water fringed by reeds. Two samples of mud were taken from different areas on the banks, a specimen of material from a decomposed egret lying partly submerged in the water, and a specimen of muddy water from a shallow, stagnant area.

MATERIALS AND METHODS

Isolation Procedures

Meat particle broth was prepared as follows. Fresh or frozen, minced, lean beef (500 g) was simmered for 20 min in 500 ml of glass-distilled water containing 1,5 ml of 1 N NaOH and then filtered. The meat particles were dried with paper towels and placed in 25×2,5 cm tubes to a height of 10 cm. The drained fluid was decanted to remove any floating fat. Soluble starch (5 g) was mixed with 100 ml of drained fluid and boiled until clear. Nutrient broth (Oxoid) (6,5 g) was added to the remaining fluid and heated until it dissolved. This was then added to the starch mixture and the whole made up to 500 ml with glass-distilled water. This liquid was added to the test tubes to a depth of about one cm above the meat and they were autoclaved at 121°C for 30 minutes.

By strictly following the above procedure, the addition of soluble starch caused the broth to gel at 4°C, while remaining fluid at room temperature. Culture medium, refrigerated immediately after sterilization and cooling can be used up to a week without the need for prior deoxygenation by boiling. Laboratory strains of *Cl. botulinum* grow profusely after 18 to 24 h in this medium†.

The four samples were each ground in an equal volume of sterile 0,8% NaCl solution and left to stand for 20 min, when the supernatant fluid was drawn off. Each sample was then divided into four roughly equal portions. Three were heated for 30 min at 65°C, 75°C and 85°C respectively, and the fourth at 80°C for an hour, according to the method of Mason[9]. These were then inoculated into tubes of meat particle broth with starch, and incubated overnight at 35°C. The following day smears were made from the bottom of the tubes and stained with fluorescein-conjugated specific *Cl. botulinum* type C antiserum (Burroughs Wellcome)†† according to the method of Walker and Battey[16].

Those cultures which were postive were immediately plated out onto egg yolk agar[10] containing 0,02% sodium azide. These plate cultures were incubated anaerobically for three days in McIntosh and Fieldes jars using two palladium catalysts per jar. Colonies picked from the cultures on the egg yolk agar were subcultured on the same medium until purified isolates were obtained. These were then plated out onto Willis and Hobbs' lactose-egg yolk-milk agar[17] for identification.

The meat broth cultures were incubated for a further 5 days to test for toxin production.

Toxin Neutralization Tests in Mice

Serum from the Egyptian goose was tested for toxicity by injecting 0,2; 0,3; and 0,4 ml quantities intraperitoneally into pairs of 6 week-old mice[3, 13] and observing them for 72 hours. The remainder of the serum was frozen at —20°C until required, as this temperature is considered to have no effect on the toxicity of *Cl. botulinum* toxin[7].

†Unpublished observation.
††Wellcome Laboratories, Beckenham, Kent.

Cultures were tested for toxin using the method of Willis[17] except that the variously treated supernatants were injected intraperitoneally into 6 week-old mice in 0,3 ml quantities. Toxin present in serum, tissue suspensions and culture fluid was typed in mice using monospecific C_1, C_2 and D antisera as described by Jansen[5].

RESULTS

All six mice receiving serum from the Egyptian goose died within 24 hours with characteristic "wasp waists"[13]. The toxin in the serum was identified as that of *Cl. botulinum* type $C\alpha$[15]. No non-specific toxicity was encountered.

Shortly after the serum had been collected for testing, 2 ml (3 200 IU) of *Cl. botulinum* type C antiserum was injected intravenously into the goose. The following day the condition of the bird had improved considerably; another injection was given. The goose thereafter recovered completely.

Four of the sixteen broth cultures made from mud, muddy water and carcase material were negative when stained with *Cl. botulinum* type C fluorescent antiserum. These four were those that were only heated at 65°C for 30 min, and, as the concentration of contaminants was very high, it is possible that they had overgrown the *Cl. botulinum*. Eight of the ten broth cultures made from mud and carcase material were found to be positive for *Cl. botulinum* when stained with fluorescent antibodies and were found to contain *Cl. botulinum* type C toxin after a further five days of incubation. The non-toxic cultures which were positive on fluorescent antibody staining, later yielded non-toxigenic strains of organisms. These were culturally and morphologically similar to *Cl. botulinum* type C.

After purification, many of the isolates became non-toxigenic or weakly toxigenic. All, however, were non-proteolytic, strongly anaerobic and produced opalescence and a pearly layer on egg yolk agar. These are typical biochemical characteristics of *Cl. botulinum* types C and D[17]. The morphology was also similar to that of other laboratory strains of *Cl. botulinum*.

Typing with monospecific antisera trypsin activation[6] showed that factors C_1 and C_2 were present and the strain was consequently identified as type $C\alpha$, according to the findings of Jansen[5].

DISCUSSION

Botulism in waterfowl is probably widespread in South Africa, but, perhaps owing to the difficulty encountered in making a definite diagnosis, it has not been reported often in the literature.

The conditions at the Austin Roberts Bird Sanctuary in Pretoria were favourable for the outbreak of the disease. *Cl. botulinum* was obviously widespread in the environment and easily contaminated the carcases of the ibis and egrets which had died from insecticide poisoning. These carcases then further polluted the water and mud. The rotting vegetation probably provided the ideal anaerobic conditions described by Quortrup & Holt[12]. Whether the toxin was ingested directly by the geese feeding on the carcases themselves, or on the maggots on these carcases, or by mud and water accidentally taken in while feeding, is a matter for speculation.

Cl. botulinum type C often loses its toxicity on subculture and this is perhaps why it has not been identified more frequently in cultures made from soil and mud. Knock[8] and Mason[9] respectively isolated *Cl. botulinum* types B and D, but not type C, from soil and mud in South Africa. Robinson[14] isolated type $C\alpha$ from the carcase of a rat implicated in an outbreak of botulism in horses.

The early recognition of positive cultures by means of fluorescent antibodies enhances the possibility of isolation: after five days contaminants may well have multiplied so extensively that isolation is considerably complicated.

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RIFT VALLEY FEVER
2. ATTEMPTS TO TRANSMIT VIRUS WITH SEVEN SPECIES OF MOSQUITO*

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SUMMARY

Seven species of mosquito among the fauna of Southern Africa were tested for their ability to transmit Rift Valley fever virus. *Anopheles coustani, Aedes lineatopennis* and *Aedes circumluteolus* were readily infected by high doses of virus but attempts at transmission of virus failed. These were regarded as inconclusive because only a small number of mosquitoes was fed. *Culex theileri, Culex zombaensis, Culex neavei* and *Eretmapodites quinquevittatus* all successfully transmitted virus at varying degrees of efficiency. *Culex theileri* was the most efficient vector and 92 to 100 per cent of females of this species were infected by 6,5—8,5 log LD_{50} of virus and 11 out of 20 mosquitoes transmitted virus. Seventy-five per cent of *Culex zombaensis* were infected by 5,8 log LD_{50} of virus and at least 2 out of 5 mosquitoes transmitted virus. Between 31 and 69 per cent of *Culex neavei* were infected by 6,6—8,5 log LD_{50} of virus and about 3 out of 22 mosquitoes transmitted virus. The poorest vector was *Eretmapodites quinquevittatus* which was readily infected but only about one out of 22 mosquitoes transmitted virus. Attempts to demonstrate transovarian transmission of virus with this species failed.

INTRODUCTION

When Rift Valley fever (RVF) appeared in domestic animals in Southern Africa in 1969, only *Aedes aegypti* [1] and *Aedes caballus* [2] among the mosquito fauna of this region had been shown capable of transmitting the virus. *A. aegypti* has not been implicated in the transmission of this virus during epizootics and seems unlikely to become so in the future. Gear *et al.* [2] had collected *A. caballus* during an outbreak in sheep near Luckhoff, Orange Free State, exposed three lots of these mosquitoes to laboratory mice, and successfully transmitted virus with one lot. Subsequent attempts, however, to transmit virus in the laboratory with *A. caballus* collected near Johannesburg had failed (Arbovirus Research Unit, unpublished work). It has now become apparent that what is at present known as *A. caballus* in South Africa probably consists of two species, as yet unnamed, and it will probably never be possible to establish which of these were used in the aforementioned experiments, because both species probably occur at Luckhoff and Johannesburg, the localities whence the mosquitoes used in the tests originated. These experiments, therefore, can no longer be interpreted satisfactorily in terms of transmission in the field. Information on species capable of transmitting RVF was therefore minimal during the recent epizootics, making it difficult to identify the important vectors, particularly when transmission was observed to occur in the absence of species of the *A. caballus* group.

In an attempt to remedy this deficiency, transmission tests were conducted with seven species of mosquito. These had come under suspicion as vectors because of their feeding habits, distribution and prevalence, and, in some species, also because of the isolation of RVF virus from wild-caught specimens.

METHODS

With the exception of *Culex theileri*, the females of all species used in the experiments were first generation progeny reared from wild-caught females. Those of *C. theileri* were from a laboratory-maintained colony in its 12th generation, established from material collected at Lake Chrissie, Transvaal. The *Anopheles coustani, Aedes lineatopennis* and *Culex zombaensis* came from near Salisbury, Rhodesia, the *Aedes circumluteolus* and *Culex neavei* from Ndumu, Natal, and the *Eretmapodites quinquevittatus* from Port Shepstone, Natal.

Attempts to infect mosquitoes were made by feeding them on either calves or hamsters while these animals were viraemic after inoculation of wild-type RVF virus. Shortly before feeding started, a blood sample was collected from the viraemic animal to deter-

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mine its virus content. This was done by titration intracerebrally in infant mice and virus concentrations are expressed as the logarithm of the LD_{50} per 0,02 ml of mouse inoculum.

Infection of individual mosquitoes was determined by inoculation of a suspension of the mosquito into infant mice. In cases where mosquitoes had been used in transmission attempts, these determinations were done on all mosquitoes two days after feeding. Hence, the 'infection status' of all mosquitoes used in attempted transmission was known.

'Infected' mosquitoes, i.e., all those which had engorged on the viraemic animal, were held at 80% relative humidity and 26°C for periods of from 9 to 30 days before transmissions were attempted; the actual time in each experiment is given in the table.

Transmission attempts were made by feeding 'infected' mosquitoes on either a calf, lamb, hamsters or 6 days old mice, as indicated in the table, exposing each animal to single or several mosquitoes. These attempts were considered valid only when one or more of the mosquitoes feeding were shown later to contain virus.

With the calves and lamb a positive or negative transmission was established by antibody tests on serum collected two weeks after mosquito feeding, with hamsters and mice by death of the animal and confirmation of the cause of death by histological examination of the liver and usually also by isolation of virus from the dead animal. In addition, surviving hamsters were bled after three weeks for an antibody test on the serum to exclude the possibility of a non-fatal infection.

RESULTS

Anopheles coustani

From the table it can be seen that three attempts were made to infect this species, two from a viraemic calf and one from a hamster. At a virus concentration of 7,5 log LD_{50}, 100 per cent of mosquitoes were infected whereas at the lowest concentration of 4,3 log LD_{50}, 45 per cent became infected.

Table: RESULTS OF ATTEMPTED INFECTION AND TRANSMISSION OF RVF VIRUS WITH SEVEN MOSQUITO SPECIES

Species	Viraemic Animal	Virus concentration in blood	Mosquito infection		Transmission				
			Day	Rate %	Day	Host	Result	No. infective mosquitoes feeding	Rate
An. coustani	Hamster	6,0	8—20	7(1(8)§			NT		
	Calf	>7,5	14—18	100(10)	16	Lamb	Neg.	1	
	Calf	4,3	8—16	45(11)			NT		
A. lineatopennis	Calf	6,4	6—14	43(7)	10	Mouse	Neg.	2	
A. circumluteolus	Calf	6,4		100(4)			NT		
	Calf	4,8	14—38	24(59)	14	Calf	Neg.	2	
					19	Mouse	Neg.	1	
					23	Mouse	Neg.	1	
C. zombaensis	Hamster	5,8	8—32	75(24)	11	Hamster	Pos.	? 1*	2/5
					15	Hamster	Pos.	2	
					30	Hamster	Neg.	2	
C. neavei	Hamster	6,6	18—20	31(26)	17	Mouse	Pos.	? 1*	3/22
					17	Hamster	Neg.	5	
	Hamster	7,5	19—20	69(16)	17	Hamster	Pos.	4	
					18	Hamster	Neg.	2	
	Hamster	8,5	19—20	68(19)	18	Mouse	Neg.	1	
					18	Hamster	Pos.	7	
					18	Hamster	Neg.	2	
C. theileri	Hamster	6,5	20—22	100(25)	19	Mice†	Pos.	2	1/2
	Hamster	8,0	19—22	95(44)	18	Mice	Pos.	11	5/11
	Hamster	8,5	21—22	92(24)	20	Mice	Pos.	7	5/7
E. quinquevittatus	Hamster	5,5	17—69	82(22)	22	Hamster	Neg.	10	1/22
	Hamster	6,0	21—77	57(28)	22	Hamster	Neg.	5	
					24	Hamster	Neg.	2	
	Hamster	6,6	8—35	71(7)	19	Mouse	Pos.	2	
	Hamster	7,3	9—29	80(20)	9	Mouse	Neg.	3	

§Figure in parenthesis indicates number of mosquitoes on which percentage is calculated.
*Successful transmission resulting from an unknown number of mosquitoes probing but not imbibing blood.
†In all transmission attempts with **C. theileri** each mouse was exposed to one mosquito.
NT=no test.

Unfortunately, during the attempted transmisison of virus, only one infected mosquito was induced to feed. This occurred on a lamb on the 16th day and no transmission resulted. Hence, apart from the observation that this species is easily infected at the dosages used, no conclusion on its vector potential can be arrived at, because inadequate numbers of mosquitoes fed during the attempted transmission.

Aedes lineatopennis

Considerable difficulty was experienced in getting adequate numbers of this species to feed even at their first feeding. At a virus concentration of 6,4 log LD_{50}, 43 per cent (based on only seven mosquitoes) were infected. On the 10th day two mosquitoes failed to transmit to a mouse. Here again it is believed that numbers of mosquitoes were insufficient for a reliable conclusion to be made.

Aedes circumluteolus

In one of the two experiments with this species only 24 per cent of mosquitoes were infected at 4,8 log LD_{50} and in the other all four mosquitoes imbibing 6,4 log LD_{50} of virus became infected. In the former experiment attempts at transmission were made on the 14th, 19th and 23rd days and quite large numbers of mosquitoes fed on the calf and mice but because of the low infection rate only four were infective. These failed to transmit the virus. While this species should not be classified as a non-vector on the basis of only four mosquitoes, it would seem that, at best, this species would be a vector of only moderate capability because of low susceptibility to infection. Nevertheless, this species occurs in prodigious numbers on the coastal plains of northern Natal and Moçambique: it is quite posible that high populations may well compensate for its poor vectorship to make this species an important vector.

Culex zombaensis

Seventy-five per cent of this species were infected by 5,8 log LD_{50} of virus. There were successful transmissions to hamsters exposed to groups of mosquitoes on the 11th and 15th days. On the former occasion none of the mosquitoes engorged, the transmission in this instance resulting from probing without the mosquito imbibing any blood. An attempted transmisison on the 30th day with two mosquitoes failed. If it is assumed that only a single mosquito transmitted virus on the 11th and 15th days, an over-all transmission rate of 40 per cent is arrived at. Although RVF virus has never been isolated from *C. zombaensis*, the results show this species to be another potential vector in the lowlands of Natal and Moçambique, where it is prevalent and a frequent feeder on the larger domestic animals.

Culex neavei

In three experiments this species was shown to possess a moderate degree of susceptibility to infection and mosquitoes successfully transmitted the virus on three occasions to either mice or hamsters. There was a considerable number of failures, however, and with a possible over-all transmission rate of only 14 per cent, this species seems to possess only a fair degree of vector capability.

Culex theileri

This species was easily infected (92—100 per cent) at the three rather high concentrations of virus used. In the transmission tests, in all of which individual mice were exposed to single mosquitoes, a total of 11 out of 20 mosquitoes engorged and transmitted virus, giving an over-all transmission rate of 55 per cent. The actual transmitting ability of this species is probably even higher as there were a further six successful transmisisons by mosquitoes probing without engorging. These were excluded from consideration in calculating the transmission rate, because it could not be determined how many mosquitoes had probed without transmitting. These results indicate that this species is an efficient vector of RVF virus.

Eretmapodites quinquevittatus

In the four experiments with this species the mosquitoes were easily infected, although infection rates were not fully consistent in relation to virus concentration in that the lowest concentration yielded the highest rate. It seems that the rate of 82 per cent at 5,5 log LD_{50} should be considered as abnormally high, since the remaining values were in proportion to virus concentration. There were five attempted transmissions, involving altogether 22 mosquitoes. Only one, in which two mosquitoes engorged on a mouse on the 19th day, was successful. With a transmisison rate of only 5 per cent it may be concluded that this species is a poor vector.

