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# JOURNAL OF THE SOUTH AFRICAN VETERINARY ASSOCIATION

# TYDSKRIF VAN DIE SUID-AFRIKAANSE VETERINÊRE VERENIGING

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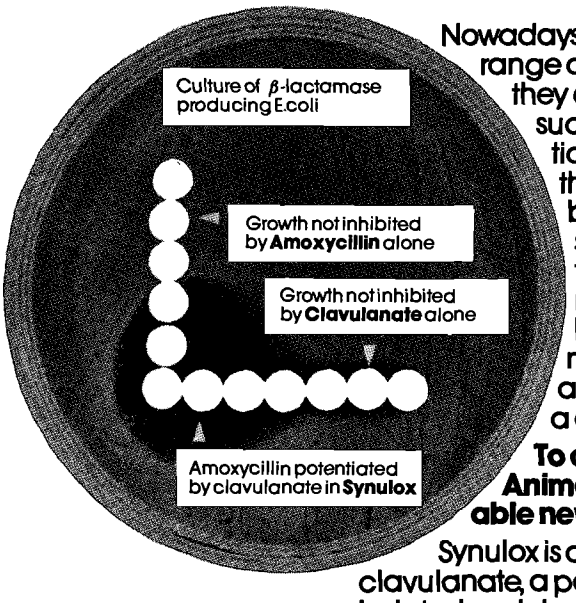


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## TYDSKRIF VAN DIE SUID-AFRIKAANSE VETERINÊRE VERENIGING

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

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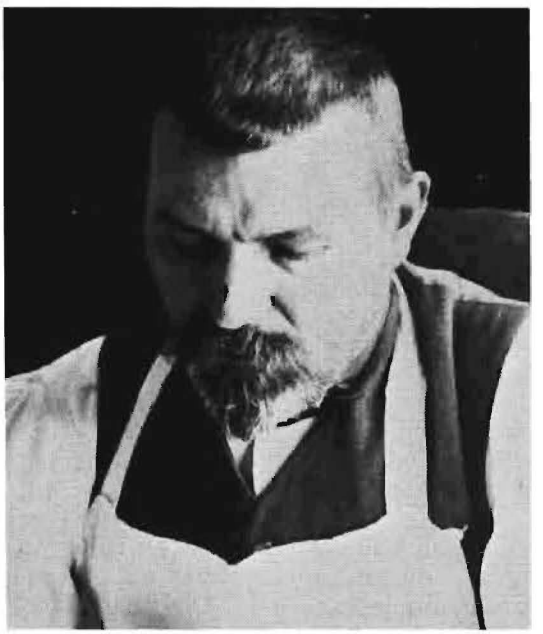
## ARNOLD THEILER-GEDENKLESING ARNOLD THEILER MEMORIAL LECTURE



# VLAMMENDE FAKKELS, OU BENE, IVOORTORINGS EN ROOI VLAE†

H.P.A. DE BOOM*

Geagte mnr. die Dekaan en kollega's

Aangesien ek 'n hekel het aan cliché's, gaan ek nie nou verklaar watter eer en voorreg dit is om hierdie lesing te kom gee nie: my siening sal aan die einde hiervan verneem word.

In die eerste instansie moet ek hierdie Fakulteit gelukwens met die instelling van 'n Fakulteitsdag, ten tweede met die instelling van die Arnold Theiler-gedenklesingreeks, en ten derde met die tydige keuse om wyle dr. Thelma Gutsche die eerste lesing te laat gee. Niemand het Theiler en sy tye se geskiedenis so sorgvuldig gedokumenteerd nagevors as juis sy nie.

Waar ons vandag die goue draad van die geskiedenis van ons professie vanaf Sir Arnold Theiler se dae tot hede wil span, is ons in die eerste plek nie soseer op akademies-historiese feite gesteld nie, maar eerder, soos 'n Paul Kruger van ouds, op die lesse wat daar vir ons in die geskiedenis opgesluit lê.

Om 'n geskikte titel vir hierdie gedagtegang te vind, het ek my tot een van Theiler se uitsprake gewend en toe, in navolging van my kunstenaardogter, my toevlug tot allegoriese uitbeeldings geneem. Van die vier beeldkonsepte wat ek gekies het, lê die eerste een in die middelpunt, met die ander driehoeksgewyse daaromheen gerangskik, om sodoende hul onderlinge wisselwerkende verband ten opsigte van mekaar te versinnebeeld.

Die vlammende fakkels beheers die middelpunt en slaan op die begeestering, die dryfkrag, die skeppende denke en die visie wat Sir Arnold se dink en doen gekenmerk het, en wat tot hede – en hopelik vir die toekoms – 'n grondslag gelê het en sal lê vir die Veeartsenykunde as wetenskap en as praktyk wat ons hier in Suid-Afrika beoefen.

'n Uiters belangrike aspek van die fakkel-konsep is die noodsaaklikheid van wedersydse onderlinge stimulering. Om te kan brand het 'n fakkel brandstof nodig, en iemand wat dit aansteek. Alhoewel spontane ontbranding dikwels skyn plaas te vind, blyk by nadere ondersoek dat buite-invloede nodig was om ontbranding te laat plaasvind en die vlam te onderhou. So was dit ook met Theiler. Sy groot klagte aanvanklik in Suid-Afrika was die gebrek aan akademiese kontak en die wedersydse stimulus wat van daar uitgaan. So het hy in 1908 met mense soos dr. Gunning van die Nasionale Dieretuin die "Transvaal Philosophical Society" gestig. En hy het toegesien dat al sy mense te Onderstepoort die vergaderings bywoon. Dit verheug my dat ons kollega's nog steeds 'n rol in daardie vereniging, nou die S.A. Biologiese Vereniging, speel.

Ek dink ook aan die rol wat dr. Turner, hoof van die destydse melaatsegestig te Westfort gespeel het, asook aan dr. Harry Green. Hy was 'n fisioloog en biochemikus – nie 'n veearts nie – maar hy was dié persoon wat by Theiler die fakkel brandend gehou het. Hieruit kom nog 'n belangrike punt na vore: in die beoefening van die veeartsenykundige wetenskap is daar ruim plek vir nie-veeartsenykundig opgeleide wetenskaplikes – gespesialiseerde wetenskaplikes op hul eie gebied. In sekere gevalle, soos die van wyle dr. H.O. Mönnig, het Theiler sodanige wetenskaplikes aangemoedig om ook die graad in veeartsenykunde te behaal. Dit staan ons professie ter eer dat ons sogenaamde "buitestaanders" in ons geledere ingetrek het en ons onsself nooit kleinlik parogiaal tot eie geledere beperk

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†Gelewer te Onderstepoort ter geleentheid van die tweede Fakulteitsdag van die Fakulteit Veeartsenykunde van die Universiteit van Pretoria, op 25 September 1985.

het nie. Dit was 'n baie vrugbare beleid. Die omgekeerde proses het ook ryke dividende besorg: waar veeartsenykundiges hulle op ander wetenskaplike terreine verder bekwaam het.

Die groot gevaar wat ons bedreig kom van die kant van die Suid-Afrikaanse Mafia, soos bedrywe deur die neefs Cannetti en Villetti: Cannetti Worrini en Villetti Traaini.

Arnold Theiler het na sy aftrede in 1927 na Switzerland gegaan met kaste vol bene en beenmonsters. Sy groot belangstelling in beensiektes, wat weens drukte van ander werksaamhede in Suid-Afrika nie tot sy reg kon kom nie, wou hy hier uitleef. In die proses het hy hom allereers in die basiese konsepte van beenhistologie verdiep, in sake waarmee eerste- en tweedejaarstudente mee kennis maak. Ten einde sy driedimensionele begrip te verbeter, het hy selfs sy vrou en dogters se breipenne en wol opgekommandeer. Hierin lê daar vir ons almal 'n belangrike les: geen saak is te eenvoudig en te vanselfsprekend om nie weer deeglik bepeins en beproef te word nie. Hoeveel male het ek nie die vrugte van hierdie soort prosedure gepluk nie.

In 1934, ten tye van die 29ste kongres van die Suid-Afrikaanse Veterinêr-Mediese Vereniging – dit het destyds so geheet – was Theiler terug op 'n besoek in Suid-Afrika en het hy 'n referaat oor sy werk gelewer. Dit was 'n meesterstuk van deeglikheid en logika. Hy is op gepaste wyse deur die voorsitter van die aand se verrigtings, dr. P.J. du Toit, bedank. Toe staan Theiler weer op en lewer die volgende veelseggende repliek, in daardie pikante Switserse Engels van hom: "Gentlemen, you may think it is only an old bone; you have to put your soul into that bone." Dit het my as jong student soos 'n bom getref en lewenslange inspirasie besorg.

Die kongres was te Onderstepoort, in die Biblioteeksaal, en ons as studente kon dit bywoon. As ek terugdink aan die begeestering wat bywoning van ons kongresse my besorg het, is dit 'n groot jammerte dat ons studente vandag om bloot logistiese redes merendeels so 'n voorreg ontsê is.

Dis vir my as anatoom heel natuurlik om die beeld van "ou bene" aan te gryp. Vir meeste van ons wek dit geen belangstelling nie: dit hou eerder iets afstootliks of weersinwekkends in. So dikwels beskou ons 'n bepaalde faset van die biologie of toegepaste biologie as uiters oninteressant, of as vermuf en verouderd, of verwarrend, en dus afstootlik. Veral by die student is dit dikwels die geval. Dit berus meesal op gebrek aan nadere kennismaking, gepaard met die onwilligheid tot inspanning, veral intellektuele inspanning. Die mens is maar van nature lui, en die luiste sisteem van sy gestel is juis die sentrale senuweestelsel. Dan moet ons die Theilerdiktum toepas, en ook by ons nasionale spel, rugby, gaan leer: dis daardie ekstra hupstootjie in die skrum wat wondere vermag. As die deurbraak eers gemaak is, is dit ongelooflik hoe boeiend die voormalig afstootlike word. Hierdie les bly ook nie net tot die akademieswetenskaplike wêreld beperk nie. Hoeveel beteken daardie bietjie ekstra moeite wat die praktisyn of amptenaar doen net nie vir sy medemens en uiteindelik vir homself nie: daardie twee myl in plaas van een myl se saamloop.

Om fakkels aan te steek bly taak nommer een van ons fakulteite. Bloot deur voorlesings en hoogheilige voorhou van voorskrifte kan dit nie gedoen word nie. Dit is 'n gestadige proses wat op heel natuurlike wyse voltrek moet word deur die voorbeeld van die dosent, deur sy houding, sy gedrag, sy entoesiasme en sy benadering van die student. Moet net nie by my met die afgesaagde storie aankom dat ons jeug verrot is nie. Ons jong mense soek juis na inspirasie en ons mag hulle net nie teleurstel nie. Na 46 jaar in die tersiêre onderwys bly dit my vaste oortuiging. Ons, as dosentekorps, moet nie teleurgestel voel as ons pogings, soos helaas so dikwels die geval is, maar power beloon word nie. 'n Mens moet eenvoudig nugter en realisties genoeg wees om te besef dat die biologie, en veral die toegepaste biologie, 'n veld is enorm van omvang, eksponensieel toenemend, dikwels uiters verwarrend en dikwels nog lank nie tot sy logiese konsekwensies opgeklaar nie. Dit is glad nie verbasend dat die nuweling aanvanklik 'n moeilike ploetertyd deurmaak nie. Ons, as dosente, moet aanvaar dat ons saaiers is; ons moet maar geduldig en volhardend aanhou met saai, of die saad nou op klip of op dorre aarde val, en of dit nou deur onkruid verstrik raak of nie. Dit wat op vrugbare aarde val is ons beloning. 'n Mens weet nooit hoe of waar of wanneer 'n deurbraak bewerkstellig word nie. Soms ervaar 'n dosent dit dat van sy oud-studente na hom kom en sê: "Die dag toe u dit of dat gesê het, het die wêreld vir my oopgegaan." Dit, terwyl die dosent op daardie tydstip vir hom 'n heel terloopse opmerking gemaak het, salig onbewus van die impak wat dit sou hê.

Die belangrikheid van die dosent kan met 'n eenvoudige rekensommetjie bewys word: vermenigvuldig sy aantal diensjare met die getal studente wat by hom klas geloop het, en u sal besef watter enorme potensiaal ten goede of ten kwade hy kan wees.