While the experiments with *E. quinquevittatus* were in progress, it was noticed that this species was mating successfully in the

cages, with the result that numbers of eggs, pupae, larvae and adults, mostly the progeny of infected females, became available. These were used to test the possibility that transovarian infection occurs with RVF virus. With this in mind, groups of eggs, larvae, pupae and adults, collected randomly, were ground up, suspensions prepared and these were inoculated separately into infant mice to determine whether they contained virus. In all, 289 eggs, 50 larvae, 50 pupae, 178 females and 295 males were tested in 17 lots. None contained virus and because of the high infection rate among the parental females it seems unlikely that transovarian transmission could be of significance in nature.

DISCUSSION

In all the experiments high infecting doses of virus were used intentionally. While this procedure favours the species under test, the purpose was to determine vector capability at virus concentrations occurring in sheep and cattle, the investigation of epizootic vectors being the main objective. From a practical viewpoint, also, it is an advantage in the initial screening of species of unknown susceptibility to have many infected specimens available when the second feeding is attempted. Nevertheless, although high viraemia levels do occur in cattle and sheep, it should be borne in mind that at lower infecting doses than those used in the tests fewer mosquitoes would become infected resulting in a lower vector efficiency.

The tests showed that four species of the local mosquito fauna are capable of transmitting RVF virus and on epizootological grounds all of these are likely to play some part in nature. It is unfortunate that because of insufficient numbers the tests with *Anopheles coustani, Aedes lineatopennis and Aedes circumluteolus,* all potentially important vectors, were inconclusive.

Of all the species tested, *Culex theileri* emerged as the most efficient vector and from the degree of vector capability shown it is believed that this species is probably the most important vector on the South African highveld. As discussed elsewhere, there is strong epizootological evidence in support of this opinion [3].

The isolation of RVF virus in *Eretmapodites* species both in South Africa [3] and Uganda [4] under circumstances unassociated with epizootics in domestic animals is suggestive that these species might be involved in a maintenance transmission cycle. *E. quinquevittatus* would appear to possess some potential as maintenance vector of this virus in Natal. It is quite common along the forested coastal zone and is exceptionally long-lived as an adult, in which stage it probably overwinters. The poor level of vector capability shown, however, is against this possibility. It would seem that if this species had been a vector over a long period of time, which would be the case if it were a maintenance vector, selection would probably have resulted in a strain of virus more invasive for the salivary gland of this mosquito with a more efficient level of transmission.

Unlike most mosquitoes, *E. quinquevittatus* is able to produce viable eggs without a blood meal. Because of this, the possibility that virus might reside in the mosquito population for long periods of time without the need for frequent transmission between vertebrate animals seemed worth investigating, although it has never yet been demonstrated conclusively to occur regularly with any mosquito-borne virus. The failure to demonstrate transovarian passage of virus, however, seems to rule out the possibility that this species could act as a virus reservoir in this manner.

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MUCOSAL DISEASE IN SOUTHERN AFRICA

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SUMMARY

A serological survey was conducted on bovine serum samples originating from the four provinces of the Republic of South Africa, Rhodesia and Botswana. The survey revealed that mucosal disease virus is prevalent in the cattle population. Approximately 60 per cent of sera tested contained demonstrable neutralizing antibodies against this virus.

INTRODUCTION

This disease was first described in New York State by Olafson & Rickard [5], they gave it the name of 'virus diarrhea' (VD) on account of the most prominent symptoms.

A few years later a disease was described in various states of the USA; it affected mainly the mucous membranes of the alimentary and respiratory tracts of cattle and was called 'mucosal disease' (MD). It appeared to have some similarity to virus diarrhoea, although it was less contagious, of a lower morbidity but with a higher mortality rate [7].

A virus producing a cytopathogenic effect in calf foetal kidney cells was isolated from the spleen of a calf suffering from virus diarrhoea and was designated the Oregon C24V strain [1]. A serological comparison between strains of virus diarrhoea and mucosal disease revealed that these two viruses were closely related [2]. Today both diseases are regarded as clinical manifestations of the same virus [8]. The disease complex MD-VD has been described in many parts of the world, and the various strains are serologically related to some extent to the prototype Oregon C24V virus.

The presence of mucosal disease in South Africa has been suspected for some years, mainly on clinical grounds. A serological survey was therefore undertaken to confirm the presence and distribution of this disease in southern Africa. Bovine sera from various parts of southern Africa were collected at random and submitted to the Veterinary Research Institute at Onderstepoort for the determination of neutralizing antibody titres against MD virus.

MATERIALS AND METHODS

Virus

The cytopathogenic Oregon C24V reference strain was used at the 38th to 40th passage level in foetal calf kidney cells. The infected cell cultures were centrifuged at 2 000 r/min and the sediment discarded. The supernatant fluid was titrated and only samples of at least $10^{5.0}$ $TCID_{50}$ were lyophilized after the addition of an equal volume of phosphate buffer containing 2% peptone and 10% lactose. The freeze-dried antigen was stored at −20°C in sealed ampoules and used as stock material. Whenever the titre dropped below $10^{5.0}$ $TCID_{50}$ as determined by routine titration, additional antigen was prepared.

Tissue Culture

Monolayers of foetal calf kidney cells grown in roller tubes were used for the serum-virus neutralization tests. Cultures of the first generation were tested for susceptibility to the above virus, and cultures of the second and third generation were used for the neutralization tests. The growth medium consisted of Hank's balanced salt solution supplemented with 5 per cent normal bovine serum, free of MD antibodies, while the maintenance medium was devoid of serum.

Serum-neutralization Tests

The constant antigen serum dilution method was used. Serial fivefold dilutions of serum were mixed with equal volumes of antigen diluted to contain an estimated 100—300 $TCID_{50}$ per 0,1 ml. After vigorous agitation and incubation for one hour at 37°C in a water bath, 0,2 ml of each serum-virus mixture was inoculated into each of two tissue culture tubes. The tubes were allowed to roll for one hour at 37°C, after which 1,0 ml Hank's maintenance medium was added to each tube. The roller drums were placed in the incubator, and the final reading of the tubes was made on the seventh day after inoculation. Serum samples which showed a 1 : 5 or greater neutralizing antibody titre against MD virus were regarded as positive.

*Section of Virology, Veterinary Research Institute, Onderstepoort.

RESULTS

The results of tests conducted on approximately 1 200 sera are presented in the table, classified according to geographical origin. It is apparent that a high percentage of the cattle population in southern Africa possesses neutralizing antibodies to MD virus. The higher incidence rate in the samples from Botswana may be due to the fact that they were collected only from farms on which mucosal disease was repeatedly diagnosed.

Table: PRESENCE OF MD NEUTRALIZING ANTIBODIES IN CATTLE IN SOUTHERN AFRICA

Country	NUMBER OF ANIMALS			Percentage positive
	Tested	Positive	Negative	
Republic of South Africa				
Province Transvaal	235	169	66	72
Province Orange Free State	60	46	14	77
Province Natal	391	199	192	51
Province Cape	382	216	166	57
Rhodesia	80	35	45	43
Botswana	100	88	12	88
TOTAL	1 248	745	687	60

DISCUSSION

The results clearly indicate a very high incidence of neutralizing antibodies against MD virus. The fact that many sera possessed neutralizing antibody titres as high as 1 : 625 indicated that the MD virus prevalent in southern Africa is very closely related or identical to the Oregon C24V strain.

Despite the apparent prevalence of the virus in South Africa, clinical disease is relatively rare and consequently at this stage it cannot be regarded as a major problem in this country. It is only on farms where intensive cattle farming is practised that the disease manifests itself and causes economic problems. On account of the observations in this country and abroad, the serological methods are inadequate to assess the economical importance of mucosal disease [4].

The isolation of the virus in tissue culture presents difficulties because of the cellular resistance arising from non-cytopathogenic strains of MD viruses [3, 6]. The foetal calf kidney cells prepared in our laboratory repeatedly have been found to be resistant to the cytopathogenic Oregon C24V reference strain. Therefore, only batches of cells which were susceptible to C24V virus were employed for the neutralization tests and for primary MD virus isolation. In 1970, MD virus was successfully isolated from diseased animals (Theodoridis, unpublished results). These strains, which produce a cytopathogenic effect similar to that of C24V virus, will be compared serologically with the reference strain and with each other in due course.

ACKNOWLEDGEMENTS

The authors thank the State Veterinarians and the Directorate of the Field Service for providing the sera and Miss S. M. Geyer with her team for propagating the tissue culture. Sincere thanks are expressed to Dr K. E. Weiss for initiating this survey and for his permission to publish this paper.

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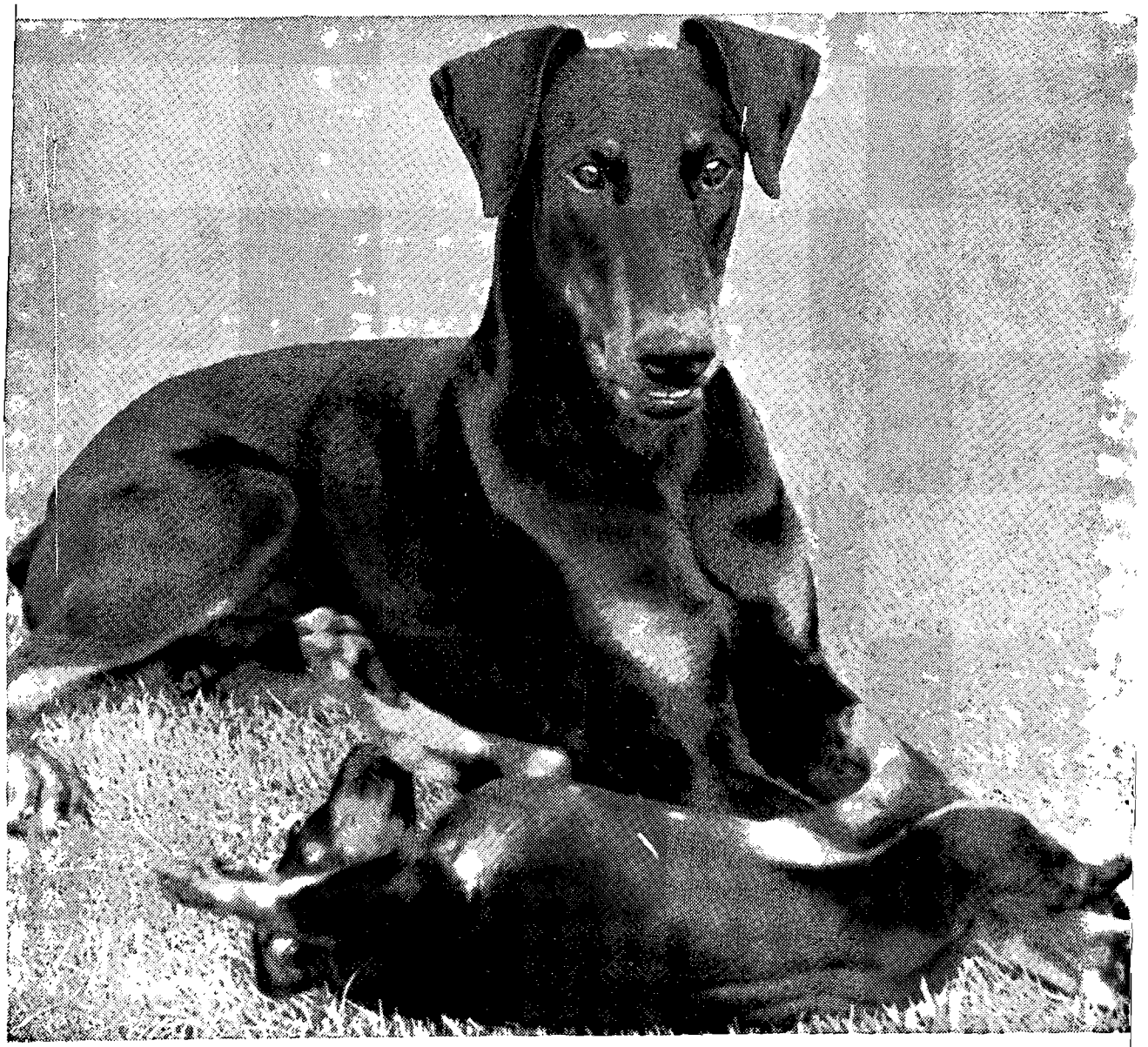

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Jl S. Afr. vet. Ass. 44 (1): 65—68 1973

CASE REPORT GEVALVERSLAG

DIAGNOSIS OF EXTENSIVE SPINAL OSTEOARTHRITIS IN A DOG USING THERMOGRAPHIC AND TOMOGRAPHIC PROCEDURES

R. L. TOLLMAN*

SUMMARY

A case of intermittent hind quarter paralysis and paresis in a dog is presented, in the examination of which conventional roentgenographs failed to yield specific diagnostic information. By means of thermography the exact site of the lesion and its inflammatory nature were determined. This allowed tomography to be applied to arrive at an accurate and specific diagnosis. The principles are explained and the procedures described briefly.

PATIENT PRESENTATION

The patient, a 2-year-old black male Labrador dog, was presented, suffering from intermittent attacks of hind quarter paresis and paralysis, apparently precipitated by exercise. There was a concomitant tachycardia, ptyalism and a partial dysphagia. Prior to the first noted attacks the patient had been involved in a fight, in which it had sustained neck injuries.

RELEVANT CLINICAL FINDINGS

Habitus

Episodes of hind quarter paresis and paralysis were observed, often immediately after the patient was removed from his cage. These episodes could be precipitated by exercise. Characteristically there was a 'warming-up' effect on exercise, and it took longer and longer to precipitate each episode. Episodes were characterized by prodromal unwillingness to walk or run, stiffness and then collapse into a sitting position, followed by total recumbency and inability to rise. Kyphosis was noted before collapse; the patient would still wag his tail after collapse. There was an occasional display of parasympathetic stimulation, such as urination, penile erection and defaecation. There was difficulty in climbing steps owing to an inability to push with the hind legs. Rectal palpation produced signs of collapse and pain. When the patient was picked up, pain was caused and the patient would groan. There was constant ptyalism and tachycardia, with a resting pulse rate of ±130, rising to 175/180 on exercise.

Neurological Findings

There were depressed gag and cough reflexes, partial dysphagia and a depressed eyeball pressure reflex, all indicating damage to the vagus nerve. This conclusion was further supported by lack of vagal response to atropine administration. Reaction to segmental spinal pinpricks indicated a segmental hyposensitivity over the lumbar area. The patellar reflex was depressed immediately after each attack, with rapid recovery to normal. No other neurological abnormalities could be detected.

Blood Chemistry

1. The serum alkaline phosphate levels were raised to 52,5 and 58,3 K.A. Units on two successive tests.
2. Slightly raised serum Ca levels of 11,3 and 12,7 mg/L 100 ml were found on two successive tests.

Electrocardiography

1. Notched R wave possibly suggestive of cardiac hypertrophy.
2. Tachycardia, with limited response to atropine administration.

Atropine Test

Atropine was administered to test the extent of vagal function. The first test elicited a limited vagal response. Successive testing at ten day intervals indicated a return of vagal response.

*Present address: 42 Murray Street, Waverley, Johannesburg. Article written when author was a final year student at the Faculty of Veterinary Science, Onderstepoort.

Radiography

Conventional radiography revealed non-specifiable pathology of the fifth and sixth lumbar interspaces. Analysis of high definition radiographs of the area was also inconclusive, as was that of soft radiographs. The only pathology that could be seen was a greying of the fifth and sixth lumbar interspaces in dorsoventral view, while the lateral views of the same area revealed no discernible pathology. A tentative diagnosis was made of a plastic disc lesion which was able to slip in and out of position and it was decided to proceed with myelography despite all its attendant risks. Before this was attempted, however, a thermographic camera on display at Onderstepoort became available and the patient was submitted to thermographic examination.

Thermography

Principle: Thermography is a technique which shows temperature differences on an object in the form of a thermal picture; it utilizes the natural infrared radiation which varies with the surface temperature of the object. The camera scans the field of view and focuses the infrared radiation on to a detector which converts the infrared signal into an electrical one. After amplification, the signal controls the electron beam of a TV monitor tube. The beam sweeps over the screen, forming a thermal picture: lighter parts represent areas with higher temperatures and darker parts relatively cooler areas. The sensitivity of the system is such that the camera will detect hot areas located beneath the skin, the heat being transmitted to the surface and reflected as white areas on the thermographs. By electronic manipulation it is possible to selectively isolate temperature equivalent areas and express these as isotherm displays.

Equipment: This consisted of an 'Aga Thermovision 680' camera with an indium antimonide (InSb) detector cooled in liquid nitrogen at −196°C (Spectral range detection 2—5,6μm), and an 'Aga Thermovision 680 TV Display'† with preset photographic recording facility using a "Polaroid" back.

Temperature Measurement: The equipment was capable of object temperature measurement from −30°C to 850°C, with a minimum detectable temperature difference of less than 0,2°C at +30°C object temperature. The isotherm function allowed single or dual selection.

†Aga Thermovision, Aga Instruments, Lidingo, Sweden.

Rationale: Radiographic evidence had indicated that there was pathology of the fifth and sixth lumbar interspaces. Should the pathological condition be caused by an inflammatory process or by a possible partial thrombus leading to an ischaemic condition, the resultant thermogram would express either 'hot' or 'cold' areas on the surface of the skin.

Results: A total of 8 thermograms was taken, including two isotherms to check the degree of equivalent vascularisation of the two hind legs. A thermogram was also taken to evaluate incidental pathology of the atlanto-axial joint where a definite lesion of osteoarthritis had been found during radiographic examination.

Analysis of thermograms of the lumbar areas revealed that there was an extensive inflammatory process over L 2, 3, 4, 5, and 6; at L 5 and 6 there was the most contrast. The areas over L 5 and 6 were then enlarged and the contrast further increased, confirming lumbar area inflammation (Figs 1 and 2).

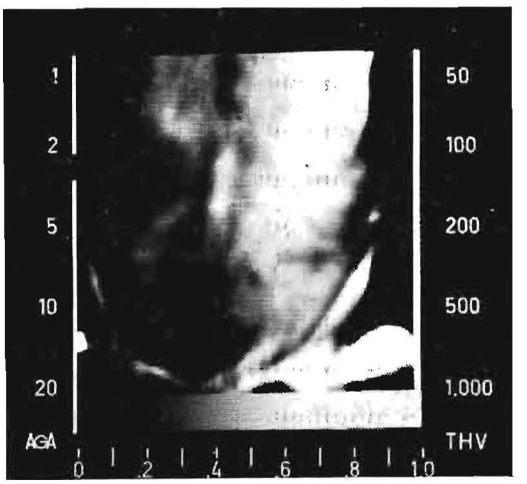

Fig. 1. Thermograph of the patient in a sitting position with 'hot' (light) areas over L5 and L6. The dark, 'cold' area is the sacral area, which had been cooled by the table.

Equivalent thermal isotherms were then then done to assess the degree of blood flow to the hind legs, in order to exclude possible iliac thrombosis. The isotherms showed that both legs were well vascularized and there was no iliac thrombosis (Fig. 3).

Analysis: The multiple nature of the lesions excluded a disc luxation and a possible vas-

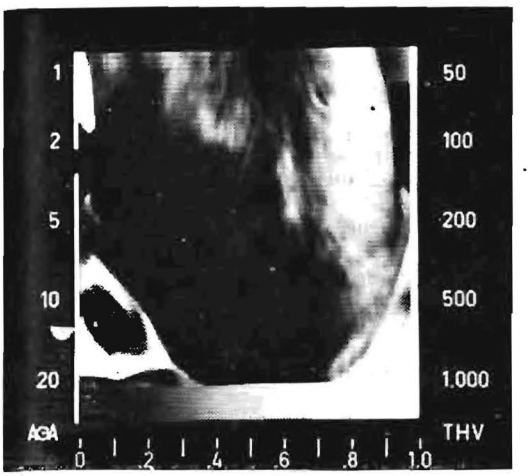

Fig. 2. Patient sitting, thermograph further contrasted and the lumbar inflammation clearly seen as the two white spots on the spine.

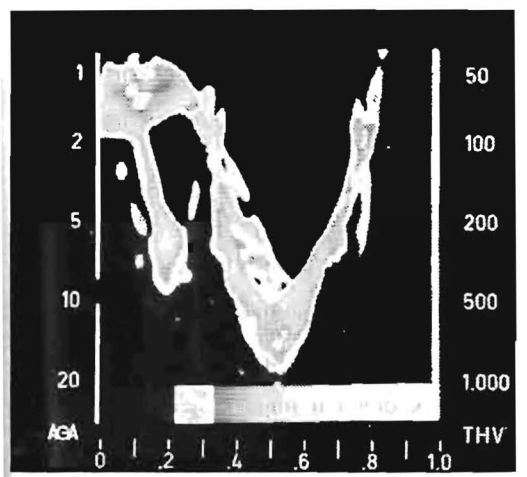

Fig. 3. Isotherm of the patient's hind legs, the patient lying on his back with the legs held up vertically. The white areas are all areas of equivalent temperature; the temperature gradients are equally distributed along the medial surfaces of the legs thus excluding iliac thrombosis.

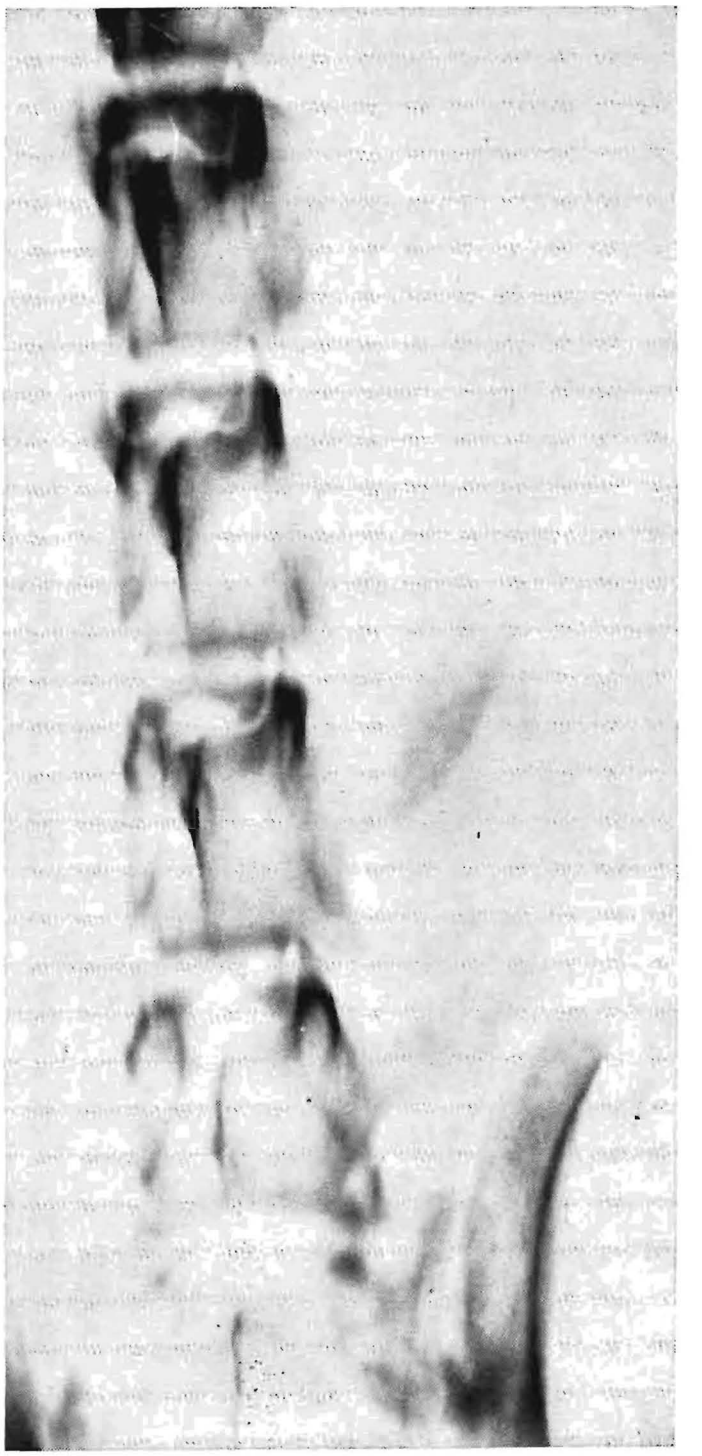

Fig. 4. Tomograph of the spine through the plane of the dorsal articulations. D-V presentation. The edges of the dorsal articulations at L5 and L6 interspace are roughened and lack definition.

cular lesion was excluded by means of the isotherm display. Evidence tended to indicate the possibility of an inflammatory osteoarthritis and, on the strength of this, it was decided to proceed with tomography in an attempt to outline the articulating surfaces of the vertebrae.

Tomography

Principle: Tomography is a special radiographic technique used to demonstrate a selected layer or layers in the body and is of special use in 'sectioning' the spinal structures so as to define clearly all structures lying within one plane. Motion is used to blur out all structures except those in the plane or layer of interest. The X-ray tube and cassette holder are connected and, during the exposure, move in opposite directions across the subject. Depending on the point at which they pivot, that layer of the body will be shown clearly with no blurring, while all deeper and shallower layers will be blurred. The point of pivot may be moved upwards or downwards and, in this way, the body of the subject can be 'sectioned' into layers.

Results: Tomographs†† through the dorsal articulating surfaces of the lumbar vertebrae indicated that there was distortion and roughening of the edges with the interarticular spaces obliterated at the intervals between L 5—6 and L 6—7.

FINAL DIAGNOSIS

Results obtained from thermographic and tomographic investigation indicated an osteoarthritis of the dorsal articulating surfaces of vertebrae L5 and L6, while thermographic analysis revealed further involvement of L2, 3 and 4 but of such a degree that radiographic and tomographic analyses were unable to clarify the pathology.

TREATMENT

Damage to the vagus nerve regenerated without further aid and all vagal function returned to normal. The patient was placed on a long term course of corticosteroid therapy; a follow-up revealed that function had returned to normal, with a complete cessation of attacks. The case has an unfortunate ending, however, in that the patient contracted peracute biliary fever and, possibly owing to suppression of the immune response by the corticosteroid therapy, died very suddenly.

††Dept. of Radiography, H. F. Verwoerd Hospital, Pretoria.

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CASE REPORT GEVALVERSLAG

NEONATAL ANAPLASMOSIS IN A CALF

J. E. BIRD*

SUMMARY

A calf which suffered from generalized icterus, anaemia, opisthotonus and nervous symptoms two days after birth died a day later. A diagnosis of anaplasmosis was made at autopsy; this was confirmed by demonstration of *Anaplasma marginale* in blood smears. It was concluded that the calf must have contracted the infection *in utero*.

INTRODUCTION

Anaplasmosis is a tick-borne disease which is widespread in South Africa [1]. It is generally accepted that the disease is found in older animals, and that most calves have a resistance to clinical infections, developing only mild forms of the disease [1].

Results of experimental work on intrauterine infection of anaplasmosis have led researchers to believe that this is a rare and unimportant source of infection [2].

The subject of this paper is a case of fatal anaplasmosis in a three days old calf.

HISTORY

The calf was born on the morning of October 30, 1971. It had appeared to be healthy, and when seen by the owner that afternoon it had been suckling vigorously. The following morning the calf was found lying in the veld. It was unable to rise and was very weak. The cow and calf were taken to a shed, where attempts were made at bottle feeding the calf. The calf continued to weaken, and the following morning, when the owner noticed opisthotonus setting in, he decided to seek veterinary assistance.

The dam of the calf, an Africander, was pregnant when purchased in 1970 and had calved on the farm. The calf in question was her first by the owner's own bull, a Jersey-Brahman cross. The farmer claimed that a month before the present case he had lost another calf in the same manner. It had been strong at birth, had weakened on the third day and gone down; progressive opisthotonus had set in. It had survived for four days in all, and then the owner, attributing the symptoms to a hereditary effect (as the dam was the daughter of his own bull) had slaughtered the calf. As far as could be determined, neither cow had shown any signs of ill health during pregnancy.

Examination of a blood smear, made at the time of the clinical examination and stained with Stevenel's Blue[3], was negative. A tentative diagnosis of *erythroblastosis foetalis* was made on the basis of the history and the negative blood smear examination.

The question of a blood transfusion was considered but this was rejected on economic grounds. Instead, 800 mg (4 ml of a solution containing 200 mg/ml) Guronsan (Chugai, Tokyo) and 5 ml Genebile (Willows-Francis) were administered intramuscularly.

Blood and urine samples were collected for clinico-pathological examination as well as blood samples for blood group typing. The following day blood samples were collected from both dam and sire. These, together with those of the calf, were submitted to the Veterinary Research Institute, Onderstepoort for blood typing.

As the calf had died, an autopsy was carried out at the same institute (see below).

CLINICAL SIGNS

The calf was recumbent and semi-comatose when presented for examination. There was severe opisthotonus and the right hind limb showed tonic-clonic twitching at intermittent intervals. There was a marked generalized icterus, and the pulse was weak and rapid (180/min). Respiration was shallow and the rate 38/min. The rectal temperature was 100,6°F. In addition, the calf, though depressed, ground its teeth intermittently. Pedal and pupillary reflexes were present but the calf appeared to be unable to see.

The results of clinico-pathological tests are listed in tables 1 and 2.

*P.O. Box 15, Hekpoort, Transvaal.

Table 1: CLINICO-PATHOLOGICAL ANALYSIS OF URINE

Strip test -- semiquantitative*

pH	7
Protein	+ + + +
Glucose	–
Ketones	–
Bilirubin	+ + +
Blood	–

*Bililabstix, Ames Company

Table 2: CLINICOPATHOLOGICAL ANALYSIS OF BLOOD*

Haematology

	Value	Normal
White cell count	$25 \times 10^3/mm^3$	$8 \times 10^3/mm^3$
Red cell count	$4{,}75 \times 10^6 mm^3$	$5–8 \times 10^6/mm^3$
Packed cell volume	41%	38–40%
Mean corpuscular volume	86 μm^3	40–60 μm^3
Haemoglobin	13,9g/100ml	10–14g/100ml
Mean corpuscular haemoglobin	27,5 ng	27–31 ng
Mean corpuscular haemoglobin concentration	32%	26–34%
CHEMISTRY		
Total bilirubin	10mg/100ml	0,1–0,4mg/100ml
Blood urea nitrogen	100mg/100ml	6–27mg/100ml
Cholesterol	165mg/100ml	80–120mg/100ml
Total plasma protein	7,5g/100ml	6,7–7,5g/100ml
Albumin	0,25g/100ml	3,1–3,7g/100ml

*Clinical Screening, Jeppe Street, Johannesburg.

RESULTS OF BLOOD GROUP TYPING

Erythroblastosis foetalis, which has been known in foals for years, is due to a blood group factor shared by the sire and its offspring but which is not present in the dam. This factor acts as an antigen in the dam during gestation, producing antibodies which are secreted in the colostrum. These antibodies cause a haemolytic process in the offspring shortly after it has suckled.

In this particular case no common factor could be established between the sire and the calf which was not shared by the dam.

AUTOPSY

A marked icterus tended to mask the anaemic changes. There was congestion of the meningeal blood vessels and marked congestion of the kidneys. The liver was enlarged and yellow owing to bile stasis. The gall bladder was empty, the bile duct patent, and the intestinal contents were bile-stained. The spleen was contracted.

Examination of Giemsa-stained blood smears revealed a severe infection of *Anaplasma marginale:* a diagnosis of anaplasmosis was therefore made.

DISCUSSION

The incubation period for anaplasmosis is remarkable for its length[1, 2]. The calf, which had a severe clinical manifestation of anaplasmosis at two days of age, must certainly have contracted the disease *in utero.*

Intra-uterine transmission of anaplasmosis appears to be extremely uncommon. Only one of seventeen calves born to cows which were pregnant while infected became infected with A. *marginale*[2]. This was revealed by the subinoculation of blood into a susceptible adult, since the calf did not show clinical signs. *Ristic*[2] was unable to establish the presence of *A. marginale* organisms in calves born to cows infected while pregnant and suggested, therefore, that intra-uterine transmission is infrequent and apparently unimportant in the spread of anaplasmosis.

The only description of clinical anaplasmosis in a newborn calf is given by Wandera & Munyua[4]; a four-day-old calf developed anaplasmosis and succumbed with an erythrocytic infection rate of forty per cent.

ACKNOWLEDGEMENTS

Thanks go to the following persons for assistance: Prof. T. F. Adelaar, Prof. D. R. Osterhoff, Dr. J. M. Olivier and Dr. R. D. Bigalke of the Veterinary Research Institute, Onderstepoort; Prof. J. M. M. Brown of the Medical Faculty, University of Pretoria.

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Jl S. Afr. vet. Ass. 44 (1): 71—73 1973

REPORT VERSLAG

SECOND WORLD CONGRESS OF ANIMAL FEEDING — MADRID, OCTOBER, 1972

P. A. BOYAZOGLU

The second World Congress was held during the six days of 23rd to 28th October 1972. Its aim was to condense the knowledge of the period following the first Congress (1966) and to predict trends during the immediate future.

Eleven hundred specialists in the field of nutrition from 54 countries attended at the national congress centre in Madrid, a modern palatial structure with all possible facilities for such an event.

The initiative was taken by the Veterinary Faculty of Madrid and whereas Prof. Dr. A. De Vuyst of Belgium was the President, the organization was entirely that of the Secretary-General, Prof. Dr. Carlos Luis De Cuenca of Spain, a discreet, highly capable organizer.

Attention is drawn to some of the names and topics which were highlights owing to the depth of knowledge of the speaker and the future significance of the topic.

The effect of wet feeding on livestock performance was dicussed by T. J. Cunha (U.S.A.). He drew attention to the differences between liquid feeding, wet feeding and pastes. His conclusions were that pigs in particular benefitted from liquid feeding when feed was restricted, their rate of gain and feed efficiency being much improved. The water to feed ratio in such cases was $2\frac{1}{2}/1$. Cattle do not benefit from liquid feeding. The decision to change to liquid feeding, however, is encouraged by the mechanization of the system, reduction in labour and increased palatability. The problems associated with the system are the cost of the installation and the segregation of ingredients, or, alternatively, gel formation.