In die finale instansie, egter, is ons almal fakkeldraers. Ek is telkens verstom oor die interessante waarnemings en idees waaroor ons kollega's in die frontlinie, met name veral praktisyns en staatsveeartse, beskik. Daarom pleit ek vuriglik vir bydraes tot ons lyfblad en vir omvangryker korrespondensiekolomme. Laat van u hoor, al het u nie al die antwoorde nie, al is u huiwerig om u vermeende onkunde wêreldkundig te maak.

In die proses van toespits op 'n bepaalde onderwerp of faset is dit noodsaaklik dat die individu hom, tydelik altans, letterlik in 'n ivoortoring moet afsonder. So kom ons dan by oorweging van die derde simbool: die van ivoortorings. Hoe noodsaaklik ookal, die ivoortoring het sy gevare: dit kan so maklik 'n gevangenis word. Met intense toespitsing ontwikkel ons so maklik tonnelvisie. Ons kan net nie buite ons selfopgelegde benepe gesigsveld beweeg nie. Of andersins is ons so verweef in afstandvisioene en horisonne dat ons nie die onkruid tussen ons tone waarneem nie. Erger nog, ons raak so verstrik in die daaglikse sirkelgang van nakom van noodsaaklike kleiner eise, dat ons oorspronklike doelwitte heeltemal vergete bly. Dit is vir my 'n wrede ironie dat daar talle takies is wat in toenemende getalle in ons gesofistikeerde samelewing daagliks ons aandag eis, takies wat op sigselwe van mindere belang is, maar tydsgewys tog dringend, dat hulle uiteindelik ons ivoortorings totaal toerank en verseël. En ons sit daarbinne, hulpeloos soos slawe vasgevang.

Hierdie gevare van die ivoorstoringbestaan bedreig nie net individue nie: dis veral georganiseerde instellings wat kwesbaar is. In ons geval dink ek in die eerste instansie aan ons Fakulteite, aan die Navorsingsinstituut, en aan ons Vereniging. Sodra sulke instellings hul oorspronklike doelwitte en ideale uit die oog verloor, en hulself op blote voortbestaan en eie kort-termyn-voordele toespits, is hulle gedoem. Laat ek u 'n voorbeeld noem wat ek die beste ken. In ons universiteitswese is die student die heel belangrikste entiteit; tweede in

rangorde is die dosentekorps, en derde die administrasie. Omdat laasgenoemde vir die goeie orde en gang van sake moet sorg, is dit haas onvermydelik dat die administrasie die botoon vier. Die dosent, omdat hy die leiding by die onderrig moet neem, tree dikwels onbewustelik egosentries op. 'n Omgekeerde stand van sake dus. Dis by verre nie dat ek die gekkigheid bepleit dat studente die leiding moet oorneem, soos die neiging in sommige lande begin posvat. Ook wil ek geensins administrasie afkraak nie. Geen organisasie, allermins 'n universiteit, kan dit bekostig om 'n swak funksionerende logistiese onderbou te hê. Theiler self het sterk gesteun op die administratiewe en organisatoriese bekwaamhede van manne soos King en Charlie Hinds. Hulle was inderdaad sy regterhand.

In ivoortorings is daar noodgedwonge etlike verdiepings wat beman moet word. Nou is dit helaas so dat juis daardie piramidale inskakeling enersyds die gevolg is van, en andersyds aanleiding gee tot, 'n oeroue gedragspatroon: die pikrangorde. Is dit te veel gevra dat ons as mense ons beter moet gedra as die bewoners van 'n hoenderhok? Of moet ons miskien weer gaan kyk hoe ons vermeende oer-oupagrootjie, die slingeraap ("gibbon"), sy hierargielose gemeenskap bedryf? Selfs die nederigste werker kom die nodige eer en waardering vir behoorlike volvoering van sy taak toe. Ons moet ook in dié opsig fakkels aansteek pleks van domweg pik. Die telefoniste/ontvangsdame speel in die praktyk dikwels 'n belangriker beeldskeppende rol as selfs die hoof/direkteur/rektor. In die handel en nywerheid word huidiglik besondere aandag aan bedryfsleiding gegee. Op professionele vlak in al sy vertakkings kan ons gerus meer aandag hieraan gee, hetsy in die onderwys, in navorsing of in die praktyk. Dis juis op navorsingsgebied waar 'n mens steeds tussen die Scylla van oormatige reglementering en die Charybdis van onbeteuelde vryheid moet deurvaar. Ek was verheug om van die onlangse samekoms te Sandton oor bedryfsleiding in die veeartsenykundige praktyk te verneem. Dis ook betekenisvol dat etlike van ons kollega's die MBA-kwalifikasie behaal het. Om hierdie aspek af te sluit wil ek op die ongewenstheid wys om bekwame dosente en/of navorsers te beloon deur hulle na administratiewe posisies te "bevorder". Moet ons nie liewer 'n tweestroombeleid volg, waarby diegene met organisatoriese aanleg direk in daardie kanaal gelei word, met eventuele nouere inmekaarskakeling van akademie en administrasie?

'n Besondere sy van die ivoortoring-gevaar bedreig ons veterinêre fakulteite in Suid-Afrika. Dit is die gevaar van intellektuele inteelt. Vanweë ons besondere omstandighede is ons gedwing om meesal van ons eie studente as dosente in diens te neem. Oorsese akademici sou hieroor hul hande in hewige afkeer die lug ingooi. Dit is 'n wesentlike gevaar, maar wat het in werklikheid gebeur? In alle eerlikheid kan ek getuig dat die proses nie so nadelig was soos 'n mens dit teoreties gesproke sou verwag het nie. Die rede hiervoor kan ek toeskryf aan die feit dat daar nog baie pioniersbloed deur ons are vloei: die sterk individualisme, die nugterheid en onbevangenheid van benadering, die praktiese sin, die veelsydigheid, oorspronklikheid en onafhanklikheid van ons denke. Waarlik, die gees van Theiler leef nog voort. Soos 'n besoekende wetenskaplike uit Israel dit heel onlangs aan my gestel het: "You South Africans have a unique way of doing things". Die "boer-maak-'n-plan"-benadering is so te sê tweede natuur by ons. Daarby ken ons ons mense, en kan ons dus meesal by aanstellings 'n beter oordeel vel. Dit neem egter nie weg dat oorsese besoeke 'n noodsaaklike onderneming vir elkeen van ons jong akademici is nie. Ons is in die gelukkige situasie dat ons geredelik maklik by Europese en Amerikaansse denkwyse kan inval. Ons moet daar gaan waarneem en persoonlik ervaar, dan hier, nie slaafs kom navolg nie, maar ons eie, unieke sintese kom skep.

'n Verdere ivoortoringgevaar is die hooghartige houding dat net ons as professsioneel-geskoolde mense die beste kan weet en dat ons ons geensins aan lekepraatjies hoef te steur nie. Sir Arnold het hier die weg gewys. Hy het altyd beklemtoon dat ons aandagtig moet luister na die waarnemings en menings van leke, veral dié wat nou by diere betrokke is, selfs na skynbaar onsinnige ou-vrou-stories: daar steek altyd iets agter. Kyk ons terug na die grootste deurbrake op navorsingsgebied, bv. perdesiekte en lamsiekte, dan was dit juis die krities-versigtige aandag aan lekepraatjies wat daartoe aanleiding gegee het. Lees ons in die Landbouverslae van die ou Kaapkolonie, dan sien ons tot ons skande dat 'n leke-minderheid teenoor 'n professioneel-gesteunde meerderheid reeds 'n eeu en 'n half gelede in 'n kommissie van ondersoek na rooiwater, bosluisoordraging voorgestaan het. Die beste les in kliniese waarneming het ek van 'n baar swartman gekry, die metode om urine by 'n verskalf te kollekteer, by 'n boeretannie.

Op 'n effens anderse noot doen ek 'n wenk aan die hand, gegrond op eie ervaring. As u in u navorsing of kliniese ondersoek op 'n waarneming afkom wat oënskynlik nie strook met u konsep van die saak, moet dit nie negeer nie: gaan met man en mag daarop in. Dit is juis in die skyn van teenstrydighede waarin die waarheid dikwels verskuil lê. Die liggaam probeer ons iets vertel waarvoor ons op daardie oomblik blind is.

Terug na die gebied van die onderwys, haal ek 'n pluspunt, twee gevaarpunte en drie probleempunte aan.

Die plus-punt: Tydens 'n informele samesyn van kollega's in die Statler-klub te Cornell, haak een van die aanwesiges af en vra my tromp-op hoekom die opleiding te Onderstepoort so 'n goeie naam het. Ietwat verleë bedank ek hom vir die kompliment en waag my mening: omdat ons soveel klem op basiese aspekte lê. Hy keer hom tot sy makkers en sê: "You see fellows, what I have been telling you all along".

Gevaarpunt een: As dosente raak ons so maklik verstrik in die taak van kennisoordraging, die student met die blote weergee van kennis, (die toets-tot-toets-sindroom), dat grondliggende ideale van die "Academia", wat ek hopelik nie hier hoef uit te spel nie, uit die oog verloor word. Ter illustrasie haal ek Shaw na geheue aan: "A lecture is the process of transformation of lecturer's notes to student's notes without going through the heads of either."

Gevaarpunt twee: Dit is 'n wrede ironie dat menige jong dosent, in sy besondere ywer om 'n vak goed te doseer, hom so op die ingewikkeldste en mees gevorderde aspekte toespits dat hy die studente verwar, verloor en selfs totaal afskrik van die besondere vakgebied. In Portugese akademiese kringe bestaan daar die gesegde: "Die hemel bewaar die student van ou straatvrouens en jong professore."

Probleempunt een: Die grootste enkele gebrek van ons akademiese opleiding is die absoluut onvoldoende tyd en geleentheid wat die student gebied word om hom in sy nuutverworwe kennis en vaardighede te oefen. Vergelyk die totale tyd wat aan kennis-oordraging bestee word met die tyd wat aan die toets daarvan gewy word: daar is 'n skrikwekkende dispariteit, wat ons met

die vrome hoop probeer besweer dat die studente wel na ure uit eie beweging sal studeer. Daar word vandag gelukkig baie aandag aan didaktiese metodes geskenk, maar dit word net van die dosent se kant gesien. Hierdie probleempunt verdien ernstige aandag. Die instel van self-evalueringstegnieke en metodes is broodnodig. Rekenaarondersteunde leer-en-toets-metodes bied hier 'n antwoord. Aangesien die "sagte ware" tog uitgewerk moet word, kan dit reeds sonder duur apparatuur vermag word.

Probleempunt twee: Dit ly geen twyfel dat keuring van voornemende studente in die veeartsenykunde baie daartoe bygedra het om ons professionele peil te verhoog. Die vraag bly steeds of ons nie tog weer 'n keer indringend moet kyk na die ontwikkeling van bykomstige aanlegtoetsmetodieke nie. 'n Mens kan net nie van die ongemaklike vermoede los kom nie dat goeie potensiaal soms verwerp kan word, en dat swakker potensiaal soms deurglip.

Probleempunt drie: Anders as by mediese fakulteite, moet veeartsenyfakulteite in hul eie hospitaal- en kliniese geriewe voorsien. In die lig van die geweldige kostestyging van apparatuur en middels, sal hierdie probleem ernstige aandag verdien.

Dit is 'n interessante en bemoedigende verskynsel dat teen enige oordrewe of foutiewe neiging in die samelewing daar altyd vroeër of later verset en teenkanting opbou. So kom ons by die laaste simbool, dié van rooi vlae: die rooi vlae van verset en rebellie.

Die rooivlag-element is noodsaaklik. In die eerste en verreweg belangrikste instansie moet dit uit nugtere, eerlike, nie-verlammende selfkritiek bestaan. Omdat alwysheid nie die enkeling beskore is nie, is dit ons plig om, nes in die geval van fakkels, mekaar by te staan. Maar dan moet dit op eerlike en konstruktiewe wyse geskied, en nie op persoonlike aanvalle neerkom nie. Weereens kan ons by ons nasionale spel se beginsels gaan leer: "Speel die bal, nie die man nie." Die versoeking is altyd daar om eie aansien of kort-termyn-belange en voordele te bevorder deur ander af te kraak. So dikwels word in dié proses van die Don Quixote-tegniek gebruik gemaak. Jy bou 'n eie beeld op van wat jy meen jou teenstaander se foute is, en bestorm die dan soos 'n Don Quixote van ouds windmeulens bestorm het. (Lyk die prentjie in ons huidige landsomstandighede nie baie bekend nie?) Dit bly 'n eenvoudige waarheid dat 'n huis teen homself verdeel nie staande kan bly nie. Vir die kompulsiewe afkrakers, eie voordeelsoekers, byltjieslypers en meer-dan-heiliges is daar in ons geledere net nie plek nie. As wetenskaplikes behoort dit tog nie so moeilik te wees om krities-analitiese denkwyses ook op onsself van toepassing te maak nie. 'n Bietjie minder gesteldheid op eie eer, 'n bietjie meer opregte nederigheid, 'n bietjie meer nugtere denke, is al wat nodig is. Ek wens ons kon 'n kode ontwerp waarvolgens sonder gevaar van persoonlike aanstoot gee, eerlike, welmenende kritiek uitgeoefen kan word.