Artificial rearing of pigs was handled by R. Braude (Reading, England) who pointed out the problems that have to be faced with early weaning, but then proceeded to 'dangle the carrot before everybody' of the vast financial advantages of the three litter sow year. This necessitates artificial rearing from as early as 1—3 days of age, with even more problems than weaning at three weeks.

J. Dreiss (Dawe's International, Belgium) discussed some concepts related to the manufacturing of premixes. Feed formulators must use additives of repute, they must assure efficient distribution and maintain efficiency for a reasonable period of time. Furthermore, successive batches should be free of the transfer of ingredients from one batch to the following one in the mixer. Important aspects emphasized by Dreiss were particle size of additives, their density, percentage included, electrostatic phenomena, hygroscopic characteristics, and accelerated denaturation as precipitated by choline additions.

Recent advances in swine feeding was an immense piece of work handled by A. Rerat of France. Aspects he gave attention to were feeding for a lean carcase, the slaughter potential of boars, efficiency of protein utilization and their sources, lipids in the diet, appetite effects, the pros and cons of restricted and *ad lib* feeding, and milk production as influenced by earlier weaning patterns. Together with many other topics discussed, this was an excellent survey of the trends in the immediate past.

Digestion of protein and other energy-yielding substrates in the ruminant animal by Armstrong of England was a good paper very well presented, dealing with protein degradation, volatile fatty acids, high grain diets, microbial synthesis and other factors. In particular, methionine was discussed as being of particular interest for the ruminant diet.

Additives in animal feeding, present and future, was an excellent paper, beautifully presented by R. Ferrando of France. He clearly sketched the two pictures, the very biased opposing schools of thought, namely, (a) the prophets of doom regarding the use

of additives and (b) the enthusiasts, who are reluctant to sacrifice the major financial benefits under stress conditions. He emphasized that in many cases Government commissions have been dominated by selected opinions and have not based their conclusions on solid experimentation. It was his opinion that changing environments, further selection and even the increased use of specific-pathogen-free animals under intensive conditions will eventually have a significant influence in adapting current zealous actions.

In a paper on alimentation and animal health, R. W. Dougherty (U.S.A.) drew attention to forages and feeds which, when ingested, produce harmful effects: (1) teratogenic effects—e.g. *Veratrum californicum*, (2) pathological changes owing to moulds—e.g. facial eczema, (3) contaminated industrial wastes—e.g. fluorine and lead, (4) high energy rations fed to incompletely adapted animals. He also drew attention to the reverse situations, in which diets are purposely unbalanced to rectify problems, as with (1) high phosphate/low calcium diets to forestall milk fever, (2) adapting mineral spectrums to fit a local condition.

There are, furthermore, situations where husbandrymen knowingly force animals into abnormal situations and they have to 'make do'. Such is the case of the range animal brought into the feedlot and pushed towards an all grain ration so that the rumen microflora shift from being gram-positive to gram-negative and lactic acid is formed in large quantities, the major problem of grain engorgement. Rumen motility subsides and will be minimal by the time pH drops below 4,5. Recognizing the true problem is half the solution.

Feed influences upon the quality of milk were discussed by A. M. Frens of the Netherlands. Milk quality was assessed according to (1) suitability for dairy product production, (2) tastefulness of the milk for direct consumption, (3) hygienic quality, influenced by the presence of pathogens, (4) bacteriological quality, influenced by the total bacterial content. It is possible to improve the nutritional quality of milk by the selection of the correct diet. Several factors can increase the energy content, such as plant oils and quality roughage. High grain feeding lowers the fat content substantially, as does fine grinding of roughage. Mycotoxins have no direct effect on adult cows, but their milk can affect young animals and infants. High Clostridium concentrations in the rumen can arise from the feeding of silages, leading to an internal source of milk contamination. Many feed sources affect milk taste.

C. Calet, of France, dealt with recent advances in poultry feeding. He pointed out that environment, breeding and nutrition are the three variables which influence productivity and economics. Different breeding lines of birds demonstrate methionine deficiency as either reduced numbers of eggs, reduced egg weights, or reduced body weight, or they show no measurable effects. Should one adapt the ration to the bird, the bird to the ration, or go to a different line altogether? The decision is a critical one when large scale economics are at play. It is not always the highest producer that is the most economical unit! In such cases a good computer programmer can help to take the difficult decision.

In considering new sources of animal and human alimentation, D. P. Cuthbertson of the U.K. pointed out that existing proteins are being adapted to improve their utilization. Proteolytic enzymes are being used to this effect. The agronomists in turn are improving cereals by producing high-yielding opaque 2 maize, rice IR8, "hiporly" barley and triticale (wheat-rye). In these cases both the quantity and the quality of production are taken into consideration. Moir, of Australia, however, was unhappy with the trends, as the rest of the plant material was ignored in their breeding programs.

Bacterial protein has received some attention in the past. Cuthbertson pointed out that, although this source of protein was high in the S amino-acids, the cell walls of bacteria were tough and resistant to rupture. Today the yeasts are in the forefront, as they are more stable genetically and have larger cells with walls that are easier to rupture. Amongst the Algae receiving attention are *Chlorella*, *Scendesmus* and Spirulina. The major breakthrough of our times, possibly has come with the use of hydrocarbon substrates for yeast production as a protein source.

The current situation regarding this specific protein source was discussed by C. A. Shaacklady (BP Proteins Ltd., London) and E. Gatumel (BP, France) in their paper on

safety in use and nutritional value of yeast grown on alkanes. The production of single cell proteins from yeasts, bacteria, fungi and algae was started at the Massachusetts Institute of Technicology in 1967. In this paper primary attention was given to alkane-grown yeasts, i.e. yeasts grown on hydrocarbon fractions which may be a distillate, such as gas oil ("Yeast L"), or linear alkanes of high purity ("Yeast G"). Research of an unbiased nature is being done for the production of single cell proteins in very large quantities. Their nutritional values and uses have been investigated exhaustively to evaluate amino-acid contents and availability, possible chronic or acute toxicity, carcinogenicity and any side effects on reproduction. Levels of inclusion of up to 30 per cent in diets have produced no detrimental effects of any kind since the commencement of research.

The digestibility of yeast is over 80 per cent by the pepsin method, and protein content is between 60 and 70 per cent, depending on the culture method. The amino-acid limitation is methionine, which, however, is available in large quantities and at low cost. A 0,3 per cent addition raises the biological value of yeast G from 61 to 91 per cent for rats. Pigs and poultry of all ages have been fed with very encouraging results.

Presently, therefore, protein of a very constant composition, with a long shelf life, and a high biological value can be produced economically and independent of climatic conditions. Current production at the pilot plant at Grangemouth is 4000 tons per year; at Lavera in France it is 20 000 tons per year. The Japanese are said to be establishing two factories. The production of single cell proteins can be considered as a milestone in human and animal nutrition.

Our own contribution, liver mineral analysis as indicator of nutritional adequacy, was an invited paper on methods incorporating atomic absorption spectroscopy and a specific sampling procedure to evaluate mineral imbalances in animals accurately and rapidly. Over the past five years basic laboratory techniques had been adapted for field situations. The method is being applied extensively, and where mineral deviations, be they excesses or deficiencies, are diagnosed, corrective procedures are bringing long term financial benefits at minimal cost.

This World Congress was an unqualified success of efficient communication amongst nutritionists. It has condensed current thinking to a meaningful concentration, and has stimulated thinking for the period ahead.

(See also INFORMATION on page 99).

SPESIALE VERSLAG

SPECIAL REPORT

DIE EUROPESE EKONOMIESE GEMEENSKAP VAN NEGE EN SY LANDBOUPOTENSIAAL

J. G. BOYAZOGLU EN W. P. BURGER

REDAKSIONELE AANTEKENING

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EDITORIAL NOTE

This special report on *The European Economic Community of Nine and its Agricultural Potential,* complementary to and expanding upon the information published in the Journal of the South African Veterinary Association, Volume 43, No. 3, page 319, has been compiled by the Agricultural Counsellor (Technical), Dr. J. G. Boyazoglu, and the Agricultural Attaché, Mr. W. P. Burger, of the South African Embassy, 51 Avenue Hoche, Paris (8e), France. It has been taken over from the 'Agricultural Report—Europe' No. 3 of January 1973 with kind permission of the Department of Agricultural Technical Services of the Republic of South Africa.

DIE EUROPESE EKONOMIESE GEMEENSKAP VAN "NEGE" EN SY LANDBOUPOTENSIAAL

I - INLEIDING

Op 1 Januarie 1973 het die Europese Ekonomiese Gemeenskap van "NEGE" 'n werklikheid geword. Hierdie geografies vergrootte E.E.G. sal ekonomies so= wel as polities swaar weeg op die internasionale weegskaal van wêreldgebeure. Met 'n totale bevolking van 253.363.000 teenoor die 205.000.000 van die V.S.A. en die 244.000.000 van Rusland, sowel as 'n nasionale brutoproduksie van 636 miljard dollar, het 'n gedugte wêreldmag tot stand gekom waarmee veral lande wat van uitvoer afhanklik is, mee rekening moet hou. Met meer as 40 persent van die wêreld se totale invoere, is die E.E.G. by verreweg die belangrikste handelsvennoot in die wêreld. Die belangstelling in hierdie handels- en tegno= logiese vennoot het gedurende die afgelope tyd skerp gestyg in Suid-Afrika. Dit is egter veral op die gebied van die landbou waar die potensiaal van hier= die vennoot onderskat word.

In vorige publikasies van die Europese landboukantoor van die Departe= ment van Landbou-Tegniese Dienste is gepoog om die landelike, wetenskaplike, sosio-ekonomiese en handelsaspekte van die E.E.G. bekend te stel. Hoewel meeste van dié inligting nog van toepassing is, word dit as noodsaaklik beskou dat hierdie inligting, in die lig van die onlangse gebeure, op datum gebring word.

II - DIE EKONOMIESE MAG VAN DIE E.E.G.

Te oordeel aan die kenmerkende tekens van die ekonomie, voldoen die Gemeenskap van "Nege" waarlik aan die vereistes van 'n supergroot wêreldmoond= heid. Die omvang van hierdie eenheid in sekere sektore word aangedui in Tabel 1 (sien aanhangsel).

Dit is duidelik dat die vergrootte E.E.G. na die V.S.A. gesien kan word as die tweede ekonomiese wêreldmag met betrekking tot bruto nasionale produk, en gesien uit die interne handelsoogpunt, die magtigste invoerder in die wêreld (40 persent teenoor die 14 persent van die V.S.A.). Die E.E.G. be= skik oor die belangrikste handelsvloot en is die grootste produseerder van motorvoertuie en staal in die wêreld.

Uit 'n kwalitatiewe sowel as kwantitatiewe oogpunt gesien, word die E.E.G. as 'n landboukundige reus beskou. Die Gemeenskap is die grootste pro= dusent van melk en melkprodukte en word slegs deur die V.S.A. oortref wat vleisproduksie betref. Daarbenewens is hy die grootste invoerder van kwali= teitslandbouprodukte en grondstowwe terwyl hy die leidende wetenskaplike en tegnologiese rol speel op die gebied van landelike navorsing en ontwikkeling.

Die ekonomiese bestendigheid van die Gemeenskap van "Ses" word be= klemtoon deur die feit dat die jaarlikse groeikoers van die nasionale produk gedurende 1960 tot 1970 op 5,3 persent gehandhaaf is teenoor die 4 persent van die V.S.A. Die globale groeikoers van die Gemeenskap van "Nege" vir dieselfde periode het egter gedaal na 4,7 persent as gevolg van die feit dat die Verenig= de Koninkryk slegs 'n groeikoers van 2,8 persent kon handhaaf.

Dit is egter uiters moeilik om die implikasies van die toetrede van Groot Brittanje tot die E.E.G. te evalueer, soos gesien uit die oogpunt van die landbou en dié van die industrie. Die industrie word nie so maklik deur middel van nasionale beleid omskryf soos in die geval van die landbou nie, ge= volglik heers daar aansienlike verskille tussen die industriële beleidsrigtings van die verskillende Gemeenskapslande waardeur die voorspelling van toekomstige ontwikkelinge gekompliseer word. Die feit bly egter staan dat hoewel Groot Brittanje wel aansienlik tot die ekonomiese potensiaal van sekere sektore sal bydra, word 'n mate van ekonomiese stagnasie ook in die Gemeenskap ingebring soos reeds gesien uit sy relatiewe lae groeikoers van 2,8 persent, en daarby

gesien, die swak vertoon van die pond sterling. Daar kan egter sekerlik aan= vaar word dat die toetreding van die Verenigde Koninkryk tot 'n nuwe mark van byna 200 miljoen verbruikers, 'n nuwe impetus en dinamiek aan sy ekonomie sal gee. Uit die industriële oogpunt gesien, is Wes-Duitsland tans by verreweg die belangrikste faktor in die E.E.G. In 'n onlangse Amerikaanse studie van die Hudson Institute, is dit egter bereken dat Frankryk as lid van die E.E.G., in 1985 een van die belangrikste industriële magte in die wêreld sal wees, ter= wyl 'n Russiese ekonomiese studie tot die gevolgtrekking kom dat Frankryk in 1995 die wêreld se derde industriële mag sal wees na die V.S.A. en Japan. Dit is egter juis interessant om daarop te let dat Frankryk alleen reeds Japan se gelyke is met 6,5 persent van die totale wêreldinvoer, en dat Wes-Duitsland reeds 10 persent van die wêreld se totaal invoer, terwyl die invoere van Italië (5,1 persent van wêreldtotaal) dié van Rusland (4 persent) oortref.

Met die uitsondering van Japan wat 'n groeikoers van 11 persent hand= haaf, sal die nuwe E.E.G. ongetwyfeld sy leidende rol in die industrie hand= haaf.

III - NUWE EKWILIBRIUM IN DIE LANDBOU

Met die verloop van tyd kan daar verwag word die toename in hulp= bronne en produksie sal aanleiding gee tot 'n nuwe ekwilibrium in die landbou van die nuwe Gemeenskap van "Nege". Die toevoeging van die grondgebied van die drie nuwe lande en hul kenmerkende produksiepatroon en kommersialisasie sal 'n deurslaggewende rol speel in hierdie verband (Tabel 2).

1. Hulpbronne

Die grondgebied van die nuwe Gemeenskap van "Nege" bedra ongeveer 90 miljoen ha insluitende die 12,6 miljoen ha van Groot Brittanje, 2,7 miljoen ha van Denemarke en 5,4 miljoen ha van Ierland. Die landboubevolking van die Gemeenskap het gegroei tot 11 miljoen met die toevoeging van 1,3 miljoen aktiewe landbouers. Frankryk bly egter nog die dominerende faktor in die landbou van die Europese Gemeenskap. Hy besit meer as 50 persent van die bewerkbare grond en meer as 30 persent van die reeds bewerkte grond en is daarbenewens na Ier= land die mees yl bevolkte land in die E.E.G.

Sedert die einde van die oorlog het Groot Brittanje drastiese stappe geneem om landbouproduksie te verhoog. Hierdie stappe is geneem na aanleiding van die duur les wat tydens die oorlog geleer is met betrekking tot die prob= leme wat ontstaan wanneer 'n land van buitelandse landbouhulpbronne afhanklik is in krisis tye. Vandag het Groot Brittanje se koringproduksie die 3,5 mil= joen ton kerf bereik teenoor die 30 miljoen ton van die Gemeenskap van "Ses". Ook wat ander graansoorte en veevoer betref is daar eweneens ernstige pogings aangewend om produksie te verhoog terwyl belangrike vordering gemaak is op die gebied van die veeboerdery.

Die landbouproduksie van Denemarke is feitlik uitsluitlik toegespits op veeboerdery waaruit bykans 90 persent van die landbou-inkomste afkomstig is.

Die afgelope aantal jare word veral gekenmerk deur die skerp styging in die produksie van vars vleis en pluimvee. In Ierland is 80 persent van die landbou-inkomste afkomstig van veeboerdery en in die besonder beeste en skape.

2. Struktuur

Oor die algemeen is die grondbenuttiging in die drie nuwe lande meer intensief as die gemiddelde van die E.E.G. In Groot Brittanje byvoorbeeld word die gemiddelde plaasoppervlakte op 32 ha gestel teenoor die gemiddelde oppervlakte van 13 ha in die E.E.G. en die 20 ha in Frankryk. Hierdie kenmerk van die nuwe lede kan verklaar word deur die feit dat daar slegs 'n beperkte oppervlakte beskikbaar is vir die landbou. Hulle word gevolglik verplig om wetenskaplike boerdery metodes toe te pas om die beskikbare grond ten volle te

benut en is hulle dus sterker georganiseer ten opsigte van koöperasies en sindikate as wat dit nodig is in die E.E.G. as geheel. Hierdie kenmerkende verskille ten opsigte van grondgebruik tussen die ou en nuwe Gemeenskapslande word geïllustreer deur die feit dat Frankryk byvoorbeeld meer as 30 persent van die totale bosoppervlakte in die E.E.G. op sy grondgebied het.

Wat die landboustruktuur betref, is dit egter die probleem van produkte pryse wat die swaarste gewig dra. Die Britse en Ierse produkte pryse is betekenisvol laer as dié wat deur produseerders in die E.E.G. verkry word.

Afgesien van die suiwere ekonomiese aspekte, is dit veral die stelsel van kommersialisasie en prysbeheer wat aansienlik verskil tussen Engeland en die E.E.G. In die geval van laasgenoemde, word aanvraag grotendeels deur interne produksie beheer gereguleer terwyl die stelsel teen buitelandse kompetisie beskerm word deur onder andere gebruik te maak van invoerheffings op sommige produkte. Veral gesien in die lig van sy handelsooreenkomste met die E.E.G. van "Ses", was Groot Brittanje tot op datum verplig om die kanale na die wêreldmarke oop te hou om tekorte in landbouprodukte aan te vul. Prysbeheer deur middel van invoerheffings was dus in die praktyk moeilik uitvoerbaar. Die probleem is egter tot 'n groot mate oorbrug deur die inkomste van die produsent jaarliks na afloop van 'n prysstudie, te subsidieer en gevolglik word die "betalingstekort" nie direk van die verbruiker verhaal nie. Groot Brittanje is tans besig om sy beleid in lyn te bring met die landboubeleid van die E.E.G. en sal ongetwyfeld meer in dié rigting beweeg in die toekoms. Trouens die oorspronklike Britse landboubeleid wat feitlik geheel en al deur die besondere meganisme van prysbeheer in stand gehou is, sal progressief aanpas met die aanvang van die Mansholt Plan. Die Britse landboustruktuur wat reeds in hierdie rigting georïenteer is, sal dus 'n verdere modernisering ondergaan.

Aangesien die verskillende lande van die E.E.G. ten opsigte van landboubeleid in dieselfde rigting georïenteer is, word 'n punt van konvergensie ongetwyfeld in die vooruitsig gestel.

IV - LANDBOUPRODUKSIE

Die jongste bekende vergelykende produksie statistieke van die landbou in die nege E.E.G. lande word in Tabel 3 opgesom (sien aanhangsel).

a - Graan

Frankryk is by verre die grootste produseerder van graan in die E.E.G. met die uitsondering van rog en hawer wat hoofsaaklik in Duitsland gekweek word.

b - Vleis

Duitsland produseer 2/3 van die varkvleis; Frankryk 3/5 van die beesvleis en Groot Brittanje 1/2 van die skaap- en bokvleis in die E.E.G.

c - Suiwelprodukte

Frankryk gevolg deur Duitsland is die grootste produseerders van suiwelprodukte.

d - Veegetalle

Groot Brittanje beskik oor meer as die helfte van die skape en bokke; Frankryk het die meeste beeste en Duitsland die meeste varke.

V - PRODUKSIE EN BEMARKINGSPATROON

Ten slotte is dit wenslik om enkele opmerkings te maak met betrekking tot produksie en die moontlike invloed van die nuwe Gemeenskap van "Nege" op produkte verkeer tussen die verskillende markte. Hierdie opsommende gedagtes is saamgestel uit uittreksels van persberigte wat verskyn het na afloop van die totstandkoming van die E.E.G. van "Nege".

1. Vleisbedryf

a - Beesvleis

Die E.E.G. van "Ses" was die wêreld se grootste verbruiker en invoerder van hierdie produk, veral wat betref die hoër kommoditeitsgroep. Die toetrede van die drie nuwe lidlande tot die E.E.G. sal nie veel verander= ing in hierdie situasie teweegbring nie, want alhoewel Ierland en Denemarke 'n oorskot van ongeveer 450.000 ton vleis produseer, is dit ongeveer gelyk aan die Britse tekort. Daar kan dus aanvaar word dat die E.E.G. van "Nege" ongeveer 10 persent beesvleisbehoeftes van buite sal moet invoer. Die huidige tekort in die E.E.G. word geskat op ongeveer 700.000 ton bestaande uit 50:50 vars hoë kwaliteit vleis en fabrieksvleis. Die tekort van 300.000 tot 400.000 ton fab= rieksvleis moet gesien word as 'n belangrike potensiële mark vir Suid-Afrika. Hoewel daar 'n sterk poging in die E.E.G. aangewend word om die produksie van vleis te verhoog, is daar so 'n vinnige toename in verbruik, dat die tekort na berâming binne drie tot vyf jaar tot 'n miljoen ton kan styg.

b - Skaapvleis

In die Gemeenskap van "Ses", was Frankryk by verreweg die grootste invoerder van veral hoë kwaliteits lamvleis. Hierdie toedrag van sake sal geheel en al verander met die toetrede van Groot Brittanje en Ierland. Aangesien die Britse verbruik van skaapvleis baie groter is as beesvleis, sal die tekort van 35.000 ton van die E.E.G. van "Ses" styg tot bykans 450.000 ton vir die E.E.G. van "Nege". Alhoewel drastiese stappe tans geneem word om ver= al die skaapvleisproduksie van Frankryk, Skotland en Ierland te verhoog, kan daar verwag word dat die tekort steeds sal toeneem as gevolg van die vinnige styging in verbruik. Aangesien die markprys van skaapvleis in Frankryk onge= veer 60 persent hoër is as die wêreldprys, en dié van Engeland 30 persent laer is as dié van Frankryk, is dit heel waarskynlik dat die Skotse en Ierse produ= sente eerder die Franse mark sal betree. Die tekort in Engeland sal na verwag= ting veral deur Nieu-Seeland aangevul word met bevrore karkasse, wat minder gewild is op die vasteland.

c - Varkvleis

Met 'n graad van selfversorging van 102 tot 104 persent, is die vergrote E.E.G. in staat om in sy eie behoeftes van varkvleis te voorsien. Met hul produksie van 600.000 ton varkvleis, sal dit veral die Dene wees wat voordeel gaan trek uit uitvoere na die ander ledelande.

Enkele tegniese aspekte is egter van belang om hier te noem:

- die tradisionële vark karkas weeg van 55 tot 60 kg in die drie nuwe lidlande terwyl dit in die ou E.E.G. lande van 75 tot 80 kg weeg;

- hoewel Groot Brittanje selfversorgend is wat varkvleis betref, voer hy 'n enorme hoeveelheid spekvark karkasse in vanuit Denemarke, Ierland, Pole en Swede.

2. Pluimvee

Die invloed van die vergrootte Gemeenskap sal veral gekenmerke word deur die verhoogde kapitaaltoevloei wat in hierdie sektor verwag word. Produksie en industrialisasie van die pluimveebedryf word in Europa al meer deur enorme nasionale en europese internasionale groepe hanteer. Daar kan ver= wag word dat die ontwikkeling van hierdie bedryf veral 'n rol kan speel op die prysstruktuur en produksiepatroon van die graanbedryf.

3. Vrugte en Groente

Die oopstelling van die Britse mark vir Franse, Italiaanse en selfs Nederlandse vrugte- en groenteprodusente sal 'n besondere groot rol speel om die patroon van hierdie bedryf in Europa te verander. Die nuwe reglemente van die Gemeenskapsmark sal dus daarop gemik wees om die toevoer van vrugte en

groente uit hierdie lande tot die Britse mark te bevorder. Veral die Franse provinsie Brittanje met sy hoogs geïntensifiseerde en georganiseerde groente-bedryf sal voordeel uit hierdie reglemente trek. Daar moet egter in gedagte gehou word dat die groente en vrugte verbruik van die Britte per capita baie laag is (1/4 van Italië; 1/3 van Frankryk). Met 'n vrye toevoer van hierdie produkte vanaf die vasteland na die Britse mark, kan daar egter verwag word dat verbruik per capita sal toeneem.

Hoewel Denemarke die afgelope aantal jare sy groenteproduksie aansienlik uitgebrei het, kan daar met die uitsondering van die Noorde van Wes-Duitsland, nie veel kompetisie vir die ou E.E.G. lande voorsien word nie.

Ierland sal voordeel trek met syaartappelbedryf en sy uitvoere na die vasteland sal sekerlik styg.

4. Wyn

Die drie nuwe ledelande is, relatief gesproke, klein wynverbruikers en groot verbruikers van sterk drank. Die per capita konsumpsie van wyn is 3,5 l in Engeland, 1,6 l in Ierland en 5,9 l in Denemarke. Die totale produksie van wyn in die vergrootte Gemeenskap is 130 miljoen hl terwyl die mark op 140 miljoen hl geskat word.

Die toetrede van die drie nuwe lede sal besliste voordele inhou vir die Franse produseerders van tafelwyne aangesien 'n verhoogde konsumpsie van kwaliteitswyne ten koste van die swakker droë tafelwyne verwag word. Die Franse is die grootste uitvoerder van droë tafelwyne maar die grootste invoerder van likeurwyne. Tans is Groot Brittanje die wêreld se grootste invoerder van sjampanje en konjak.

Wat betref die sogenaamde "Commonwealth" wyne wat hoofsaaklik van die likeurwyn tipe is wat tradisioneel deur Suid-Afrika na Engeland uitgevoer word, kan ons kompetisie verwag in die E.E.G. Lande soos Italië (Marsala likeurwyne), Spanje en Portugal (hoë gehalte wyne) sowel as Cyprus en Griekeland (lae gehalte wyne) is direk en indirek geassosieerd met die E.E.G. en hou 'n gevaar in vir Suid-Afrikaanse wyne op die Engelse mark.

5. Suiwelprodukte

Alhoewel Groot Brittanje die grootste invoerder van suiwelprodukte in die wêreld is, kan daar 'n situasie van "status quo" verwag word aangesien Nieu-Seeland, veral wat botter betref, tot 1978 preferensiële behandeling op die Britse markte sal ontvang. Wat kaas betref, is Groot Brittanje alreeds 'n groot invoerder van kontinentale en Deense kase, en kan dus nie veel verandering in die situasie teweegbring nie.

6. Suiker

Deskundiges is van mening dat die situasie wat suiker betref minstens tot 1975 onveranderd sal bly. Frankryk, Wes-Duitsland en Italië mag moontlik voordeel trek uit die Britse toetrede aangesien Groot Brittanje 2/3 van sy suikerbehoeftes van 2.700.000 ton moet invoer. Dit is egter 'n baie hipotetiese moontlikheid wat in alle geval binne die breëre internasionale suikerooreenkoms sal moet plaasvind. Onderhandelinge sal tussen 1973 en 1975 in aanvang neem om 'n nuwe kommunale suikerooreenkoms aan te gaan teen 1975. In hierdie verband sal daar rekening gehou moet word met die onderontwikkelde lande wat tans reeds 'n versekering eis dat hul suiker vrye toegang tot die Gemeenskap sal hê.

7. Graan

Met die toetreding van die drie nuwe lande, het die graad van selfversorging in graan gedaal van 86 persent vir die Gemeenskap van "Ses" na 80 persent in die Gemeenskap van "Nege". Die totale tekort aan graan word dus op ongeveer 20 miljoen ton geskat.

Wat koring betref, is Denemarke selfversorgend terwyl Groot Brittanje sowat 1,3 miljoen ton moet invoer. Frankryk wat by verreweg die grootste koringprodusent in die Gemeenskap is, is in 'n gunstige posisie om, veral wat betref kwaliteit-koring en moontlik harde koring, op die Britse mark te kom= piteer met Kanada wat tans die grootste verskaffer is.

8. Landbou en Voedselindustrie

Die vergrote E.E.G. sal interessante moontlikhede bied vir die basiese produkte produsente in veral Frankryk, Italië en tot 'n mate Nederland, wat nou direkte toegang kry tot die voedselindustrie van Groot Brittanje en Denemarke. Dit wil voorkom asof Brittanje alreeds vir 'n geruime tyd groot beleggings op die Europese vasteland, in die besonder Frankryk, gemaak het met die oog op die toetrede tot die Gemeenskap. Oor die algemeen gesien, is daar 'n sterk moontlikheid dat die Britse beleggings in Frankryk en Italië nuwe dryfskrag aan die voedselindustrie in hierdie lande sal gee.

VI - SLOTOPMERKINGS

Vir die Europese Ekonomiese Gemeenskap van "Nege" het die tyd aange= breek om sy volle verantwoordelikheid as 'n wêreldmoondheid op te neem en sy stem te laat hoor op die podium van die wêreldtoneel.

Sy geweldige ekonomiese potensiaal, sy intellektuele en politieke krag is gerusstellend vir baie, maar beslis verontrustend vir sommige.

Wat die landbou betref, het die E.E.G. ontwikkel tot 'n mag wat wêreldrepêrkussies veroorsaak. Die Gemeenskap met sy ontsettende potensiaal as 'n mark vir landbouprodukte, sal wel deeglik in aanmerking geneem moet word in die internasionale landbou. Sy beleid van voorkeur tariewe is egter 'n probleem wat vir baie lande insluitende Suid-Afrika êrenstige komplikasies mee= bring. Die Gemeenskap voel egter dat hy, weens sy verantwoordelikheid teenoor sy vroëre kolonies sowel as teenoor sy tradisionele vennote om die Middellandse See, geregverdig is om so 'n beleid toe te pas. 'n Periode van onderhandelinge neem egter binnekort in Geneva in aanvang om hierdie uiters delikate handels= probleem te bespreek.

Wat die interne landbou van die nuwe Gemeenskap betref, sal die drie nuwe lede beslis bydra tot 'n groot transformasie in die landboubedryf. Ier= land is essensieel 'n landbouland, Denemarke beskik oor 'n uiters produktiewe veebedryf terwyl Groot Brittanje oor 'n groot uitvoermark vir verwerkte voed= selprodukte beskik weens sy assosiasie met die Statebondslande.

Soos dit dan duidelik uit hierdie oorsigtelike verslag blyk, sal Frankryk beslis die leidende rol in die landboubedryf van die E.E.G. speel. Hierdie slotsom word beklemtoon deur die feit dat verskeie landboulande van die wêreld reeds gespesialiseerde handelskantore in Parys geopen het om hul landbouprodukte in die Gemeenskap te bevorder.

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VERWYSINGS

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Parys, 24 Januarie 1973

TABEL 1: DIE EKONOMIESE MAG VAN DIE E.E.G. VAN "NEGE"

	E.E.G. (9)	V.S.A.	U.S.S.R.	JAPAN
I - ALGEMEEN				
Oppervlakte '000 km^2	1.524,9	9.363,4	32.402,2	369,2
Bevolking '000 (1970)	252.609	205.395	242.768	103.540
Bruto nasionale produk - miljard $	626	991,1	288	280
Hulp aan onderontwikkelde lande - miljard $	6,3	4,9	0,3	1,3
II - INTERNASIONALE HANDEL				
Invoere (% van wêreldtotaal)	40,1	13,7	4,0	6,5
Uitvoere(% van wêreldtotaal)	40,6	15,5	4,6	6,9
III - LANDBOUPRODUKSIE in '000 ton				
Graan (gemid. 1968/70)	90.476	192.966	160.145	1.742
Vleis (1969)	16.056	23.227	9.520	1.136
Melk (1969)	97.153	52.707	81.500	4.513
Botter (1969)	1.633	512	1.065	?
Kaas (1969)	2.251	1.209	0.500	?
Eiers (1969)	3.504	4.053	2.028	?
Wyn (gemid. 1968/70) '000 hl	135.736	12.413	20.383	?
Aartappels(gemid. 1968/70)	45.934	14.077	96.851	?
Suikerbeet(gemid. 1968/70)	60.325	21.863	84.203	?
IV - NYWERHEID				
Produksie van primêre energie '000 Tec	500.113	2.151.397	1.386.090	71.392
Produksie van petroleum produkte '000 ton	498.634	565.488	?	159.689
Produksie van elektriese energie Gwh	856.013	1.738.142	740.926	350.590
Produksie van staal '000 ton	138.073	122.120	116.000	93.322
Produksie van motorvoertuie '000	9.670,6	6.550,2	348	3.178,7
Kompers in diens (geskat)	20.000	60.000	6.000	8.000
V - VERVOERDIENSTE				
Spoorwegvervoer (passasiers) milj km	154.194	10.568	226.300	181.921
Handelsvloot (1.7.1970) bruto tonne=maat ('000)	57.970	18.463	14.832	27.004
Motorvoertuie in sirkulasie (1.1.72)				
- Toeriste motors '000	55.262	89.861	1.700	8.779
- Per '000 inwoners	219	432	?	85
Beeldradio ontvangstelle '000	57.504	81.000	30.744	21.879
- Per '000 inwoners	228	399	127	214
Telefone '000	50.206	115.222	12.000	19.899
- Per '000 inwoners	203	567	50	194