In Theiler se dae het die hare ook maar gewaai. Karl F. Mayer, een van sy vroeë medewerkers, was net soos Theiler 'n man met 'n geweldige sterk persoonlikheid. Hy sou aan Theiler gesê het dat Onderstepoort te klein vir die twee van hulle was. Hy is na Amerika waar hy groot naam gemaak het. Tydens 'n veel latere besoek aan Onderstepoort het dit my opgeval met watter entoesiasme en eerbetoon hy oor Theiler gepraat het, sonder die geringste sweem van bitterheid. Ander voorbeelde van hoe sake geskik kan word is die wyse waarop aanvanklike botsings tussen ons Vereniging en Dierewelsynorganisasies tot heelhartige samewerking omskep is, en die wyse waarop haakplekke tussen ons en die Aptekersvereniging uit die weg geruim word. Uit eie ervaring dink ek terug aan daardie ongemaklik pynlike oomblikke toe my destydse kollega en nou ons geëerde Dekaan met 'n gesig van onweer en 'n paar kragwoorde aan my kom verduidelik het dat dinge ** net nie so kan aangaan nie; of aan die kere wat ons huidige departementshoof van Anatomie op haar nimlike en minlike wyse maar met 'n ernstige frons my op dreigende krisisse attent kom maak het. In plaas van verdelend, het dit saambindend gewerk: daardie gevoel van "saam-'n-sak-sout-opeet" is geskep. Dit is daardie oomblikke wat my by terugblik vandag die grootste genoegdoening gee.

Ons kan in oorsig van hierdie simbool gerus gaan kyk hoe die senuweestelsel beheer toepas. Op laer vlak is daar die gedurige spel van stuit en weeromstuit tussen die simpatiese en die parasimpatiese stelsel; op hoër vlak tussen die limbiese en kortikale (prefrontale) stelsel.

Dis 'n seën dat ons 'n groep van soveel uiteenlopende persoonlikhede, belangstellings en begaafdhede vorm. Dit gaan per slot van sake nie om eie gewin of aansien nie. Die definisie van sukses kom uiteindelik neer op die volle ontwikkeling en uitlewing van elkeen se eie potensiaal ten goede.

Die finale diagnose en prognose? Ruim toegegee dat daar altyd plek is vir verbetering en vooruitgang om aan ons strewes stukrag te gee, is dit my onomwonde mening dat ons 'n diagnose van "in wese kerngesond" kan stel, met 'n gunstige prognose. Tydens my verblyfperiodes in die VSA het ek my ore ingeskerp op menings van kollega's aldaar. Die uitslag was baie bemoedigend. Dis interessant om kennis te neem van die grootste gemeenskaplike faktor in hierdie meting van Suid-Afrikaners aan internasionale standaarde. Dit was hulle gewilligheid om in te spring en hard te werk. Komende van 'n volk wat bekend is om sy hardwerkendheid, is dit veelseggend.

Ten slotte herinner ek u daaraan dat die wetenskap groter is as die enkele mens, maar dat die mens groter is as die wetenskap.

Geagte meneer die Dekaan en kollega's, as u by die aanhoor van hierdie toespraak, wat as my laaste boodskap aan u beskou kan word, slegs 'n breukdeel van die stimulus ervaar het as wat ek by die opstel daarvan belewe het, sal ek ryklik beloon en geëerd voel.

ADDRESS VOORDRAG

# DIE UNIVERSITEIT, DIE DOSENT EN DIE STUDENT

H.P. VAN DER SCHIJFF
Vise-Rektor (Natuurwetenskappe), Universiteit van Pretoria*

Geagte meneer die dekaan, dames en here

Om by hierdie fakulteit en in hierdie omgewing 'n navorsingsdag te open bly steeds 'n moeilike maar aangename taak. Dit is 'n moeilike taak omdat u en u omgewing gekoester lê in 'n tradisie van indringende navorsing wat nie alleen vir die veebedryf van Suid-Afrika en vir dele van die res van Afrika vooruitgang en voorspoed gebring het nie, maar ook vir die naam Onderstepoort roem in die wêreld verwerf het. In so 'n omgewing voel 'n mens dus huiwerig om so 'n dag te open want jy weet jy het met wetenskaplikes in 'n wetenskaplike omgewing en met tradisies wat ver teruggaan te doen. Dit is egter ook 'n maklike taak omdat jy weet jy praat met 'n fakulteit en sy mense wat net soos 'n goeie boom wat veelvuldig vrugte dra, 'n stam het wat goed in 'n stewige wortelstelsel geanker is. Daarom is dit vir my aangenaam en 'n voorreg om vandag hierdie navorsingsdag te open.

Meneer die dekaan, u fakulteit is bevoorreg daarin dat u terug kan kyk op 'n lang geskiedenis waarop u almal trots is. 'n Geskiedenis van indringende navorsing waarop die fakulteit gefondeer is en waarop u trots voortbou soos u vandag weer doen.

## HOE LYK ONS OMGEWING

U en u fakulteit is maar te goed van die feit bewus dat ons bodem en natuurlike hulpbronne nie onuitputlik is nie. Aan die wat miskien so geglo het is die werklikhede van die laaste paar jare van droogte fel tuisgebring; omgewingswerklikhede teenoor werklikhede van ons bevolkingsaanwas en samestelling wat ons daagliks laat besef dat die eise wat aan ons as Suid-Afrikaners en wetenskaplikes gestel gaan word, nie minder sal word nie maar veeleisender. 'n Bevolking wat in die jare 2050 bykans 95 miljoen sal tel. Met 'n bevolkingsamestelling wat op sigself baie hoë eise aan die breë gemeenskap gaan stel, is dit duidelik dat groot uitdagings vir die wetenskaplike en bioloog voorlê. Werklikhede van 'n bevolkingstoename waarmee ons as wetenskaplikes rekening mee moet hou. 'n Bevolkingstoename wat omgewingsgebonde en omgewingsafhanklik is en waarvoor ons as natuurwetenskaplikes medeverantwoordelikheid vir hulle (ons) voeding, skuiling en kleding moet aanvaar. Die vraag is hoe ons die mas gaan opkom en of ons dit ooit sal kan opkom. Moet ons nie maar liewer handdoek ingooi en wegvlug nie? Geneem teen die agtergrond van ons huidige landsprobleme lyk dit 'n geregverdige vraag te wees, maar dames en here, dan kom die teenvraag – waar gaan ons of julle heen waar dit uiteindelik anders gaan wees? Waar is daar nie probleme nie? Want hierdie probleme is wêreldprobleme waarvan ons nie kan wegkom nie. Ons wil ook nie daaraan ontkom nie want ons is wetenskaplikes en juis in sulke probleme lê vir die wetenskaplike groot uitdagings en geleenthede. Maar dan moet die wetenskaplike goed voorberei en opgelei word vir sy taak. Die universiteit moet kennis neem van wat om hom plaasvind.

## ONS TAAK AS WETENSKAPLIKES

Nou, meer as enige ander tyd in ons bestaan, moet ons *toesien dat ons jongmense, al ons jongmense, goed* opgelei word. Hulle moet met waagmoed en selfvertroue die werklike gekompliseerde lewe ingaan om hulle bydraes tot die oplossing van hierdie probleme te lewer. Dit is nou die tyd dat ons as bioloë ons in die biologieoefening moet ingrawe. Ons moet ons verdiep in die biologiese wêreld waar ons onsself nie alleen besig hou met die wonderlikste van die skepping, die lewe self nie, maar ook met die noodsaaklikste ter wêreld, die instandhouding van die lewe om ons. Werk die biologie dan nie ook met die talle probleme wat verband hou met die voorsiening van voedsel om die welvaart van sy gemeenskap in stand te hou nie? Daar lê vir ons as bioloë, wetenskaplikes, opvoeders en voorlopers in die gemeenskap wonderlike uitdagende dae voor, maar dan moet ons onsself in die regte gesindheid voorberei in die dissipline van ons belangstelling. Ons moet duidelikheid verkry oor die doel van universiteitsopleiding en van ons taak in hierdie land.

Om reg aan die opleiding en toekomsverwagtinge van u studente te laat geskied moet u oor u siening van 'n universiteit en universiteitsopleiding besin. Wat verwag u van 'n universiteit? Wat is die eise wat u in die eerste plaas aan uself stel? Watter eise stel u aan daardie inrigtings waaraan u uself verbind het om jongmense vir die toekoms op te lei of waaraan u uself gaan verbind om aan u opleiding te verskaf, u voor te berei vir die lewe in die gemeenskap waarin u uself gaan bevind? Die doelstelling van 'n universiteit ten opsigte van u opleiding in u spesifieke vakgebied kan moontlik in ooreenstemming met die siening van prof D J du Plessis, voormalige rektor van Wits, onder vier hoofde gegroepeer word, naamlik:

die behoud van kennis
die oordra van kennis
die uitbreiding van kennis
die aanwending van verworwe kennis en navorsingsresultate
in diens van die gemeenskap

## DIE BEHOUD VAN KENNIS

Dit moet sonder meer vir u duidelik wees dat enige universiteit met sy infrastruktuur van fakulteite,

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departemente, biblioteke, museums, navorsingsinstitute en personeel wat hierdie instellings beman noodwendig 'n geweldige groot hoeveelheid kennis versamel. Dit is 'n bron van kennis wat nie alleen vir geslagte wat kom bewaar moet word nie. Dit moet daagliks aangevul word deur nuwe kennis uit die wêreldgemeenskap van wetenskaplikes wat nuwe kennis genereer deur skeppende navorsing en geestesontwikkeling. Hierdie kennis word veral in biblioteke bewaar maar word ook van voorganger na opvolger oorgedra. Dit is die taak van die akademikus en student om hierdie kennis wat deur die geestelike aktiwiteite van voorgangers en tydgenote gegenereer is, sy eie te maak deur die uitbouing van 'n eie biblioteek in sy eie vakgebied, maar ook oor vakgebiede heen. Sowel vir elke universiteitsmens as vir elke ontluikende universiteitsmens wat geleerde wil word, is dit ook 'n vereiste om in sy eie reg 'n bewaarder van kennis te word. 'n Akademikus en student sonder 'n eie biblioteek kon net sowel ongeletterd gebly het. U moet begrip en liefde beoefen vir die goeie boek op u vakgebied maar ook vir alle boeke wat die menslike gees verhelder.

## DIE OORDRA VAN KENNIS

Om slegs 'n bewaarder van kennis te wees dien geen doel nie, want kennis word gegenereer om oorgedra en gebruik te word en dit is die taak van elke universiteit en elke universiteitsdosent. Studente meld hulle by universiteite, die bemarkers van kennis aan om gedurende hulle opleidingsproses kennis te verwerf. Op hulle beurt kan hulle weer daartoe oorgaan om kennis oor te dra en selfs later as dit hulle beskore is en hulle die wil daartoe het, nuwe kennis deur navorsing te genereer. Die taak van die Suid-Afrikaanse universiteit in die voor- en na-oorlogse jare was daarop toegespits om agterstande uit te wis want 'n nuwe wêreld kon toe betree word. Hierdie periode in ons land se bestaan het dan ook hoofsaaklik met die oordrag van kennis gepaard gegaan. By hierdie universiteit, net soos by ons ander universiteite het die klem veral by die natuurwetenskappe baie sterk op die opleiding van wetenskaplikes geval – in u geval van veeartsenykunde. Die jong geslag moes op hoogte gebring word met bestaande kennis wat in hierdie kennisbron gesetel was en van elders bekombaar was. Ons moes kennis in die natuurwetenskappe wat bestaan het en bekombaar was, ons eie maak sodat dit weer oorgedra kon word aan nuwe geslagte van bioloë wat voorberei moes word. Jong bioloë moes opgelei word wat na ons skole kon gaan om die verworwe kennis wat hulle hoofsaaklik van hulle dosente uit boeke en tydskrifte geleer het, oor te dra aan die kinders wat aan hulle voete gesit het, sodat 'n nuwe geslag na vore kon tree wat beter toegerus sou wees vir hulle universiteitsloopbaan. Daarby was hierdie universiteit net soos ander nog 'n klein inrigting en fasiliteite vir navorsing was aanvanklik karig, maar die wil het alreeds by sommiges, soos 'n Arnold Theiler en sy tydgenote bestaan om voort te beur om ook hulle verdere opdrag as universiteitsdosente, naamlik navorsing en die generering van nuwe kennis uit te bou. 'n Nuwe stadium van universiteitwese is deur hulle betree, naamlik, die stadium van opleiding wat navorsing as basis moes hê.