TABEL 2: LANDBOUSTATISTIEKE VAN DIE E.E.G. LANDE 1969/1970

	Frankryk	W. Duits=land	Italië	Neder=land	België	Luxem=bourg	Groot Brittanje	Dene=marke	Ierland
Totale oppervlakte 1000 km^2	551,6	248,0	301,2	33,6	30,5	2,6	244,0	43,0	70,3
Bevolking 1000de	49.920	60.165	52.750	12.743	9.619	336	55.283	4.870	2.910
Bevolkingsdigdheid / km^2	90	200	172	380	315	130	277	133	41
Bewerkte grond - miljoen ha	31,5	13,5	19,8	← 4,5 →			12,0	2,7	5,4
Aktiewe landboubevolking (% van totale bevolking)	14,0	8,9	18,9	7,0	← 4,9 →		2,5	11,7	26,9
Bydrae van landbou tot nasionale inkomste (% van nasionale inkomste)	6,0	3,8	10,3	6,2	← 4,5 →		3,1	7,9	17,8
Gemiddelde plaasgrootte in ha	20	11	8	10	← 10 →		32	21	16

TABEL 3: LANDBOUPRODUKSIE IN DIE E.E.G. LANDE

	Frankryk	W. Duits=land	Italië	Neder=land	België	Luxem=bourg	Groot Brittanje	Ierland	Dene=marke	E.E.G. (6) *	E.E.G. (9) *
GRAAN '000 ton 1968 - 1970 gemid.											
Koring	14.108	5.947	9.614	666	789	40	3.665	385	448	34.232	40.023
Rog	334	3.047	72	206	78	5	12	1	126	-	-
Gars	8.858	4.948	288	370	552	48	8.135	780	5.095	16.107	30.938
Hawer	2.802	4.074	455	299	298	44	1.253	249	754	8.459	10.737
Mielies	6.168	398	4.408	-	-	-	-	-	-	13.853	13.859
VLEIS '000 ton 1969											
Bees- en kalfsvleis	1.508	1.092	732	272	216	10	909	322	240	4.363	5.917
Skaap en bok	108	10	35	8	1	-	215	46	3	176	452
Vark	984	2.141	407	516	347	8	903	142	710	5.729	7.536
SUIWELPRODUKTE '000 ton 1969											
Melk	31.061	22.262	10.417	7.975	3.908	211	12.764	3.678	4.877	72.465	93.570
Botter	544	522	69	112	97	7	60	78	144	1.275	1.491
Kaas	752	471	464	270	35	1	120	29	109	2.059	2.333
VEEGETALLE '000 de 1969 - 1970											
Beeste	21.719	14.286	9.612	3.879	2.713	186	12.697	5.842	2.835	50.727	70.591
Koeie in melk	9.491	5.848	4.510	1.891	1.066	64	5.409	1.700	1.153	21.755	29.857
Varke	10.275	19.323	9.224	5.294	3.094	109	8.062	1.155	8.378	49.382	65.795
Skape/bokke	10.616	901	9.168	362	88	5	26.391	4.010	92	21.496	53.711

* Graanproduksie vir 1971
Vleisproduksie vir 1970
Suiwelprodukte vir 1970
Veegetalle E.E.G. (6) lande vir 1971
E.E.G. nuwe lande vir 1969 - 1970

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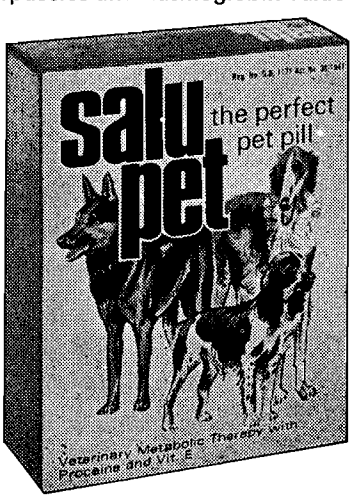

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MAMMALS OF THE SEA — BIOLOGY AND MEDICINE

S. H. RIDGEWAY (ED)

C. C. Thomas, Springfield, Illinois. 1972. pp xii+812. Figs: 133 line drawings, 11 karyotypes, 2 coloured drawings, 6 coloured photographs. Graphs: 22, Tables 44. Price not stated.

This work, triggered to an initially ill-fated start by the first International Symposium on Cetacean Research held in Washington, D.C., in 1963, is a most commendable effort to establish marine mammalogy as an interdisciplinary science. It can be regarded as the outcome of the research on dolphins and other marine mammals at the United States' Naval Undersea Research and Delevopment Centre at San Diego, and Point Mugu, California, although the ultimate contributions came from various American institutes, including the University of Hawaii, and from the Ocean Research Institute of the University of Tokyo, Japan.

It is most gratifying to note that a veterinarian—the editor—has taken the lead and that the senior author of another chapter—that on Comparative Microscopic Anatomy—is also a member of our profession. After all, who but the veterinarian, well-versed in comparative anatomy, physiology, pharmacology, pathology, medicine and animal behaviour, should be better equipped for the task? One is grateful that the U.S. Navy has grasped this **point.**

Covering adequately a field so vast, so replete with potential information, of both academic and practical interest, and yet up till now so sketchily documented, mainly on account of logistic problems (how does one get a properly fixed brain from one of the larger cetaceans?), poses a porcupine-like rather than a slippery porpoise-like problem. Criticism at the general set-up and organisation of material there can well be, and this will vary according to individual opinion, but on the whole the editor has managed well to compound an entity from different sources and by different authors. In the preface the editor has made it clear that the objective was "to cover the basic biological and medical sciences as they relate to marine mammals rather than to develop an advanced treatise on current research in the field." This statement is repeated on the dustcover. Yet, inevitably, each author has interpreted this directive somewhat differently and according to his own insight. Efforts have been made to correlate statements and to have one author referring to the other's text but not always so. It does happen that a certain aspect is touched upon by more than one author and that even the subject index does not always act as an infallible guide. So, for instance, blood clotting is dealt with on pages 655 and 664, but comes in for mention again on page 707. In the last chapter (10), on homeostatic mechanisms, one encounters mention of anatomical detail not recorded in chapter four (Anatomy). Hearing is treated in the chapter on Senses and Communication and again in the last chapter, this time from a different angle. Nevertheless, and provided he is forewarned, the intelligent reader should be able to extract all the knowledge as given in this informative work. A complete subject index would probably have to be a computerized job. When all is said and done, however, the landlubber, innocent of cetacean jargon, is left vaguely wondering what a "melon" really is, and of what tissue(s) baleen is composed.

Chapter by chapter the contents are as follow, each chapter being followed by a fairly extensive bibliography.

Chapter one: General Biology by Masaharu Nishiwaki. Deals briefly with taxonomy, morphology for identification purposes, distribution, abundance, migration, food, reproduction, behaviour, parasites and miscellaneous known facts, species by species. All the more important species (113) are depicted in black and white line drawings. Obviously, lack of knowledge precludes justice being done to each of the subheadings in every case. The author clearly indicates the numerous hiatuses. To orientate the uninitiated a scheme of classification would have been very helpful. Now one has to page madly

back and forth to make sure where each species fits in.

Chapter two: The Sea Otter by Karl W. Kenyon deals with the sea otter in the same style as that of the previous author.

Chapter Three: The Central Nervous System by Nobert J. Flanigan. This author has taken the editor's directive far too seriously and has taken great pains to explain basic fundamentals which really belong to a textbook on introductory neuro-anatomy. He explains at length why so little is known particularly about cetacean neuro-anatomy, but fascinating morsels of information are dangled briefly in front of one's nose, to be snatched away as soon as one wants to know more. To compensate, a fairly extensive bibliography is given but the student of neuro-anatomy must also look at that of other chapters, particularly numbers 7 and 10, to glean all information about references on this aspect.

Chapter Four: Observations on the Anatomy of some Cetaceans and Pinnipeds by Robert F. Green. One gains the impression that the author was overwhelmed by the magnitude of his task: the general tone is spiritless and manner of dealing with the subject rather skimpy and unbalanced. Sketchy detail is given, rather than a well-balanced comparative account. Checking of manuscript/proofs was not very conscientiously done leading to such gibberish as: "The stylo-hyals attach to the cranium by cranium by cartilaginous ceratohyals which connect the basihyals to well ossified rod-like stylohyals" (p. 257). This piece should have been deleted entirely. Or on p. 275: "Since the *chin* (shin!) is contained within the body contour and is almost totally immovable, the sacral vertebrae are forced to assume an almost vertical position so as to allow the foot to assume the plantigrade position." On p. 282 the *metatarsal* is mentioned with reference to the manus. A misunderstanding of what comprises the tunica vaginalis cavity (p. 270), and mis-spellings such as broncus (fig. 4-13), opthalmic (p. 268), vas efferentia/deferentia (p. 270) and vesicular seminalis (p. 271) are some of the minor blemishes.

Some of the drawings are uninformative. Fig. 4-23 shows the M. gracilis and M. semi-membranosus (spelt M. semimembranous) to all appearances attached to the linea alba. The vagina one would never recognize for what it is.

The mis-spelling of German titles in the references is something terrible. One can imagine the volley of invective from a true-blooded Dutchman about the mangled remains of the "Koninklijke Akademie der Wetenschappen". Haste, my otherwise highly esteemed American colleagues, is no excuse for sloppiness.

Chapter Five: Comparative Microscopic Anatomy of selected Marine Mammals by John G. Simpson and Murray B. Gardner. This chapter, which starts with a delightful, down-to-earth bit of honesty and realism, has been very ably written. The comparative high-lights have been realized and well portrayed. There is some excellent information concerning ultrastructure of cetacean lung. Histopathology is also included, where known, and one realizes how little material is as yet available. A few slips do show: "Para-aminosalicylic acid (PAS) positive droplets" (page 301); "total blood-air barrier (of the lung) is relatively thin, in the order of 0.5 mm thickness" (legend: fig. 5-23); mucous in place of mucus, and the confusion about correct Latin spelling of anatomical structures: bronchiolae, glomerulae, corpus cavernosis, corpus cavernosa.

Chapter Six: Behaviour of Marine Mammals by Melba C. and David K. Caldwell. Ably written and touches numerous facets.

Chapter Seven: Senses and Communication, also by the Caldwells. A good exposition of what is known and, more particularly, of the many puzzling problems still confronting the scientist.

Chapter Eight: Evolution and Cytogenetics by Deborah Duffield Kulu. A well-balanced account of a problem-strewn field. Eleven karyotypes are illustrated.

Chapter Nine: A Checklist of Marine Mammal Parasites by Murray D. Dailey and Robert L. Brownell, Jr. Under each host a list of parasites is given according to the parasite's taxonomical position, together with the author/s. This is followed by a list of parasite genera and locality in the host. The list is divided into sections for each of the three host orders. Authors' names have not been repeated here. Representatives of common parasitic groups found in marine mammals are then described briefly and illustrated. The pathogenicity is touched upon here

and there: it is obvious that a vast field remains to be explored, also in this respect. The authors appear to have taken greater pains in collecting references, other than those appearing in the English language, than their colleagues.

Chapter Ten: Homeostasis in the Aquatic Environment by Sam. H. Ridgeway. This chapter is the real high-light. It is virtually a book in itself and is brimful of interesting and fundamental information, much thereof in tabular form, with references. The title is too restricted, as information is given on a very wide range of subjects, ranging from physiology to medication, from animal husbandry to surgery. It ends with brief thoughts on future developments: behavioural engineering, mariculture, conservation and marine mammals as research laboratory animals.

The book has been put out in true C. C. Thomas tradition but the score in the game 'printer's devil versus publisher' has run relatively more in favour of the former.

Marine biologists and anyone concerned with marine mammals in one way or another should possess this book. The veterinary anatomist, physiologist and ethologist will find much in these pages to interest him. To the wives of veterinarians, this book is the answer what to give hubby for Christmas or as a birthday present. The veterinary student, dreaming of new worlds to conquer, might well find his inspiration here.

H. P. A. de B.

BOOK REVIEW — BOEKRESENSIE

LAMENESS IN CATTLE

PAUL R. GREENOUGH, FINLAY J. MACCALLUM & A. DAVID WEAVER

Oliver & Boyd, Edinburgh, 1972. Pp. XIV & 478; over 250 illustrations. Price £9.—.

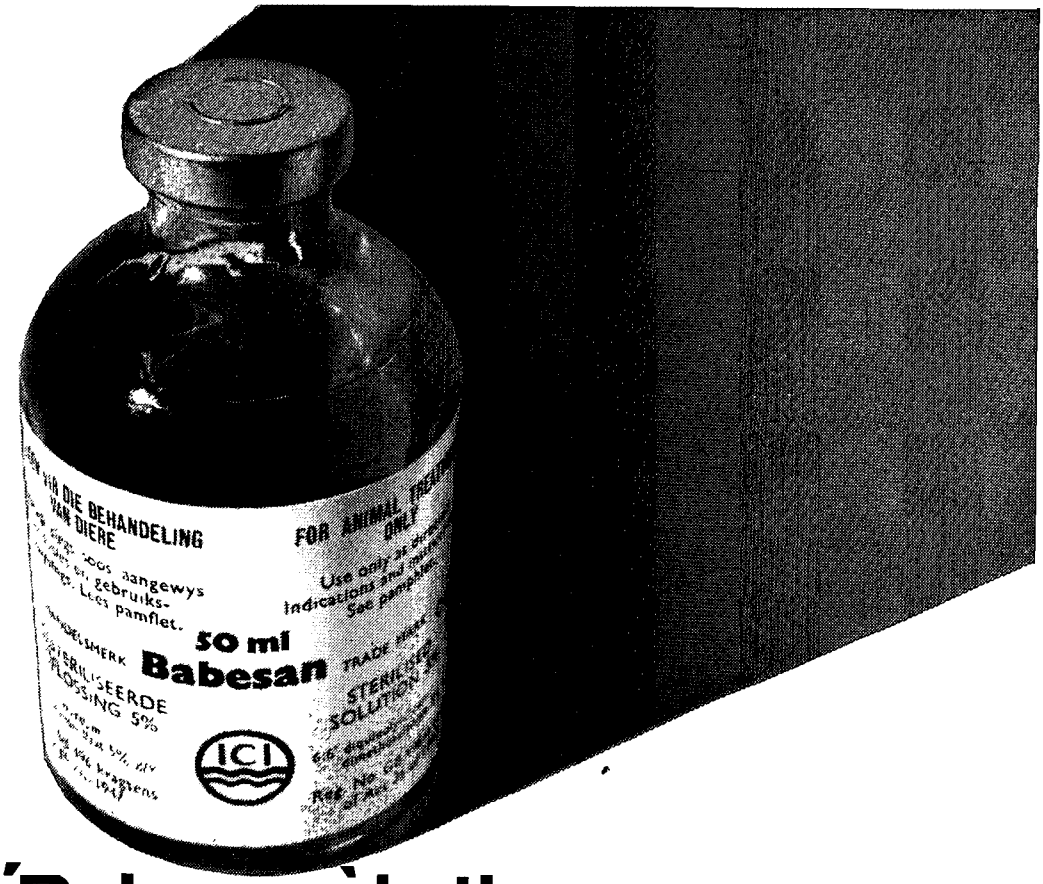
One's first reaction on receiving this book might well be: 'At last a textbook on bovine orthopaedics', for this book is very long overdue and immediately, in a very meritorious manner, fills that space on the bookshelf which has been waiting for it for years.

First the general layout of the book: After the introduction the next 40 odd pages are used for functional anatomy of the limbs. As such very pertinent information is presented that should also have the attention of the student in Anatomy and Animal Management. Another 30 pages are given to anaesthesia to be followed by general examination and radiography. The rest of the book is given to pathological conditions of the limbs and spine with a very extensive bibliography at the end.

This book is strongly recommended to all clinicians dealing with bovine cases. As is inevitable, there would be differences here and there between the views of individual clinicians and those of the authors. This possibility, however, in no way diminishes the value of the book.

The illustrations are all clear, the layout of the reading matter very acceptable and the quality of the paper is good.

C. F. B. H.



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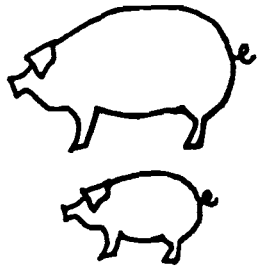

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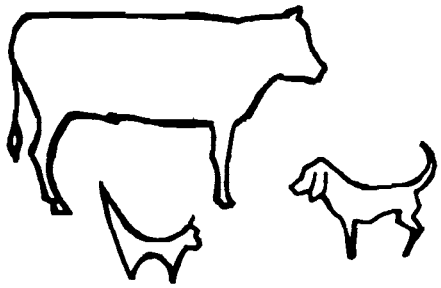

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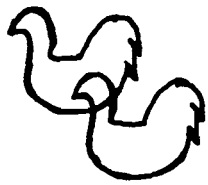

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SYMPOSIUM ON WILDLIFE CONSERVATION AND UTILIZATION PRETORIA JUNE 4 - 8, 1973

Symposium theme: Wildlife Conservation Utilization in Africa.

The emphasis will be on Africa south of the Zambezi and on the utilization of wildlife resources, but papers relating to other areas and broader ecological subjects will also be included.

Wildlife will be taken to mean any vertebrate species and/or its habitat which might be subject to management practices, and will include mammals, birds, fish, and aquatic and terrestrial life forms.

Utilization will include any form of exploitation such as commercial harvesting, food gathering, illegal trading, sport fishing or hunting, and tourism.

Organizers: The five-day symposium is being organized by the Southern African Wildlife Management Association with assistance from various other bodies.

Dates: Monday 4th to Friday 8th June 1973.

Venue: The symposium will be held in Pretoria, South Africa, at the new buildings of the University of South Africa. The University will be celebrating its Golden Jubilee at the the time. Excellent facilities for all Symposium activities will be available.

The proceedings: Papers read at the symposium will be published, subject to editorial acceptance, in special issues of the Journal of the Southern African Wildlife Management Association.

Contributors: Any person who may wish to read a paper at the symposium should advise the Organizing Committee without delay on the attached form. Abstracts will be required at a later stage for inclusion in the Programme.

Activities: These will include daily wildlife filmshows, evening social events, day outings, commercial displays and exhibtis, and excursions after the symposium if the demand warrants them. Tours to the Kruger National Park and other reserves can be arranged.

Accommodation and travel: Reservations and bookings can be made for delegates by Salvo Travel Bureau (Pty) Ltd., P.O. Box 3797, Pretoria. Local transport from hotels will also be arranged.

Registration: The symposium registration fee for all delegates will be R10,00 (approximately £5,37, US$12,49). Where possible, registration should be effected through the post on receipt of the Second Symposium Circular.

Correspondence: *All* correspondence in connection with the symposium should be directed to the following address: WMA Symposium Organizers, P.O. Box 413, Pretoria, South Africa.

INDEX TO SOUTH AFRICAN PERIODICALS

The **Index to South African Periodicals** is an alphabetical list of articles appearing in South African periodicals and is arranged under the name of the author and the subject of the article. It should be of great value to all research workers concerned with current South African material. It has been produced by the Johannesburg Public Library since 1945.

The *Index* may be consulted in the Reference Department of the Johannesburg Public Library and in most of the larger libraries in the country. The current issues are also obtainable from the Johannesburg Public Library at R10-00 per annual volume.

INDEX VETERINARIUS AND THE VETERINARY BULLETIN

As the result of the adoption of computerised techniques, including printing by photocomposition, under the Commonwealth Agricultural Bureaux Mechanization Scheme, both **Index Veterinarius** and **The Veterinary Bulletin** are now being produced mechanically by INSPEC for the volume years 1972 and 1973.

As before, the two journals continue to provide a comprehensive coverage of the veterinary literature from all parts of the world published in various languages. Titles are selected from nearly 850 serial publications regularly scanned and from books, monographs, annual reports and other non-serial publications.

All major items of veterinary literature are abstracted in *The Veterinary Bulletin* and listed in *Index Veterinarius*. In addition, titles in marginal fields of veterinary medicine, and related fields of other biological sciences, minor contributions, extension literature etc., are only listed by title in *Index Veterinarius*. Coverage is kept up to date through a constant review of the list of journals scanned. Recently arrangements have been made with the Institute of Statistics and Documentation of the Free University of Berlin for a regular supply of titles of articles appearing in German language veterinary periodicals in order to improve coverage of German veterinary literature.

Under the new system, *Index Veterinarius* is now produced monthly instead of quarterly and as a result the delay between publication of an article and its listing in *Index Veterinarius* has been reduced from 8—9 months to less than 12 weeks. Thus, besides being a comprehensive alphabetically arranged subject and author index of current veterinary literature the journal provides a useful current awareness service. In the 12 issues of Volume 40 produced during 1972, as many as 17,338 titles, along with their full bibliographical details, have been listed under one or more subject headings and under the name of the first author. The new journal provides improved topicality, more detailed subject headings and citation of foreign language titles, facilitating reference to original articles. There will be an annual cumulative edition and also the information will be available on magnetic tapes.

The Veterinary Bulletin, also now produced by computer techniques continues to be a monthly journal. More abstracts of current veterinary literature are published in it than ever before and the 12 issues of Volume 42 contain as many as 7,248 abstracts in addition to 8 review articles on topics of current interest.

RESEARCHERS AIM FOR TWO LITTERS A YEAR

Finn×Poll Dorset ewes at the Rowett Institute, Bucksburn, Aberdeen, are lambing on a 205-day cycle and producing more than 2 lambs in each litter amounting to 3,7 lambs a year from each ewe. These results have been achieved by using a prolific breed, controlling lighting and giving the ewes sufficient feed to fulfil their potential. "We regard this as an experimental test bed to look at these three factors," said Dr John Robinson, who is responsible for ewe nutrition in intensive sheep trials. The controlled lighting allows us to breed the ewes at any time of the year, but we feel that the experience gained in sheep prolificacy, and particularly in the nutrition of ewes and lambs, can be directly applied to many conventional outdoor flocks."

All the ewes in the unit are Finnish Landrace×Poll Dorset Horn and so far the ewes have not been selected. There is considerable variation in prolificacy so researchers hope that future selection will improve ewe output still further. The ewes are mated so that their first lambing is at 13 months old. Lambs are weaned at 28 days, and breeding is planned on a 205-day cycle. This gives a 6—8 weeks interval between lambing and mating again. To achieve this plan the ewes

are treated with pessaries to synchronise oestrus and two months after mating the lighting is abruptly increased to give a day-length of 18 hours. This is maintained for one month and the light is then reduced by 3½ minutes a day so that at lambing time the day-length is the same as that in August and at mating is equal to October's.

"With a 145-day pregnancy and a 28-day lactation it should, in theory, be feasible to think in terms of a twice-a-year breeding system," said Dr. Robinson, "but there are practical problems in such a tight schedule. The longer 205-day cycle works admirably and we can plan ahead with certainty."

The level of production and the rate of reproduction must put a considerable physiological strain on the ewe, so adequate nutrition is essential. The ewes are given 1¾ times their maintenance ration from weaning to one month after mating, when they are abruptly reduced to maintenance level for the second and third months of pregnancy. At this stage the ewes are X-rayed and for the rest of their pregnancy are fed according to the number of lambs they are carrying. The feed level after lambing is adjusted according to the number of lambs being suckled.

"It is possible, at least in the short-term, to achieve a high level of production from ewes in an intensive system," said Dr Robinson. "However, the effect that good management and, above all, adequate and correct feeding can have on ewe output has a direct application to more conventional, extensive production systems."

Average litter sizes at Rowett have ranged from 2 to 2,50 lambs per ewe, their maximum genetic potential. But without adequate feeding their performance would be much lower. "One has only to see the effect of bringing hill ewes down to better farms to realise the effect of nutrition," said Dr. Robinson. "Blackface ewes that lamb at less than 100 per cent on the hills can reach 160 per cent in the lowlands. This draws attention to the importance of equating nutrition with the genetic potential of a flock."

The intensive unit at Rowett is geared to early weaning of lambs. "We are turning out 100 lambs to the butcher every three and a half months with complete predictability," said Dr R. Orskov, who is responsible for lamb feeding. "We have to use feed that gives a high growth rate at an economic cost starting with lambs of little more than 28 days old. Sheep, being ruminants, are often considered to be poor converters of concentrate feeds, but the opposite is the case. We have found that creep-fed lambs weaned at 28 to 35 days on to barley-based concentrates have conversion ratios of about 3 : 1".

These results are more surprising than they sound, since in the most recent series of trials young lambs have been achieving these conversion ratios when fed on whole barley, a system that promises to be useful. The lambs are creep-fed before weaning and then transferred to another building for finishing. Here they are penned in batches of up to 25 and any reluctant feeders soon pick up the habit from the others. No hay is fed. The lambs have water and an ad lib supply of whole barley plus a protein-mineral supplement.

These Rowett trials prove first that Finn crosses can be highly prolific and that they can produce excellent butchers' carcasses. And for all sheep breeders they show the level of feeding that is needed to allow a ewe to reach her true potential. Lambs can be weaned successfully at four to six weeks and finished on concentrate feeds alone to give a gain of up to 1 lb a day at a conversion ratio of 3 : 1.

Early lambing flocks, or flocks kept intensively, could well benefit financially from finishing lambs in this way and it could also form part of a more intensive system of producing lamb from the hills.

(From: **Agricultural Report — United Kingdom and Scandinavian Countries.** No. 110. 19 February, 1973. Agricultural Counsellor (Scientific), South African Embassy, Trafalgar Square, London, W.C. 2N 5 DP, England. Published by Dept. Agricultural Technical Services, Pretoria).

Felocell

the new modified live virus feline distemper vaccine

Norden virologists have achieved a second major breakthrough in the protection of domestic cats against feline distemper.

Felocell – similar in many ways to 'Felocine', but with one important difference – is *a modified live virus vaccine.* 'Felocine' is an inactivated virus antigen. Now you can select the type of feline distemper vaccine you prefer and be assured of the same high level of safety and dependability. Both are derived from the snow leopard virus. Both are produced on Norden's feline Established Cell Line. Both generate maximum immune response with a single dose at 9 weeks of age.

Although Felocell is similar to 'Felocine', it is remarkably different from *any other modified live virus vaccine!*

- Felocell protects at the earliest possible age. A single 1 ml. dose dependably immunizes kittens at 9 weeks of age, substantially reducing susceptability period between weaning and normal vaccination time.
- Felocell routinely produces a level of protection approaching that of natural infection.
- Felocell eliminates the danger of transmission of toxoplasma and other contaminants such as reovirus, picornavirus, syncytial, leukemia and sarcoma viruses.
- Felocell maintains a consistent titer of ten million antigenic particles per dose.
- Felocell is unusually stable. In laboratory tests, it was shown to survive incubation at 98.6° F. for 3 weeks with no loss of viral titer.
- Felocell is safe. And it's gentle – causes no sting, pain or lump formation.

If you prefer an inactivated tissue culture vaccine, the name is 'Felocine' – the nation's number one choice for over 2 years. If your preference is for a modified live virus vaccine, switch to new Felocell. Either or both can be the basis for a single-dose program of the highest standards.

It all adds up to a modern approach to feline immunology: One dose at nine weeks of age.

A. S. Ruffel (Pty) Ltd. Division of Smith Kline Animal Health.

FOOT-AND-MOUTH DISEASE SCARE IN BRITAIN PROVES TO BE SWINE VESICULAR DISEASE

Foot-and-mouth disease was reported to have broken out among pigs at Marston in Staffordshire on the 13th December, 1973. A further outbreak occurred a day or two later. In pursuance of the British slaughter policy, all contact animals, including 133 cattle, 180 sheep and 1 goat were slaughtered.

The Animal Virus Research Institute at Pirbright subsequently identified the disease as Swine Vesicular Disease, clinically indistinguishable from foot-and-mouth disease, and caused by the 'porcine enterovirus'. It had never occurred in the United Kingdom before and the authorities have been unable to trace the source of the present infection. Outbreaks in recent years have been confined to Hong Kong and Italy.

Cattle, sheep and goats are immune to the disease.

There have been 14 outbreaks up to 3 January, 1973. These have involved the slaughter of 3 683 pigs.

European veterinary officers were to meet in Brussels at the end of February in an attempt to find a common link between the swine vesicular disease outbreaks which had hit five coutries.

When the U.K. virus was identified last December it was at first thought that the epidemic was restricted to Britain, but it has since been discovered that within a few weeks similar outbreaks have occurred in Poland, Austria, Italy and France.

At a meeting in Rome research workers and veterinary officers from affected countries exchanged information on the disease and an international policy of eradication through slaughter was agreed. The facts of the British outbreaks were put to the meeting by Dr John Brooksby, Director of the Animal Virus Research Institute, Pirbright, Surrey. He said that the meeting in Brussels would try to establish a common international source of the disease. Most of the outbreaks had occurred within a few weeks and, apart from four outbreaks in Austria which were linked with those in Poland, there did not appear to be any direct connection between the outbreaks in the five countries.

"This all suggests that there is some common source of the disease," said Dr Brooksby. "The international exchange of information is important if this source is to be identified. Once this is done it may be possible to eradicate the disease. It would be of value to all countries to do this, so there is a good case for carrying out an energetic, international slaughter policy. Most countries had agreed to take the disease seriously and attempt to slaughter it out."

The total of outbreaks in the U.K. has now (middle of February) reached 46 and over 20,000 pigs have been slaughtered. It is considered too early to gauge the effect of setting up the control area which covers most of England.

Research at Pirbright has shown that foot-and-mouth disease disinfectants can vary in their effectiveness in controlling SVD. Certainly acids and alkalis alone, which can give good control of foot-and-mouth, are less succesful when used against SVD. Although detailed formulations still have to be worked out, the addition of some detergents and oxidising agents produces big improvements. Nevertheless, the virus experts stress that foot-and-mouth disinfectants will give satisfactory results if used at a slightly higher rate.

(Modified from: **Agricultural Report — United Kingdom and Scandinavian Countries:** No. 109 and 110. 26 January and 19 February, 1973. Agricultural Counsellor (Scientific), South African Embassy, Trafalgar Square, London, W.C.2N 5DP, England. Published by Department of Agricultural Technical Services, Pretoria).

INFORMATION INLIGTING

POWDERED SKIM MILK PREVENTS VIRUS VACCINE INACTIVATION

Room temperature and/or water sanitizers rapidly reduce the potency of Newcastle disease and infectious bronchitis (IB) drinking water type vaccines. These ill effects can be largely overcome by the use of powdered skim milk (PSM) at a concentration of 1 : 400 in the drinking water together with the vaccine, according to R. F. Gentry and M. O. Braune, Pennsylvania State University. The 1 : 400 level can be approximated by adding 0,45 kg of PSM to 225 litres of drinking water.

As little as 1 ppm. chlorine or quaternary ammonium compound and/or room temperature, can greatly reduce the potency of ND, IB, and avian encephalomyelitis (AE) vaccine. The addition of PSM practically neutralizes these adverse effects of both the sanitizers and the room temperature.

Virus neutralization tests on 34 flocks vaccinated in the field against ND and IB, without the use of powdered skim milk showed that 32% had not responded to the ND vaccine and 44% had not responded to the IB vaccine. Where PSM was used on 42 flocks, all responded favourably to ND vaccine and only 4.8% failed to respond to IB vaccine.

(**Poultry Digest,** Vol 31, No. 368; P.O. Box 1220, Redlands, California 92373 (October 1972). Reported in **Agricultural Report — Washington D.C.** No. 58. 24 November, 1972. Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, N.W., Washington D.C. 20008, U.S.A. Published by the Dept. of Agricultural Technical Services, Pretoria).

INFORMATION INLIGTING

INCREASING MEAT SHORTAGE

The F.A.O. expects that by 1980 the world consumption of meat will have increased considerably and that a world meat shortage of around two million tons will have arisen. A notable aspect is the increasing shortage which may be expected by the enlarged European community. The forecast is that consumption will rise from around 660 000 tons in 1970 to 1 072 000 tons in 1980, almost double the present consumption.

The F.A.O. stated that between 1969 and 1970 the world production of meat rose by approximately 4% (excluding China), while world trade increased by around 8%.

The increased production is above all due to a greater production in Australia and in Europe, and as regards meat types, to an increased production of mutton and poultry meat. There was an increase in the international trade in pork amounting to 22% and in poultry meat to 18% during the period 1969 to 1970.

(**Agricultural Newsletter from the Netherlands.** The Hague; No. 10 — 1972. In: **Agricultural Report —Europe,** No. 4. February 1973. Agricultural Counsellor (Technical), South African Embassy, 51 Avenue Hoche, Paris (8e), France. Published by the Dept. of Agricultural Technical Services, Pretoria.)

INFORMATION INLIGTING

LAMB SHORTAGE IS LONG-TERM

The nine Common Market countries will have a deficit of more than 350,000 tons of lamb meat in 1975 and, despite a considerable rise in production, the situation will be just as bad in 1985.

"All the calculations that have been made show that we will have to import at least 300,000 tons a year for the foreseeable future", Mr Joseph le Bihan, Director of Economics at the French Agricultural Research Institute, said at a beef and sheep symposium at Kirkley Hall, Northumberland.

"The only possible sources of this lamb meat are the countries of the southern hemisphere—New Zealand, Australia and South America," he said, and added: "The market

for food, particularly meat, is strange, and it is possible that all the predictions will be proved wrong. In estimating consumption and production there are many variable factors, such as the growth of population in each country, the relative profitability of other enterprises on the farm and customer preference. At the moment consumption of lamb a head is rising fast in France but falling in Britain. We estimate that by 1985, Britain will require 495,000 tons as against the present 553,000 tons, and French demand will have risen from 150,000 to 246,000 tons. The pattern of the British lamb market would also change. By 1985 production in the UK would rise by almost 30 per cent."

(From: **Agricultural Report — United Kingdom and Scandinavian Countries,** No. 109. 26 January 1973. Agricultural Counsellor (Scientific), South African Embassy, Trafalgar Square, London, W.C.2N 5DP, England. Published by Department of Agricultural Technical Services, Pretoria).