## UITBREIDING VAN KENNIS – NOODSAAKLIKHEID VAN NAVORSING

Net soos die boom nie sonder wortels kan bot nie, net so kan kennis nie op sigself teer nie. Kennis moet steeds deur nuwe kennis aangevul word. As dit nie gedoen word nie, stagneer ook daardie kennis wat reeds deur voorgangers verwerf is. In die wetenskappe kom die wetenskaplike nooit tot rus nie. Hy moet saam beplan, spook en worstel om by te dra anders word hy langs die stroomoewer saam met die stoppels en opdrifsels uitgestoot. Die eise wat aan ons as natuurwetenskaplikes aan universiteite gestel word is hoog, want ons word nie slegs gesien as oordraers van kennis nie maar by uitstek as genereerders van nuwe kennis. Opleiding en navorsing kan net nie geskei word nie en daardie universiteitsdosent wat nie navorsing doen nie, hoort nie op universiteit nie.

Na die tweede wêreldoorlog het 'n wyer wêreld vir die mensdom oopgegaan. 'n Wyer wêreld wat ou gevestigde praktyke, gewoontes en tradisies sou laat verkrummel; 'n wyer wêreld wat ook afstand oor kontinente en geestelike en kleurafstande tussen mense sou laat krimp. Die wetenskaplike goue eeu is betree. 'n Goue eeu waarvan u en ek deel is en waarvan die einde nog lank nie in sig is nie. 'n Tydvak wat aan baie mense welvaart en gemak sou bring waarvan hulle slegs kon droom. Maar dit is ook 'n eeu waarin armoede deur duisende beleef word. Dit staan in skrille kontras met dié wat het en lei tot wêreldprobleme wat nog na oplossings soek.

In hierdie tye word baie eise aan die wetenskaplike gestel, maar veral aan dié wat as akademici aan ons universiteite hulle pad moet vind. As akademici moet hulle navorsing doen want om die jong gemoed te voed en respek by hom af te dwing, moet elke universiteitsdosent ook skepper wees. Dit maak nie soveel saak wat die uitvinding of skepping is nie. Dit is nie belangrik nie. Wat wel belangrik is, is die lewenslange geestesgesindheid van die soeker, die soeker na nuwe dinge, die soeker na die waarheid. Die wetenskaplike en akademikus moet 'n waarheidsoeker wees en daarom moet hy navorsing doen. Al is dit dan ook net om die waarheid vir jouself te vind, daardie waarheid wat selfvertroue aan jou gee en selfvertroue aan die jong gees wat homself nog moet vind, oor te dra. Wat dus vir die universiteitsdosent van groot belang is, is nie so seer die kennis waaroor hy beskik nie, maar sy houding teenoor kennis. Hy is daagliks in aanraking met studente. Wat sy houding teenoor kennis is, sal in sy studente se houding teenoor die wetenskap weerspieël word. En dit is onteenseglik waar dat daardie dosent wat navorsing doen respek afdwing en sy studente teenoor uitdagings stel. Hy word nie net 'n aantrekkingskrag vir sy studente nie, maar ook vir dosente want hy is akademies sterk, interessant en uitdagend. Daarom is 'n universiteit se sterkte in sy navorsing en nagraadse studente geleë. 'n Departement sonder navorsingsaktiwiteite kom noodwendig in 'n negatiewe spiraal en boer agteruit. Die wat swak is, word nog swakker en dit wat goed is, word beter. Veral navorsing deur nagraadse studente is van groot belang. Daarom moet universiteite 'n baie hoë premie op personeel van gehalte plaas. Die kompetisie word net so sterk. Stel liewer niemand aan nie as iemand wat nie die mas gaan opkom nie. Beweeg ook weg van inteling, want net soos inteling in die praktyk is die oes wat akademiese inteling lewer, gering.

Die keuse van personeel moet vir die universiteit 'n saak van erns wees. Wanneer 'n goeie personeellid aangestel word, hoef jy nie te vra wat hy doen nie, want sy akademiese aktiwiteite sorg dat daar steeds vooruitgang is. Word 'n swak personeellid aangestel sit 'n universiteit met hom vir die res van sy lewe want sy mark-

waarde is ook noodwendig swak. Van markwaarde gepraat, is dit ook so dat die markwaarde van 'n student dikwels bepaal word deur die markwaarde en aansien van sy leermeester. Veel eerder moet gevra word wie sy leermeester was as 'n getuigskrif. Dosente wat voortreflike navorsing doen bring finansiële voordeel vir die universiteit. Hulle publikasies verdien sowel bykomende subsidie by die Departement van Nasionale Onderwys as finansiële ondersteuning vir navorsing en fasiliteite van die WNNR en SNO (Stigting, Navorsing en Ontwikkeling). En hierdie fondse is nie gebonde aan spesifieke projekte nie, maar aan die persoon. 'n Gekeurde navorser het boonop die vryheid om sy eie navorsingsveld te kies.

Die universiteitsdosent moet 'n voorloper wees want hy weet nooit watter briljante materiaal in sy klas sit nie. Wat hy wel weet, is dat sy klasse volgepak is met hoogs intellektuele mense wat hy moet uitdaag en uitlok om hulle verstand en vermoëns te ontwikkel. Slegs deur self navorsing te doen sal hy daarin slaag, want dan sal hy die briljante na vore laat tree om sy bydrae te maak. Hulle moet ook uitgedaag word om te dink en veral vir hulle self te dink deur betrokke te raak met dit wat aan hulle gedoseer word. Elke student sal nie 'n navorser word nie, maar deur ons voorbeeld moet ons wel dié stimuleer wat dit kan word.

Die ontdekking van die werklike begaafde student is egter nie so maklik as wat dit lyk nie want hyself weet meestal nie dat hy begaafd is nie. Hierdie tipe persoon is heel dikwels soos die delikaatste blom wat slegs onder ideale omgewingsomstandighede kan uitblom, maar wat gou verwelk en verskrompel as die omgewing ongunstig is. Aan die anderkant mag daar egter ook nie net na die begaafde omgesien word nie. Veral in ons land met sy ingewikkelde samestelling moet daar ook 'n gevoel vir die minderbevoorregte wees, vir die gemiddelde wat sy gemiddeldheid moet ontdek. Ons volle potensiaal moet ontwikkel word daarom sal ons as akademici ook moet beplan om die agterstand wat oor die jare opgebou het, positief uit te wis.

## DIENS AAN DIE GEMEENSKAP

Deur voortreflike jong mense vir 'n beroep op te lei lewer die universiteit alreeds 'n geweldige groot gemeenskapsdiens, maar dit is nie genoeg nie. Die werklike universiteit met sy groot bron van kennis moet die gemeenskap ook bystaan om probleme op te los. Universiteitspersoneel behoort by uitnemendheid daartoe in staat te wees. Wanneer 'n universiteit en sy personeel nie so betrokke raak nie versuim hulle hulle plig of is nie in staat om 'n bydrae te lewer nie. Daarom is ek reeds gunstig ingestel teenoor daardie universiteitswetenskaplikes wat in aanvraag by die gemeenskap is. Daarenteen is die wat nie in aanvraag is nie in baie gevalle vir die universiteit 'n verleentheid. Heel dikwels is hierdie soort akademici ook lugtig vir die wêreld daar buite en sluit hulle hulself op in die beskermende ivoortoring van hulle selfvoldaanheid.

Saam hiermee is dit ook noodsaaklik dat universiteitspersoneel en studente ten nouste by vakverenigings betrokke sal raak, want dit is daar waar kennis teen kennis en nuwere idees getoets kan word. Hierdie aktiwiteite is net so belangrik as navorsing self omdat die universiteit se beeld hierdeur voortreflik uitgedra word. Daarom moet universiteite hulle voortreflike dosente in staat stel om die buiteland te besoek. In ons geografiese en politieke isolasie is dit van die uiterste belang.

## MAAR WAT NOU VAN DIE STUDENT?

Hier bo het ek my siening van universiteite en die vereistes wat aan universiteitsdosente gestel behoort te word, duidelik gestel. Die vraag by u moet nou wees: WAT VAN DIE STUDENT? Watter eise behoort aan studente wat universiteit toe gaan gestel te word? Belangrikste van alles is egter watter eise stel hy aan homself en aan sy universiteit? Hoe sien ons studente hul opdrag en missie? Kom hulle hierheen om slegs maar deur kennis volgeprop te word, of kom hulle om hulle intellek te oefen en uit te daag?

Talle studente kom universiteit toe om te studeer, maar talle kom sonder dat hulle werklik weet wat hulle wil kom studeer. Dit is seker nie altyd verkeerd dat talle kom sonder dat hulle presies weet wat hulle op universiteit gaan maak nie omdat baie van ons studente net nie voldoende voorligting op skool of in sy ouerhuis ontvang het nie. Deur ons skole word daar baie gepraat oor die voorbereiding van kinders vir 'n universiteitsopleiding, maar of hulle altyd daarin slaag, is vir my 'n onuitgemaakte saak.

My ondervinding as universiteitsdosent wat oor meer as 30 jaar strek, is dat talle studente afkomstig van veral ons Afrikaanse skole onvoorbereid is vir die werklike eise van 'n universiteitsopleiding. Hulle mag goed presteer het in hulle eksamens op skool, in veral die toelatingsvakke, maar sover dit die werklike eise wat aan ons universiteitstudente gestel word betref, is hulle dikwels onbeholpe. Daarom dat talle Afrikaanse studente hulle ook nog kan verlustig in argaïese kinderagtige praktyke soos ontgroening wat nie by 'n akademiese inrigting pas nie.

Ek wil beweer dat akademies georiënteerde studenteaktiwiteite meestal op die agtergrond geskuif word deur die nie-akademies georiënteerde praktyke soos sport en ander sosiale aangeleenthede. Daar word op talle terreine met ander universiteite geskakel, maar in hierdie skakeling kom weinig ten opsigte van dit waaroor studente op universiteit is tot sy volle ontplooiing.

Vir talle studente is dinge soos sport, jool en intervarsity vandag nog veel belangriker as hulle indringende voorbereiding vir hulle loopbaan in 'n geweldige komplekse gemeenskap. 'n Gemeenskap waarin die voorbeelde van die leiergroep 'n beslissende uitslag op ons voortbestaan kan hê. Gaan kyk maar by studentefunksies en prysuitdelings watter waarde aan akademiese prestasies geheg word, om nie eers van die studentepers te praat nie. Dan moet ek byvoeg dat met akademiese prestasies nie slegs bedoel word, uitblink in eksamens nie, maar werklike wetenskaplike verdieping en beoefening. Dit gaan nie altyd om hoe goed jy 'n eksamen kon slaag nie, maar wel om jou insig in 'n vak. Watter eise stel u aan uself in u voorbereiding as wetenskaplike? Watter eise stel u aan u universiteit? Watter eise stel u aan u dosente?

## WATTER MAATSTAWWE IS VIR U BELANGRIK IN U KEUSE VAN 'N UNIVERSITEIT

Waarom besluit 'n student om na 'n besondere universiteit te gaan? Hierdie universiteit as u wil? Word hy beïnvloed deur die universiteit se akademiese prestasie of sy sportprestasies of dalk sy kulturele prestasies?

In die keuse van 'n universiteit is daar baie dinge wat tel, maar ek meen die belangrikste moet altyd akademiese prestasies bly. Die intellektuele vermoëns van die student moet tot volle ontwikkeling uitgedaag

word. Daar moet ook gekyk word na nagraadse aktiwiteite van universiteite. Hier wil ek slegs noem dat die kultuurverplasing na 'n ander inrigting as waar jy voorgraads opgelei is, 'n navolgelingswaardige voorbeeld is wat ons Suid-Afrikaanse studente gerus kan nastreef. Die student moet meer blootstelling kry, ook buitelandse blootstelling, om ten volle as wetenskaplike en mens te ontwikkel.

## DIE KRITIESE INGESTELDHEID VAN DIE WETENSKAPLIKE

'n Verdere saak waarin ons studente hulle moet skool is 'n kritiese ingestelheid teenoor die wetenskap. Die beste eienskap van 'n student is na my mening die bevraagtekening van die wêreld waarin hy leef. Die bevraagtekening van feite en die bevraagtekening van sy dosent, naamlik, is sy dosent op hoogte van sy vak of is sy dosent se leiding gebou op navorsingsgrondstene of bring hy sy kennis op die beste manier na die student. Die universiteit is 'n tersiëre onderwysinrigting waar geleerdheid bemark word en ons studente moet toesien dat hulle die beste waarde vir hulle geld kry. Net soos in die geval van 'n motorkar is geleerdheid en kennis egter ook 'n kommoditeit wat bestuur moet word. Net soos die eienaar van 'n motorvoertuig moet leer om hom te bestuur en veilig te bestuur, moet die student ook die nuwe geleerdheid wat hy by die universiteit bekom, bestuur en vertroetel. Die grootste probleem wat ek met ons hedendaagse student ervaar is dat hy altyd terugkom na dieselfde bron om sy tenk vol te maak. In baie gevalle hervul hy nie eers weer sy tenk nie, maar teer hy vir die res van sy lewe op die bietjie kennis wat hy op universiteit soos 'n spons ingeneem het of wat met hoë druk in hom ingepomp is.

In sy jeugjare bied 'n universiteitsopleiding aan die student 'n afspraak met die lente van die wetenskap. Hulle het 'n afspraak met die lente. Sy kom na hulle vensters om hulle in die vroeë oggendure te wek om die nuwe dag te ontdek, die nuwe dag om wetenskaplike te word. Daardie soeker na die waarheid wat steeds rusteloos soekend is omdat die volle waarheid vir die soekende gees van die wetenskaplike nooit sal bestaan nie. Die natuur om ons, die werkterrein van die bioloog wat die hele ekosisteem behels, is die huwelik tussen die toekoms en die verlede want die hede se ingeboude voortreflike moontlikhede is te danke aan alles wat die omgewing deur die eeue heen in hom opgebou het.

En wat 'n pragtige biologiese erfenis het u en ek nie ontvang om te bestudeer en te ontgin nie. Wanneer ons om ons land begin rondkyk word ons ontdekkingsreisigers in ons eie wêreld. Die nuwe wêreld van die biologie lê op die drumpel van ons agterdeur. Laat ons die valleie en berge van ons land deurvors sodat ons geïnspireerde wetenskaplikes word wat kan help om ons landsprobleme op te los vir die dag as ons nie meer daar is nie.

Laat ons ons lesse uit die natuur, die ekosisteem self neem in die woorde van die groot Amerikaanse skrywer en natuurmens, Henry Dawid Thoreae, wat gesê het: "Every part of nature teaches that the passing away of one life is the making room for another. The oak dies down to the ground leaving within its rind a rich virgin mould, which will impart a vigorous life to an infant forest. The pine leaves a sandy sterile soil, the harder woods a strong and fruitful mould. So this constant abrasion and decay makes the future growth. As I live now so shall I reap. If I grow pines and birches my virgin mould will not sustain the oak; but pine and birches or perhaps weeds and brambles will constitute my second growth".

As Afrikanerwetenskaplike voel ek trots op dit wat ons gedoen het maar terselfdertyd is ek bewus van die agterstand wat nog uitgewis moet word – 'n agterstand wat ons almal saam as wetenskaplikes moet aanpak en uitwis.

ARTICLE ARTIKEL

# PLASMA CONSTITUENTS IN NGUNI COWS OVER FORTY-EIGHT HOURS

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ABSTRACT: Ganhao M.F.; Hattingh J.; Kay G.W.; Cornelius S.T.; Grobbelaar J.A.N. **Plasma constituents in Nguni cows over forty-eight hours.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 177-180 (En). Department of General Physiology, University of the Witwatersrand, 1 Jan Smuts Avenue, 2001 Johannesburg, Republic of South Africa.

Plasma constituents were investigated at ninety minute intervals over a forty-eight hour period on four unrestrained Nguni cows (in small cubicles) in order to study the presence or absence of rhythms. No circadian, ultradian or diurnal rhythm was found for any of the parameters investigated. Basal values over a forty-eight hour period were obtained for certain plasma constituents. These values are of use for studies relating to the effects of stress in cattle.

Key words: Cattle, plasma, circadian rhythms.

## INTRODUCTION

The present study was undertaken to establish values for a number of plasma variables on undisturbed and unanaesthetized cows over a forty-eight hour period in order to investigate the presence or absence of rhythms.

Such values are of importance for stress studies on cattle. Work by Hattingh *et al.*[14] comparing the blood composition of succinyldicholine-culled elephants and buffaloes with that of undisturbed animals shot in the brain, revealed changes in the levels of certain blood components which were attributed to stress due to a combination of herding and darting with succinyldicholine (and the resultant asphyxia). Similar changes were observed in the blood composition of cattle unaccustomed to handling or to blood sampling in a crush and it was concluded that the stress experienced by cattle during these events and during slaughter was not different to the stress experienced by buffalo culled using succinyldicholine[15]. Erasmus & Krause[8] found a high variation in cortisol concentration between and within cattle breeds which made it difficult to gauge at which level of cortisol production stress effects became measurable and they also suggested that thyroxine concentrations were an indicator of adaptation to pen conditions[9]. Certain variations attributed to stress by the above-mentioned workers may have been due to the presence of rhythms. Circadian rhythms in different plasma constituents have been investigated in some mammals, including man[3 6 16 25 26 30], pigs and mares[4], horses[31], deer[5], sheep[10 11 23] and cattle[12 17 19 28 29]. In the latter studies, plasma corticosteroid variations have either shown an ultradian rhythm[12], a diurnal rhythm[28 29] or no diurnal rhythm[17] and those of plasma prolactin have shown no rhythm[12 19].

## MATERIALS AND METHODS

### Animals and blood sampling

Four mature Nguni cows were housed individually for two days and nights in cubicles, in a large shed, amongst other cows. To minimize stress as a result of frequent venipuncture and animal manipulation, blood was withdrawn from an indwelling jugular catheter as described by Kay & Grobbelaar[18]. There was no interference with feeding and rumination since animals were able to continue with activities such as eating, drinking and limited physical movement while being sampled, and illumination was not necessary at night. Oestrus behaviour was monitored according to fern patterns of the cervical mucous and at the time of blood sampling all animals were in the mid-luteal phase. At the end of the forty-eight hour collection period two blood samples were taken at ten minute intervals after the animals had been mildly stressed by prodding, shouting and the clapping of hands. This was done to ensure that the animals were at rest during the forty-eight hour period and that the values obtained were a true reflection of basal values.

### Analytical techniques

Animals were allowed to stabilize for six hours after cannulation. Blood samples were withdrawn at ninety minute intervals over a forty-eight hour period and the cannulae were flushed regularly with heparinized saline (100 U/ml). Blood was withdrawn into a heparinized syringe (100 U/ml) and immediately aliquoted into four test tubes, of which one contained 80 $\mu\ell$ of fluoride/EDTA and another 100 $\mu\ell$ of 4 mmol/$\ell$ reduced glutathione. The samples were centrifuged after the haematocrit was determined. Plasma was frozen at $-20°C$ until it was analysed for cortisol (coat-a-count solid phase radioimmunoassay, Diagnostic Product Corporation), ACTH (double antibody radioimmunoassay, Diagnostic Product Corporation), corticosterone (radioimmunoassay using rabbit antibody to corticosterone, Bioanalytical, (1,2,6,7 (n)-$^3$H) corticosterone, Amersham and standard, Sigma), catecholamines (HPLC[20]), endorphins and enkephalins (extracted as described by Angwin et al.[1], using sep-pak reverse phase $C_{18}$ cartridges, Waters Association and separated by HPLC[21]), prolactin (radioiodination as described by Greenwood et al.[13] using antiserum NIAMOD-anti-OPRL-1, precipitating antiserum, Welcome donkey anti-rabbit-RD-17 and standards NIAMOD-OPRL-I-1), TSH (competitive radioimmunoassay, Amersham), $T_3$ (coat-a-count solid phase radioimmunoassay, Diagnostic Product Corporation), $T_4$ (coat-a-count solid phase radioimmunoassay, Diagnostic Product Corporation), total lipids (colorimetric, Boehringer Mannheim), cholesterol (enzymatic colorimetric, Boehringer Mannheim), total protein (Lowry et

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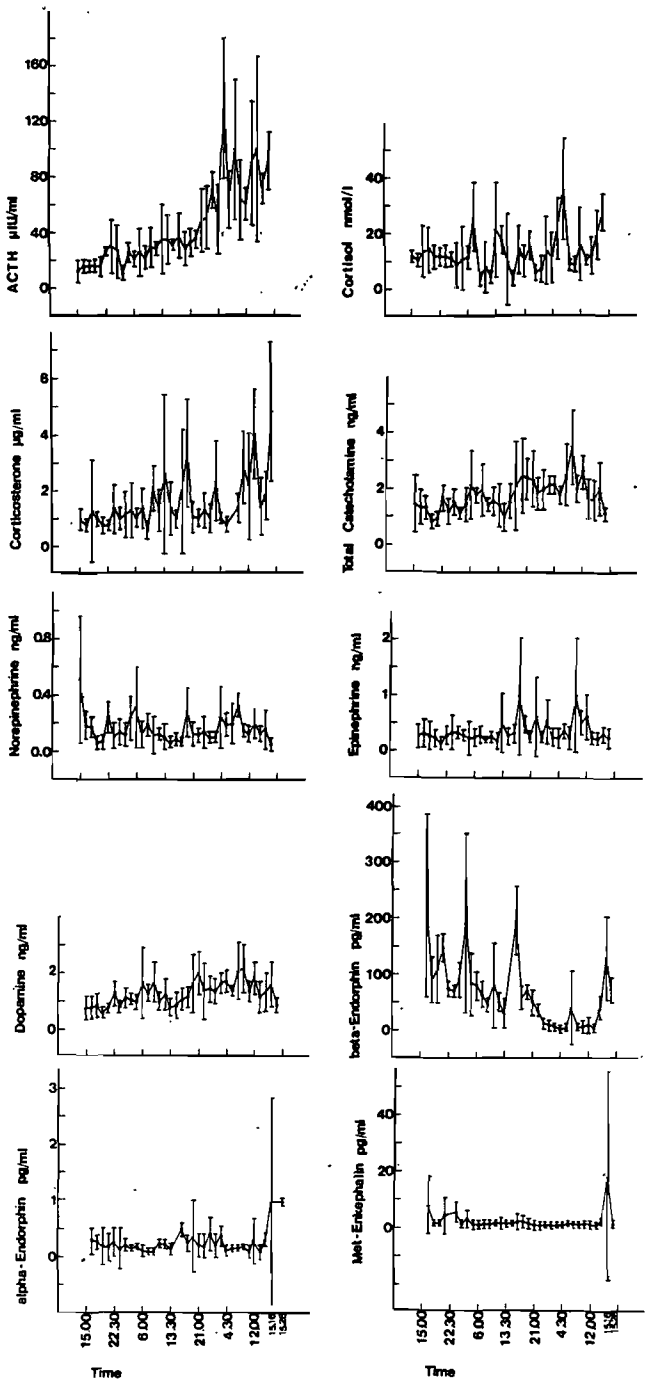


**Fig. 1a:** Forty-eight hour profiles for the variables investigated for the four cows. The last two values in each case were obtained at 10 minute intervals.