INFORMATION INLIGTING

PREDICTION AND PREVENTION OF KETOSIS

In the early stage of lactation cows utilize body fat to provide energy to maximum milk yield. If fat is released from the fat depots more rapidly than it is metabolized, there is a build-up of ketones in the blood that can have a detrimental effect on the cow. Cows vary in their abilities to use body fat for milk production, but in general if the cow's energy requirement exceeds her dietary intake by more than the equivalents of 5 lb. of grain per day, then that animal will be running the risk of developing clinical ketosis. This risk can be decreased if the cows are supplied with a glucose-producing material such as propylene glycol that will help the cow to use the energy provided by the fat depots. In a series of experiments conducted at the Animal Research Institute, Ottawa, the antiketogenic effectiveness of several levels of propylene glycol supplementation was tested with cows during the first 8 weeks of lactation.

The addition of propylene glycol at 3% (60 lb/ton), ($10-80); 6% (120 lb/ton) ($21-60) or 9% (240 lb/ton) ($53-20) of a grain mixture fed to cows during the first 8 weeks of lactation reduced the quantity of ketones in the milk and blood and decreased the incidence of ketosis compared with levels when the same amount of grain mixture was fed without supplementation.

THE EFFECT OF ADDITION OF PROPYLENE GLYCOL* TO GRAIN MIXTURE ON MILK YIELD AND COMPOSITION, BODY WEIGHT LOSS AND INCIDENCE OF POSITIVE REACTION OF MILK TO KETONE TEST

	Control	*3%	*6%	*9%
No. of Cows	30	29	18	16
Milk Yield (lb/day)	51,4	53,6	53,0	48,4
Composition				
Fat (%)	3,21	3,09	2,85	3,17
Protein (%)	3,19	3,26	3,16	3,13
Lactose (%)	5,06	5,10	5,18	5,23
Body Mass Loss (lb/day)	1,94	2,24	1,94	2,39
Ketone Positive Milk	36	8	3	3
Clinical Ketosis	4	1	—	—

1 lb.=0,45 kg

It has been concluded from the results of these experiments that the inclusion of propylene glycol in the grain mixture at the 3% level for normal herds (incidence of Ketosis $<10\%$) or 6% for problem herds (incidence of Ketosis $>10\%$) during the first 6 weeks of lactation would be effective in reducing management and veterinary costs.

(**Canadex,** 410.661; Canada Department of Agriculture Animal Research Institute, Ottawa. In: **Agricultural Report** — Washington, D.C. No. 56. 10 November, 1972. Agricultural Counsellor (Scientific), Embassy of South Africa, 3051 Massachusetts Avenue, Washington, D.C. 20008, U.S.A. Published by the Dept. of Agricultural Technical Services, Pretoria).

PRODUCTION OF BIO-SYNTHETIC PROTEINS

In December BP-France's Cap Lavera factory started deliveries of its bio-synthetic proteins produced from petroleum by-products to compound feed manufacturers under the brand name Toprina. The product is an odourless, tasteless cream-coloured powder which can be incorporated into feed in the same way as other additives. It has a protein content of about 70% and a lysine content of 7,8% compared with 7,4% for fishmeal and only 6,1% for soyameal.

The revolution in the feed industry which bio-synthetic porteins will cause will only take place slowly. The output of the prototype factory at Cap Lavera will not reach 50% capacity until next spring and full capacity of 16 500 tonnes per annum until after a year of operation. It has already been decided to build a larger factory with a capacity of 100 000 tonnes. As France imported 1 300 000 tonnes of soya and 80 000 tonnes of fishmeal in 1971, the full effect of bio-synthetic proteins on the economics of livestock production will not be felt for some years yet. In the meantime various other vegetable based substitute proteins will appear on the market.

In addition to basic feed, the Cap Lavera factory produces two special feeds for young calves. The outlets for the new product in the calf feed sector already seem particularly favourable.

In the BP laboratories research is going ahead to complement bio-synthetic proteins, not only with milk serum but also other carbohydrate sources such as various starches and dextrins, lactose and finely ground cereal flours.

(**Agra Europe.** 6 December 1972. In: **Agricultural Report — Europe.** No. 4. February 1973. Agricultural Counsellor (Technical), South African Embassy, 51 Avenue Hoche, Paris (8e), France. Published by Dept. of Agricultural Technical Services, Pretoria).

EUROVET — A VETERINARY HANDBOOK TO EUROPE

Eurovet, a veterinary study group supported by the Royal College of Veterinary Surgeons and the British Veterinary Association, has just issued a handbook with the subtitle "An Anatomy of Veterinary Europe". Inspired by a realisation of the mutual lack of detailed knowledge of veterinary matters between Britain and Europe, the handbook, it is hoped, may be repeated in future years and expanded to a definitive book of reference. In his preface, the chairman of Eurovet also refers to the assistance which the British profession has received by virtue of its representation as observer on the E.E.C. Veterinary Liaison Committee and refers to the handbook as a "friendly gesture" to mark the end of a decade of efforts to bring about veterinary harmonisation, and also to mark the holding of the First European Veterinary Congress in Wiesbaden this year.

The handbook contains a useful account of E.E.C. and national veterinary regulations and directives, including lists of notifiable diseases. It also includes a directory of veterinary organisations in the ten countries of an enlarged E.E.C. and covers such other matters as general veterinary practice and education and training in these countries General articles outline the organisation of the E.E.C., agriculture and the E.E.C., artificial insemination in Europe and meat hygiene in an enlarged Community.

It is a commendable and successful attempt to produce a work of reference in a field where the present state of general knowledge of European practices, particularly those relating to animal health, is sadly deficient. It is to be hoped that it will also act as a stimulus towards greater harmonisation of animal health regulations in the Community, a matter which has been under discussion for more than ten years without any very effective progress being made, and which, once resolved, could remove a number of obstacles to free trade.

Eurovet can be obtained from Eurovet, 7 Mansfield Street, London W1M OAT, 142 pp, price £1.50 postage and packing included.

COLLOQUIUM ON FEEDSTUFFS OF ANIMAL ORIGIN AND THEIR FUTURE IN HUMAN NUTRITION

On 12 October, 1972, a most interesting colloquium on the use and future of animal proteins in human nutrition was held by the French Animal Production Association (Association Française de Zootechnie). Three interesting reports can be mentioned:

1—The use of domesticated animals as a source of protein for human beings: its progress, future and possible necessary husbandry adaptations, by Mr. R. Février, Inspector General of I.N.R.A. (National Institute of Agricultural Research);

2—Aquaculture: new source of animal proteins in human nutrition, by Mr. P. Rouzaud of the Institut National Agronomique (Agricultural University of Paris);

3—Animal production development and the world's nutrition problems, by Mr. J. Coleou of the Institut National Agronomique.

The Proceeding of this colloquium can be obtained from: Le Secrétariat, Association Française de Zootechnie, 16 rue Claude Bernard, 75231 Paris 05, France.

SCIENCE BOOKS QUARTERLY

This valuable review, consisting of evaluations and annotations by professional reviewers, who are specialists in their field, and published by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington, D.C. 20005, is available at the Central Agricultural Library, Department of Agricultural Technical Services, Pretoria.

HIGHLY QUALIFIED MANPOWER IN RSA

Only 5 per cent of the White male graduates in the RSA are in possession of Dtoctor's degrees and an additional 10 per cent of Master's degrees. These two groups of persons together constitute a mere 1,4 per cent of the economically active White males in the country. These data are supplied in a report* on highly qualified manpower in the RSA which has just been released by the Human Sciences Research Council.

The report is based on data supplied by more than 80 000 graduates and persons with equivalent qualifications who are included in the National Register of Natural and Social Scientists maintained by the Institute for Manpower Research of the HSRC.

Since South Africa has to compete with other countries to an increasing extent and in a variety of fields, it is essential that constant attention be paid to the availability of highly trained manpower. The part played

HOOGGEKWALIFISEERDE MANNEKRAG IN RSA

Slegs 5 persent van die Blanke manlike gegradueerdes in die RSA beskik oor 'n D-graad en nog 10 persent oor 'n M-graad. Hierdie twee groepe persone maak saam maar ongeveer 1,4 persent van die ekonomies bedrywige Blanke mans in die land uit. Hierdie gegewens blyk uit 'n verslag* oor hooggekwalifiseerde mannekrag in die RSA wat so pas deur die Raad vir Geesteswetenskaplike Navorsing vrygestel is.

Die verslag is gebaseer op gegewens wat deur meer as 80 000 gegradueerdes en gelykwaardig gekwalifiseerdes verstrek is en wat in die Nasionale Register vir Natuur- en Geesteswetenskaplikes wat deur die Instituut vir Mannekragnavorsing van die RGN in stand gehou word, opgeneem is.

Waar Suid-Afrika in toenemende mate en op 'n verskeidenheid van gebiede met ander lande moet kompeteer, is dit noodsaaklik dat voortdurend gelet sal word op die

by specialised and highly qualified manpower in the technological and social development of the RSA is increasing in importance. It appears from the report that approximately 45 per cent of all doctorates held by White males have been obtained since 1960. This is largely the result of increased expenditure of government funds on research and training at high level. However, it also appears that 37 per cent of all doctorates held by males were obtained abroad, which indicates that the RSA is still to a considerable extent dependent on overseas countries for the specialised training of its top manpower.

It is in the national interest of the RSA, in particular, that constant attention be paid on a continuous basis to the supply of and demand for highly qualified manpower. Acting on the recommendation and with the assistance of the Scientific Adviser to the Prime Minister, the Joint Council of Scientific Societies and the Federation of Societies of Professional Engineers, the Institute for Manpower Research is consequently planning to launch a research programme on highly qualified manpower. Data will be gathered on the job situation and salary structure of high level manpower in the country so that it will be possible to make realistic estimates of the future supply of and demand for such manpower.

Approximately 80 000 persons whose names appear in the National Register of Natural and Social Scientists will receive a questionnaire by post in March 1973, in which they will be requested to participate in the research programme. Persons receiving this questionnaire are earnestly requested to complete and return it as soon as possible.

The processing of the data will commence directly on receipt of the questionnaires and reports on the findings will be made available from the end of the year. It is expected that the proposed research will enable constructive recommendations to be made to the authorities and other bodies on the training facilities, salaries and utilization of high level manpower in the country.

*"Graduate Manpower of South Africa" — Report No. MM-36 of the Institute for Manpower Research of the South African Human Sciences Research Council. A copy is available for perusal at the Secretariat of the SAVA. This bilingual publication is available at Van Schaik Bookstore, P.O. Box 724, Pretoria, at R6,25.

beskikbaarheid van hoog geskoolde mannekrag. Die rol wat gespesialiseerde en hooggekwalifiseerde mannekrag in die tegnologiese en maatskaplike ontwikkeling in die RSA vervul, neem in belangrikheid toe. Uit die verslag blyk dat ongeveer 45 persent van alle doktorsgrade waaroor Blanke mans beskik, sedert 1960 verwerf is. Dit is grotendeels die resultaat van toenemende besteding van staatsfondse aan navorsing en opleiding op hoë vlak. Dit blyk egter ook dat 37 persent van alle doktorsgrade, wat mans betref, oorsee verwerf is, wat daarop dui dat die RSA nog in 'n hoë mate van die buiteland afhanklik is vir die gespesialiseerde opleiding van sy hoogs geskoolde mannekrag.

Dit is veral in die RSA van nasionale belang dat op 'n deurlopende basis na die aanbod van en vraag na hooggekwalifiseerde mannekrag gelet sal word. Daar sal dus op aanbeveling en met die steun van die Wetenskaplike Raadgewer van die Eerste Minister, die Gesamentlike Raad van Natuurwetenskaplike Verenigings en die Federasie van Verenigings vir Professionele Ingenieurs, 'n navorsingsprogram oor hooggekwalifiseerde mannekrag deur die Instituut vir Mannekragnavorsing geloods word. Gegewens sal ingewin word oor die arbeidsituasie en salarisstruktuur van hoëvlakmannekrag in die land sodat realistiese ramings van die toekomstige vraag na en aanbod van sodanige mannekrag gemaak kan word.

Ongeveer 80 000 persone wie se name in die Nasionale Register vir Natuur- en Geesteswetenskaplikes verskyn, sal gedurende Maart 1973 'n vraelys oor die pos ontvang waarin hulle versoek word om aan die navorsingsprogram deel te neem. 'n Beroep word op elkeen wat sodanige vraelys ontvang, gedoen om dit so spoedig moontlik in te vul en terug te stuur.

Die verwerking van die gegewens neem onmiddellik na ontvangs van die vraelyste 'n aanvang en verslae daaroor sal van die einde van die jaar af beskikbaar gestel word. Die verwagting is dat die beoogde navorsing sal lei tot konstruktiewe aanbevelings aan die owerhede en ander instansies oor die opleidingsgeriewe, salarisse en benutting van die hoëvlakmannekrag in die land.

*„Gegradueerde Mannekrag in Suid-Afrika" — Verslag nr. MM-36 van die Suid-Afrikaanse Raad vir Geesteswetenskaplike Navorsing se Instituut vir Mannekrag. 'n Kopie is by die Sekretariaat van die SAVV ter insae. Die tweetalige publikasie is verkrygbaar by Van Schaik-Boekhandel, Posbus 724, Pretoria, teen R6,25.

Fotografie: A. M. du Bruyn, met vriendelike toestemming van die beeldhouer, dr. h.c. Coert Steynberg, en die eienaar, die Departement Nasionale Opvoeding.

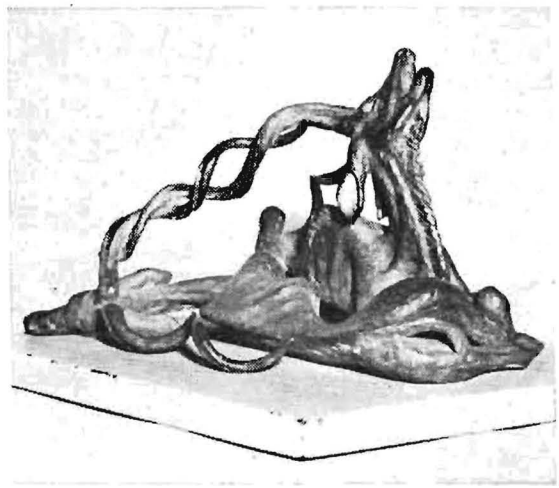
INTERTWINING OF HORNS OF FIGHTING KUDU BULLS

This occurence is by no means unknown or rare. According to Dr. G. de Graaff of the National Parks Board of Trustees, the biologist of the Kruger National Park at Skukuza, Dr U. de V. Pienaar could call to mind about half-a-dozen cases during his almost twenty years of office. In the latter's Annual Reports mention is made every now and again of such cases. Still it presents a striking scene.

Usually the bulls fight during the mating season for possesison of one or more cows. One can visualize that a coincidental simultaneous twisting of their heads in opposite directions during a forward lunge of the two combatants may cause such an intertwining. Once a critical point has been reached, struggles to release the interlock will generally be futile: the chances of synchronous opposite turning movements are slender. Such animals usually die of thirst, hunger, exhaustion and exposure. No evidence of breaking of necks has come to light.

The photograph on the left was taken in the bushveld in the vicinity of Thabazimbi by Mr. A. M. du Bruyn of the Section Photography of the Veterinary Research Institute, Onderspoort. Note the large area denuded of vegetation as a result of struggling. Disturbance of the carcasses of the animals is the work of scavengers.

This occurrence has been portrayed strikingly by the famous South African sculptor, Coert Steynberg, in the statuette "Folly of War" on the right.



Photography: A. M. du Bruyn, with kind permission of Dr h.c. Coert Steynberg and the owner, the Department of National Education.

INEENSTRENGELING VAN HORINGS BY VEGTENDE KOEDOEBULLE

Hierdie verskynsel is geensins onbekend of seldsaam nie. Volgens dr. G. de Graaff van die Raad van Kuratore vir Nasionale Parke, kon die bioloog van die Kruger Nasionale Park te Skukuza, dr. U. de V Pienaar hom in sy ampstermyn van amper twintig jaar ongeveer 'n sestal gevalle voor die gees roep. In lsg se jaarverslae kom dan ook elke nou en dan melding van sodanige gevalle voor. Tog bly dit 'n aangrypende beeld.

Gewoonlik baklei die bulle met paartyd ter verkryging van een of meer koeie. 'n Mens kan indink dat 'n toevallige, gelyktydige draaiing van hul koppe in teenoorgestelde rigting terwyl die vegtendes na mekaar stoot so 'n ineenstrengeling sal veroorsaak. Indien 'n kritiese punt bereik is, sal verder sparteling om los te kom, meesal tevergeefs wees: die kanse vir sinkroniese draaibewegings in teenoorgestelde rigting is uiters gering. Sulke diere vrek dan gewoonlik as gevolg van dors, honger, uitputting en blootstelling. Geen getuienis van breek van nekke het aan die lig gekom nie.

Die opname links is geneem in die bosveld in die omgewing van Thabazimbi deur Mnr. A. M. du Bruyn van die Seksie Fotografie van die Veerartsenykundige Navorsingsinstituut, Onderspoort. Let op die groot kol wat deur die sparteling ontbloot is. Versteuring van die diere se karkasse is deur aasdiere veroorsaak.

Hierdie gebeure is treffend verbeeld deur die gevierde Suid-Afrikaanse beeldhouer, Coert Steynberg, in die beeldjie „Oorlogswaansin".