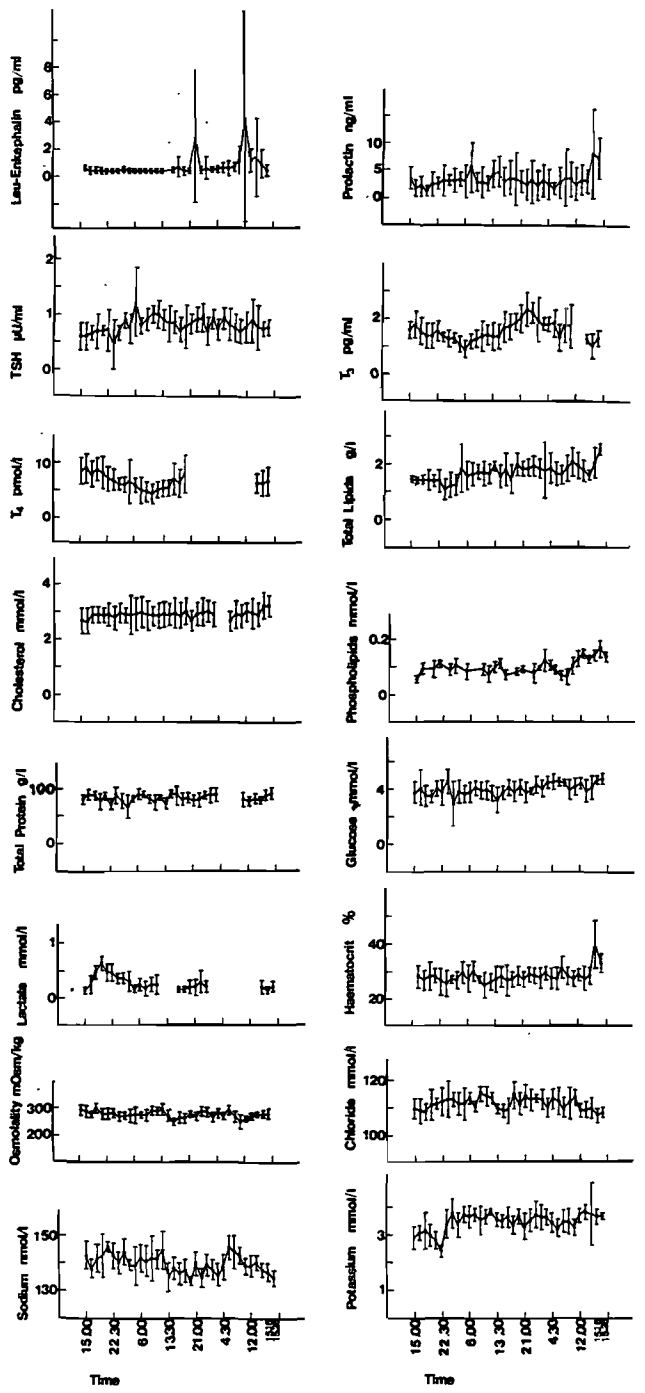


**Fig. 1b:** Forty-eight hour profiles for the variables investigated for the four cows. The last two values in each case were obtained at 10 minute intervals.

al.[22] using BSA standards), glucose (enzymatic colorimetric, Boehringer Mannheim), lactate (enzymatic UV, Boehringer Mannheim), osmolality (Wescor 512OB vapour pressure osmometer), chloride (CMT10 chloride titrator, Radiometer) and sodium and potassium (FLM3 flame photometer, Radiometer). Precinorm (Ul71735, Boehringer Mannheim) was used as a control.

## Statistical analysis

Forty-eight hour profiles on each cow were plotted for each variable with concentration against time. The mean and standard deviation were calculated for the four cows for each variable every ninety minutes and plotted with concentration against time (Fig. 1). Percentage deviation from the mean was also calculated for each profile by combining the four individual profiles as a transverse mean and the individual ninety minute values were then expressed as the percentage from the mean. Forty-eight hour profiles of the percentage from the mean were plotted for each variable and a Student *t* test was used for comparing points on profiles. Overall forty-eight hour means, standard deviations and ranges were calculated for each variable (Table 1).

## RESULTS

No circadian, diurnal or ultradian rhythms were observed for any of the variables investigated. Only the forty-eight-hour profiles of concentration against time for the four cows are shown in Fig. 1. ACTH increased throughout the forty-eight hour period, doing so

Table 1. Overall mean, standard deviation and range over 48 hours for each variable.

| Variable | | Mean | Standard deviation | Range |
|---|---|---|---|---|
| ACTH | µIU/ml | 42 | 34 | 10 – 190 |
| Cortisol | nmol/ℓ | 12 | 10 | 2 – 50 |
| Corticosterone | µg/ml | 1,0 | 1,1 | 0,3 – 5,5 |
| Total catecholamines | ng/ml | 1,8 | 0,8 | 0,6 – 4,9 |
| Norepinephrine | ng/ml | 0,2 | 0,1 | 0,03 – 0,5 |
| Epinephrine | ng/ml | 0,4 | 0,4 | 0,1 – 1,1 |
| Dopamine | ng/ml | 1,2 | 0,6 | 0,1 – 3,4 |
| β-Endorphin | pg/ml | 66 | 70 | 1 – 390 |
| α-Endorphin | pg/ml | 0,3 | 0,4 | 0,1 – 1,1 |
| Met-enkephalin | pg/ml | 1,5 | 6,7 | 0,1 – 70,0 |
| Leu-enkephalin | pg/ml | 0,3 | 1,3 | 0,1 – 14,0 |
| Prolactin | ng/ml | 3,0 | 2,4 | 0,3 – 11,4 |
| TSH | µg/ml | 0,8 | 0,3 | 0,2 – 1,3 |
| $T_3$ | pg/ml | 1,5 | 0,5 | 0,4 – 3,1 |
| $T_4$ | pmol/ℓ | 7,1 | 11,0 | 1,2 – 11,0 |
| Total lipids | g/l | 1,7 | 0,4 | 0,8 – 2,7 |
| Cholesterol | mmol/ℓ | 2,9 | 0,4 | 2,2 – 3,6 |
| Phospholipids | mmol/ℓ | 0,1 | 0,1 | 0,1 – 0,2 |
| Total protein | g/ℓ | 78 | 9 | 60 – 94 |
| Glucose | mmol/ℓ | 4,0 | 0,6 | 2,7 – 6,0 |
| Lactate | mmol/ℓ | 0,3 | 0,2 | 0,2 – 0,7 |
| Haematocrit | % | 28 | 3 | 21 – 34 |
| Osmolality | mOSm/kg | 286 | 8 | 270 – 305 |
| Chloride | mmol/ℓ | 111 | 4 | 104 – 122 |
| Sodium | mmol/ℓ | 140 | 5 | 130 – 151 |
| Potassium | mmol/ℓ | 3,5 | 0,4 | 2,3 – 5,3 |

Table 2. Overall mean, standard deviation and range over the initial 24 hours for certain variables (see text).

| Variable | | Mean | Standard deviation | Range |
|---|---|---|---|---|
| ACTH | µIU/ml | 23 | 12 | 8 – 68 |
| Cortisol | nmol/ℓ | 12 | 9 | 2 – 43 |
| Corticosterone | µg/ml | 1,2 | 0,9 | 0,3 – 4,5 |
| Epinephrine | ng/ml | 0,3 | 0,2 | 0,1 – 1,1 |
| Total catecholamines | ng/ml | 1,4 | 0,7 | 0,6 – 4,0 |

Table 3. Mean and standard deviation for samples taken 10 minutes after stress (after the forty-eigth hours) for variables that changed with stress.

| Variable | | Mean | Standard deviation |
|---|---|---|---|
| ACTH | µIU/ml | 72 | 7 |
| Cortisol | nmol/ℓ | 19 | 8 |
| Corticosterone | µg/ml | 1,8 | 0,8 |
| β-Endorphin | pg/ml | 134 | 70 |
| α-Endorphin | pg/ml | 1,1 | 1,8 |
| Met-enkephalin | pg/ml | 18,2 | 34,6 |
| Prolactin | ng/ml | 8,0 | 8,2 |
| Total lipids | g/l | 2,1 | 0,5 |
| Haematocrit | % | 40 | 8 |

significantly ($P < 0,05$, compared to the initial value) after thirty-six hours. Cortisol and corticosterone spiked irregularly after the initial twelve hours of sampling and followed the same trend as ACTH. However, these differences were not significant. Total catecholamines demonstrated an irregular pattern with epinephrine being relatively stable the first twelve hours of sampling. Norepinephrine and dopamine demonstrated an irregular pattern throughout the forty-eight hours of blood sampling and β-endorphin, irregular spikes. The latter were found to be statistically insignificant. α-Endorphin, met-enkephalin, leu-enkephalin, prolactin, TSH, $T_3$, $T_4$, total lipids, cholesterol, phospholipids, total protein, glucose, lactate, haematocrit, osmolality, chloride, sodium and potassium all failed to demonstrate significant changes throughout the forty-eight hour period of blood sampling. Overall means, standard deviations and ranges were calculated for all the variables on the four cows over the forty-eight hour period (Table 1). In the case of ACTH, cortisol, corticosterone, epinephrine and total catecholamines, the values over the first 24 hours are shown in Table 2.

Blood samples taken 10 minutes after the animals were mildly stressed by prodding, shouting and the clapping of hands revealed mean increases for the following variables: ACTH, cortisol, corticosterone, β-endorphin, α-endorphin, met-enkephalin, prolactin, total lipids and haematocrit. The overall mean and standard deviation for these variables are shown in Table 3. These increases were not significant (probably due to individual variation) except for the case of haematocrit ($P < 0,05$, compared to the overall forty-eight hour mean).

## DISCUSSION

No circadian, ultradian or diurnal rhythm was found in this study for any of the variables investigated and basal values over a forty-eight hour period were established for Nguni cows. Hormonal, opioid and other measurements were done using reagents for studies on human blood. The absence or presence of a rhythm would however, still have been detected on a relative basis, but some of the basal values obtained obviously depended on the similarity in structure between the bovine and human proteins, which may have been very little (e.g. TSH).

Controversy as to whether cattle demonstrate a rhythm in cortisol secretion is found in the literature. Fulkerson et al.[12] reported an ultradian rhythm and Thun et al.[28] found a temporal correlation between cortisol secretion and the light-dark cycle. Oxenreider & Wagner[29] observed a diurnal rhythm in the cow which was less distinctly defined than that found in man, whereas Hudson et al.[17] failed to find a diurnal rhythm in the bovine species. Cortisol results in this study agree with those of Hudson et al.[17] since no circadian, ultradian or diurnal rhythm could be detected over a forty-eight hour period. In similar vein, Fulkerson et al.[12] and Koprowski et al.[19] could not demonstrate a rhythm for prolactin secretion. This was confirmed by the present results on Nguni cows. The absence of definite rhythms is appreciated more when the mentioned results are compared with the marked rhythms found in other mammals where there is over 100% deviation from the mean. This is shown in man[26], horses[31], mares and pigs[4], and in sheep[11] [23] for cortisol secretion.

Contradiction as to whether cattle demonstrate a corticoid rhythm could be due to species and/or oestrus and reproductive cycle differences, since Fulkerson et al.[12] used two Jersey and two Friesan cows, Hudson et al.[17] four Jersey cows with two six months pregnant, Wagner et al.[29] primiparous Holstein cows and Thun et al.[28] seven Brown Swiss bulls (one blind). In this regard it has been claimed that the pattern of plasma cortisol secretion in dogs is dependant upon species[7]. Another possibility is differences in the sleep-wake pattern. In man a temporal relationship between steroid elevation and rapid eye movement sleep was observed[30]. Orth et

al.[25] found that the period of the pituitary-adrenal cycle is not necessarily twenty-four hours in length, but rather a function of the duration of the subject's habitual sleep-wake cycle. Ruckebusch[27] observed that wakefulness occupied eighty-five percent of the twenty-four hour period in herbivorous species and that cattle spent a major portion of this wakeful period in a state of drowsiness. Balch[2] found that healthy adult cattle slept little if at all and Morag et al.[24] suggested that a high percentage of roughage reduced sleep periods in sheep. Although the animals used in the present study often lied down, they were always conscious.

Variables which are normally used as a measure of stress such as ACTH, cortisol, corticosterone and total catecholamine concentrations increased gradually after the first twelve hours of sampling in the present study. This is probably the result of confinement to a small area and consequent limited physical movement for a long period. Irregular "spiking" was also observed during the forty-eight hour study in ACTH, cortisol, corticosterone, total catecholamines, epinephrine, norepinephrine, endorphin and enkephalin concentrations. These peaks may be indicative of discomfort or fright experienced by the animals due to noise, movement, etc. and indicate the (extreme) variability of hormonal secretions in these animals (see also below).

Although careful attention was paid to the design of the present study, stress was not totally eliminated (as is evident from the ACTH and other results during the second day, see below). The results obtained on some variables after hand clapping, prodding, etc. (last two samples) showed increases and supported the concept that values obtained over the forty-eight hours are of animals at rest. In addition, the increases noted are similar to the "spiking" referred to above and again suggest a very sensitive control of hormone secretion. The stress observed in this study may be virtually eliminated by radio-controlled blood sampling on free-ranging animals and such studies are in progress.

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ARTICLE ARTIKEL

# THE IODINE CONTENT OF FRESH MILK SAMPLES IN NATAL AND THE EFFECT OF IODOPHOR TEAT DIPS ON MILK IODINE CONTENT

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ABSTRACT: Van Ryssen J.B.J.; Van Malsen S.; Van Blerk J.G. **The iodine content of fresh milk samples in Natal and the effect of iodophor teat dips on milk iodine content.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 181-185 (En). Department of Animal Science, P.O. Box 375, 3200, Pietermaritzburg, Republic of South Africa.

The iodine content of fresh milk samples from bulk milk transport vehicles (tankers) and from bulk tanks on individual farms was determined. Approximately 75 percent of all the samples fell within the normal range of 25 to 300 μg iodine/ℓ of milk. The mean iodine concentration in the tanker samples was 257 μg/ℓ and in the farm tank samples 294 μg/ℓ, while the medians of the iodine concentrations in the surveys were 214 and 218 μg/ℓ respectively. A total of 1,75 percent of the tanker samples and 5,5 percent of the individual farm samples contained more than 1000 μg/iodine/ℓ, a level which is considered to be undesireable for human consumption. Iodine containing teat dips (2000 mg available iodine/ℓ) increased the iodine concentration of the milk of cows treated with these teat dips by between 11 and 60 μg/ℓ.

Key words: Milk iodine, dairy cows, teat dips.

## INTRODUCTION

Investigations in various countries of the world showed substantial increases in the iodine concentrations of fresh milk over the past 20 – 30 years[3 12 14]. Hemken[13] claimed that in the USA iodine toxicity was now more likely to occur in humans than iodine deficiency. He summarized the situation as follows: "All recent published values support the contention that milk and milk products are currently, on the average, a very high source of iodine for humans. However, the amount reported is quite variable."

The normal range of iodine levels in cow's milk lies between 5 and 300 μg/ℓ[12] or 5 and 400 μg/ℓ[19] with average values quoted as 40 μg/kg[6] and 75 μg/kg[19]. A level of below 25 μg/ℓ is considered indicative of deficient iodine intake in cows[1]. Extremely high levels of iodine in milk are sometimes recorded[6 7 13]. This could be due to a high iodine intake of cows and to over-supplementation of iodine[1 13], the treatment of cows with iodine containing teat dips[7 10 13 20], contamination of milk due to iodophor in cleaning agents used in milk handling equipment[6 13] or the treatment of cows against conditions such as lumpy jaw, footrot or metritis with iodine containing compounds[3 8 16].

In many countries of the world upper legal limits of permissible iodine concentrations in milk have been laid down. The USA and some European countries allow iodine levels of up to 1 000 μg/ℓ in milk[13]. In Australia and Switzerland an iodine level of above 500 μg/ℓ is illegal[6]. In Victoria, Australia, the iodine content in milk from farms is monitored once a month. If the level is above 300 μg iodine/ℓ the farmer receives a warning, if above 500 μg/ℓ a financial penalty is imposed on him[16]. According to H. Lück (1984 Animal and Dairy Science Research Institute, Irene, personal communication) no legal limit for iodine in milk has been decided upon for South Africa. The only stipulation according to the Government Gazette[11] is that no component which may render milk unfit for human consumption may be present in milk.

Many areas in Natal have been reported to be iodine deficient[5] and the supplementation of iodine to dairy cows in Natal has therefore been recommended[5]. Mixed milk samples were collected and analyzed for iodine.

It has been well established that post-milking teat dipping with iodophor teat dips can increase milk iodine levels[13]. The increment in milk iodine levels due to iodophor teat dips can vary tremendously, depending on factors such as concentration of iodine in the teat dips[7 10], teat dip mixture[20] and pre-milking udder wash practices[10]. At iodine concentrations of above 5 000 mg/ℓ in teat dips, substantial increases in milk iodine content were observed[7 10 20]. However, at teat dip iodine concentrations of 1 000 mg/ℓ and lower, very little or no change in milk iodine levels was measured in some trials[2 19] but not in all[20]. A series of trials were thus conducted to determine the effect of teat dips containing 2 000 mg iodine/ℓ on milk iodine content under a practical farming situation. For this purpose mixed milk samples were collected and analyzed for iodine.

## MATERIALS AND METHODS

### Milk sampling – surveys

At milk depots in Pietermaritzburg, Ixopo and Mooi River 171 milk samples (250 ml each) were collected over a period of 7 months (July 1984 to January 1985) from bulk milk transport vehicles (tankers). These tankers usually contained milk from more than one farm. The milk samples were collected at the depots before the milk was unloaded. The milk was agitated and then sampled with a sampling rod and cup.

A total of 73 milk samples was collected on individual farms from bulk milk tanks on the farm. The milk in farm tanks is stirred continuously and a sampling cup was used to collect the milk. The samplers used in both surveys were experienced in routine milk sampling for the Dairy Board.

The milk samples were stored in plastic bottles containing potassium dicromate ($K_2 Cr_2 O_2$) as a preservative at a concentration of 2g/ℓ milk. Samples were re-

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frigerated on arrival at the depots; and were usually collected from the depots and analysed within three days after sampling.

### Teat dipping

Four series of tests were conducted on Jersey cows at the University Research Farm to determine the effect of iodine containing teat dips on the iodine concentration in their milk. During each series of trials which were separated by approximately one month intervals, 20 to 30 cows were divided into 2 groups. In all the tests a chlorhexidine teat dip, (Hibitane; Reg. No. G425; ICI) was used on half the cows. This teat dip was also used routinely in the herd prior to this investigation. In the first three tests an iodine containing teat dip, Vetra CF, (polyethylated nonyl phenol – complex P3; Reg. No. G396; Henkel, SA) containing approximately 2 000 mg/ℓ available iodine was used on the other half of the cows. In the last test Iosan (polyglycolether iodine complex Iosan; Reg. No. G1300; Ciba Geigy) containing 2 000 mg available iodine/ℓ was used. When the same cows were used in subsequent tests, care was taken not to include any cow which was treated with an iodine dip in a previous test, in the control group. The test treatments were applied for two weeks before 2 sets of milk collections one week apart were done. Cows from the 2 treatments per test were paired and used only if their levels of concentrate feeding and levels of productions during the week prior to collection were similar.

The cows were milked twice daily. The initial jet of milk at each milking was discarded into a strip cup. A pre-milk teat wash with water was done only when the teats were dirty. Otherwise the "dry wipe system" (RF Horner, 1985 Allerton Veterinary Laboratories, Pietermaritzburg, personal communication) was used to clean and stimulate the udder. After each milking each teat was fully immersed in the relevant teat dip with the use of a squeeze bottle. Milk yield was measured and the milk sampled at the afternoon and subsequent morning milking were mixed in a ratio of 3:5. No preservative was used, but the milk was refrigerated immediately after each collection and analysed for iodine concentration within 24 hours of collection.

### Iodine determination

Iodine in milk was determined according to the method described by Lacroix and Wong[15]. An Orion Research model 701/digital pH meter (Orion Research, Cambridge, Massachusetts) equipped with an Orion 945300 iodide specific ion electrode and an Orion 90-01 single junction reference electrode was used. The instrument was calibrated with an iodine standard of potassium iodide to give a range of 1 to 128 mg iodine/ℓ. The method of standard addition of iodine standards was used and electrode performance checked before each batch of measurements.

This method of iodide determination is slow and tedious. Therefore, after the accuracy of the technique was confirmed initially, only approximately 20% of the samples per batch were analysed in duplicate.

### Statistics

In view of the skewness of distribution of iodine concentration in milk, logarithmic transformations were applied on the data to determine whether statistically significant differences were present in concentrations between sources of milk and type of tanks. The medians of the iodine concentrations were calculated to provide a better description of the distribution of iodine concentrations. The statistical package "Genstat" was used to compare results. Student's method of paired differences was used for the statistical comparison of treatment effects in the teat dip trial[18].

## RESULTS

### Milk iodine concentrations

Tables 1 & 2 depict the distribution of the iodine concentrations measured in milk tanker and farm samples, respectively. The mean and median levels of iodine in the milk and the ranges recorded, are presented in Table 3. In all cases a distinctly skew distribution was observed, viz. a decrease in number of samples with a concentration of above 500 μg/ℓ, but usually an increase again at above 1 000 μg/ℓ, except for the Mooi River samples. A substantially smaller proportion of the samples from tankers from the Mooi River area (12,7%) showed iodine levels of above 300 μg/ℓ than from Pietermaritzburg (28,7%) and Ixopo (38,0%) areas. However, none of the differences between depots or tank types were statistically significant (Table 4). This same trend was not evident in the milk collected from individual farms in the Mooi River area. A total of 25,7% of all the bulk tanker samples and 28,8% of the samples from individual farms contained more than 300 μg iodine/ℓ while 1,75% of the tanker and 5,5% of the farm samples contained more than 1 000 μg iodine/ℓ.

Table 1: Distribution according to iodine concentration of mixed milk samples from bulk milk tankers

| Range in iodine concentration μg/ℓ | Pietermaritzburg Depot | | Ixopo Depot | | Mooi River Depot | |
|---|---|---|---|---|---|---|
| | No. of samples | % of total | No. of samples | % of total | No. of samples | % of total |
| 50 – 99 | 3 | 4,5 | 1 | 2,0 | 0 | 0 |
| 100 – 199 | 31 | 47,0 | 13 | 26,0 | 29 | 52,8 |
| 200 – 299 | 13 | 19,7 | 17 | 34,0 | 19 | 34,5 |
| 300 – 399 | 10 | 15,2 | 8 | 16,0 | 6 | 10,9 |
| 400 – 499 | 1 | 1,5 | 7 | 14,0 | 1 | 1,8 |
| 500 – 599 | 3 | 4,5 | 2 | 4,0 | 0 | 0 |
| 600 – 699 | 1 | 1,5 | 0 | 0 | 0 | 0 |
| 700 – 799 | 3 | 4,5 | 0 | 0 | 0 | 0 |
| 800 – 899 | 0 | 0 | 0 | 0 | 0 | 0 |
| 900 – 999 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 1 000 | 1 | 1,5 | 2 | 4,0 | 0 | 0 |
| > 300 | 19 | 28,7 | 19 | 38,0 | 7 | 12,7 |

The mean iodine concentraion of all the tanker samples was 257 μg/ℓ and that of the individual farm samples 294 μg iodine/ℓ while the medians of these samples were 214 and 218 μg iodine/ℓ, respectively. The lowest concentration recorded was 65 μg iodine/ℓ in a farm sample from the Pietermaritzburg area and the highest level 1190 μg iodine/ℓ in 3 individual farm samples also from the Pietermaritzburg area.

Table 2: Distribution according to iodine concentration of milk collected from milk tanks on individual farms

| Range in iodine concentration µg/ℓ | Pietermaritzburg area | | Ixopo area | | Mooi River area | |
|---|---|---|---|---|---|---|
| | No. of samples | % of total | No. of samples | % of total | No. of samples | % of total |
| 50 – 99 | 4 | 14,8 | 0 | 0 | 4 | 11,4 |
| 100 – 199 | 11 | 40,8 | 5 | 45,4 | 9 | 25,7 |
| 200 – 299 | 8 | 29,6 | 2 | 18,2 | 9 | 25,7 |
| 300 – 399 | 1 | 3,7 | 3 | 27,3 | 6 | 17,2 |
| 400 – 499 | 0 | 0 | 0 | 0 | 3 | 8,6 |
| 500 – 599 | 0 | 0 | 0 | 0 | 2 | 5,7 |
| 600 – 699 | 0 | 0 | 0 | 0 | 0 | 0 |
| 700 – 799 | 0 | 0 | 0 | 0 | 0 | 0 |
| 800 – 899 | 0 | 0 | 0 | 0 | 1 | 2,9 |
| 900 – 999 | 0 | 0 | 0 | 0 | 1 | 2,9 |
| > 1 000 | 3 | 11,5 | 1 | 9,1 | 0 | 0 |
| > 300 | 4 | 15,2 | 4 | 36,4 | 13 | 37,3 |

Table 3: Average concentrations (µg/ℓ) of iodine in milk and the minimum and maximum concentration measured in the survey

| Samples from bulk milk tankers | | | | | |
|---|---|---|---|---|---|
| Depot | Number | Arithmatic mean | Median | Minimum | Maximum |
| Pietermaritzburg | 66 | 255 | 193 | 95 | 1030 |
| Ixopo | 50 | 310 | 260 | 90 | 1188 |
| Mooi River | 55 | 215 | 198 | 120 | 467 |
| Average | - | 257 | 214 | - | - |
| **Samples from individual farm tanks** | | | | | |
| Area | Number | Arithmatic mean | Median | Minimum | Maximum |
| Pietermaritzburg | 27 | 295 | 191 | 65 | 1190 |
| Ixopo | 11 | 290 | 206 | 111 | 1074 |
| Mooi River | 35 | 295 | 242 | 99 | 900 |
| Average | - | 294 | 218 | - | - |

Table 4: Logarithmic transformed medians to compare iodine concentrations (µg/ℓ) between milk depots and type of container of the milk

| Depot* | Tank type* | | | |
|---|---|---|---|---|
| | Farm | | Tanker | |
| | | SED | | SED |
| Pietermaritzburg | 5,3489 | 0,1084 | 5,3273 | 0,0693 |
| Ixopo | 5,4304 | 0,1698 | 5,5842 | 0,0796 |
| Mooi River | 5,5078 | 0,0952 | 5,3219 | 0,0759 |

*None of the differences were statistically significant.
SED = Standard error of difference.

## Teat dips

Statistically significant increases of 60 µg iodine/ℓ ($P<0,05$), and 46 and 54 µg iodine ($P<0,01$) were observed (Table 5) in 3 tests (Test 2, 1 and 4 respectively) when the teats of the cows were treated with iodophor teat dips as compared to the iodine in the milk of the cows treated with the chlorhexidine teat dip. In Test 3 this difference was not significant and only 11 µg iodine/ℓ above that of the non-iodine control. The iodine concentrations (µg/ℓ) in the milk of the non-iodine controls were 156, 181, 182 and 177 in tests 1-4, respectively, and the percentage increases in iodine concentrations due to the iodophor teat dips were 34,6%, 33,1%, 6,0% and 26,6% above these levels, respectively.

Table 5: Effect of iodine containing teat dips (2 000 mg/ℓ) on the iodine concentration in milk and the mean milk yields of cows during the trials

| | Tests | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Number of pairs | 14 | 6 | 9 | 13 |
| Iodine-based teat dips (µg/ℓ)+ | 210 | 241 | 193 | 223 |
| Chlorhexidine teat dip (µg/ℓ) | 156 | 181 | 182 | 177 |
| Standard error of difference | 9,2 | 17,0 | 8,7 | 9,7 |
| Difference (µg/ℓ) | 54** | 60* | 11 | 46** |
| Difference (%) | 34,6 | 33,1 | 6,0 | 26,6 |
| Mean milk yield of cows | | | | |
| Iodine group (ℓ/day) | 13,6 | 13,9 | 13,7 | 12,1 |
| Chlorhexidine group (ℓ/day) | 13,5 | 15,1 | 13,8 | 11,9 |

*Differences statistically significant ($P<0,05$)
**Differences statistically significant ($P<0,01$)
+Tests 1 – 3: Vetra CF (polyethylated nonyl phenon-iodine complex, P3 Reg. No. G 396, Henkel SA)
+Test 4: Iosan (polyglycolether-iodine complex, Reg. No. G1300, CibaGeigy)

## DISCUSSION

Approximately 75 percent of all the milk samples collected contained less than 300 µg iodine/ℓ, the suggested upper level in cow's milk under normal conditions[12]. However, the small number of samples with very high concentrations of iodine resulted in inflated average values. The lowest iodine concentration measured, was 65 µg/ℓ. This may indicate that a state of iodine deficiency did not exist on any of the farms[1]. However, the nature of the samples was such that the degree of iodine contamination could not be established. The existence of iodine deficiencies on some farms can therefore not be ruled out completely. The present survey should rather be viewed in terms of the supply of iodine to the consumer, than as indicative of the iodine status of dairy cows in Natal.

This Natal survey followed a pattern of distribution of iodine concentrations in milk very similar to the pattern in surveys done overseas where extremely high iodine levels, up to 4 000 µg/ℓ[13] were observed, but where the majority of samples tested, were well below those high levels. Mean iodine levels of 425, 457 and 646 µg iodine/ℓ of milk were measured in the U S A[6 13]. In Australia mean levels of 570 and 760 µg iodine/ℓ were found[9 12 13]. These mean values were substantially higher than those in the Natal survey. In South Africa Blom[4] found that the iodine concentration in the milk of a group of cows varied between 170 and 460 µg/ℓ. On the other hand, in a survey in the Netherlands[3] a milk iodine level of 36,5 µg/ℓ was the highest concentration measured. In a review on the iodine in milk and milk products Harding[12] quoted similar low iodine levels in milk in different countries and showed that the iodine levels varied tremendously within and between countries.

Concern is expressed world-wide about the increased

contribution made by milk to the high iodine intakes of humans[8 12 14]. According to the NRC[17] standards a healthy adult human requires between 100 and 300 μg iodine per day. The recommended requirement for infants younger than 6 months is 35 – 40 μg iodine per day and from 6 months to one year of age 40 – 50 μg per day[8 14 19]. For children and young adults the daily iodine requirements increase with age from 60 to 150 μg[19].

Iodine intakes by the human of between 50 and 1 000 μg/day are considered safe[13 18]. However, Harding[12] cited views suggesting that iodine intakes of above 500 μg or of above 2 000 μg per day were potentially harmful to humans. According to the National Research Council[17] the potential chronic toxic effects of high intakes of dietary iodine in man are not very clear. In Tasmania the occurrence of thyrotoxicosis in humans was attributed to excessive iodine intakes through milk and bread[17 21].

The suggested contribution made by milk to the iodine intake of humans varies widely. Binnerts (cited by Harding[12]) estimated that on average 25% of the iodine intake of humans in the Netherlands was derived from milk but this decreased to 5 – 10% after the introduction of prophylaxes through other sources. Renner[19] calculated a contribution of 50% of the recommended human intake of iodine through the consumption of one litre of milk per day, while Hemken[14] quoted the contribution of dairy products to the iodine intake of adults to be 38 – 50%. Taylor, according to Berg & Padgitt[2] estimated that typical infant and toddler diets in the USA contained 6 – 10 times their daily allowance of iodine and that dairy products contribute 56-85% of the iodine taken in by infants and toddlers. Accepting an additional iodine intake from other sources such as iodized salt, food from marine origin, etc. various authors pointed out that with a high intake of milk containing high levels of iodine, the iodine consumption of humans can exceed the upper safe limit[8 13 14].

The different factors such as high iodine intakes through feed[1 13] and the use of iodophor teat dips and sanatizers in the dairy[10 13 20] can contribute to the relatively high iodine concentrations in milk. Incorrect supplementation of iodine in feeds could lead to an overfeeding of the mineral to dairy cows and a consequent high level of iodine in milk[13]. Bad management during the cleaning of milking machines, the milk containers on the farm and transport tankers could lead to elevated iodine levels in milk[10 13 14]. Iodine containing teat dips are widely used in Natal and could be responsible for some of the extra iodine in the milk. Further factors which can contribute to the increase in milk iodine due to iodophor teat dips are the dip formulation used, udder preparation before milking, such as thoroughness of cleaning the udder and the milk yield of the cow[13 14 20].

The increase of between 11 and 60 μg iodine/ℓ milk due to the iodophor teat dips containing 2 000 mg iodine/ℓ as observed in the present trial constitutes a small fraction of the iodine necessary to increase the milk iodine level to above 1 000 μg/ℓ. Conrad & Hemken[7] measured an increase of 80 to 100 μg iodine/ℓ milk when using a teat dip containing 10 000 mg titratable iodine/kg. Teat dips with an iodine level of 5 000 mg/ℓ, increased milk iodine levels by 99, 291[20] and 197[9] μg/ℓ. In summarizing the effect of teat dipping on milk iodine levels of different trials, Harding[12] concluded that milk iodine levels are generally elevated from 300 to 500 μg/kg and even higher when iodophor teat disinfectants are used. However, the iodine concentration of the teat dips used, were not reported[12].

With teat dips containing 1 000 mg iodine/ℓ and less, the increase in milk iodine was usually low[2 10 12]. However, this was not observed in all investigations[12 20], but in most trials changes in milk iodine levels corresponded to changes in iodine concentrations in the teat dips[10 12].

The effect of udder washing before milking on iodine levels in milk was found to be negligible in some trials[7], but in other cases to be very effective in reducing the iodine content in milk of cows treated with iodine teat dips[10 20]. The increase in milk iodine after treatment of cows with iodophor teat dips was ascribed solely to the absorption of iodine through the teat skin and its re-excretion through the milk[7], or mainly or partially to contamination of the milk from the udders when premilking udder washing was not done effectively[10 20]. The recommended "dry wipe system" as used in Natal prescribes the washing of teats before milking only when they are soiled. In practice the frequency of premilking udder washing will fluctuate depending on many factors such as weather conditions. Factors such as rain washing off the sanitizer solutions or long grass brushing against the teats and removing some of the teat dip residue, can also influence the final iodine contamination of the milk[12]. The different responses, viz. increases of 11, 46, 54 and 60 μg iodine/ℓ with the use of iodophor teat dips as compared to teat dips containing no iodine, observed in the present trial, could be attributed, at least partially, to differences in udder washing practiced during the trials. Frequency of udder washing was not recorded but will also vary under practical farming conditions.

Milk reaching the public in Natal is mixed before distribution. From the present survey it can be concluded that the consumer in Natal, at least those served by the milk depots used in the survey, will not be at risk of taking in excessive levels of iodine through their milk. The risk of over consumption of iodine may exist on individual farms where milk high in iodine (above 1 000 μg/ℓ) levels may be used for home consumption over extended periods.

From the present study and published reports the contribution of iodophor teat dips (containing 2 000 mg iodine/ℓ) to elevated iodine levels in milk seems to be relatively small, compared to "normal" iodine levels in milk[6]. Factors which may have contributed to the very high iodine levels observed in the few samples of milk collected in the survey could have been due to the incorrect dilution and use of iodophor teat dips, iodine containing sanitizers used in milking equipment and milk handling facilities, or to the overfeeding of iodine[6 7 10 13 20]. Through proper management and control, it should be possible to maintain the iodine concentration in milk at levels of below 300 μg/ℓ.

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**BOOK REVIEW** **BOEKRESENSIE**

## ZUR VERGLEICHENDEN ANATOMIE VON DAMTIER, SCHAF UND ZIEGE

### Osteologie und postnatale Osteogenese

K. POHLMEYER

1st Edn. Paul Parey, Berlin and Hamburg, 1985, pp. 187, illustrations 68, and 2 extensive tables. Price not stated. ISBN 3-489-76316-5

As those conversant with German usage will realise, this is not a textbook, but the results of a careful, detailed anatomical study on the skeleton of 40 fallow deer (*Dama dama* L. 1758) ranging from neonatal to senile, as well as seven foetuses all between approximately 55 and 190 days post conceptum. Sexual differences and age changes are recorded with reference to each bone. Paranasal sinuses are included. A general comparison with the skeletal elements of sheep (German Blackhead Mutton, German Texel sheep and their crosses) and goat (German White Improved Breed), and, where relevant, of red deer (*Cervus elaphus hippelaphus* L. 1758) and roe deer (*Capreolus capreolus* L. 1758) is included.

In tabular form maximum and minimum linear measurements and standard deviation of all the skeletal components of the fallow deer are given, for adult male, adult female, and juvenile respectively. In the second table, the ages of ossification of the epiphyseal plates are detailed, for all the skeletal components of Dama, as well as for the appendicular elements of goats and early and late maturing sheep.

Most of the illustrations are by way of black and white photographs, unfortunately not of the best quality – only those who have tried this will know how exceedingly difficult it is to obtain good photographic reproduction in black and white for any anatomical material.

In critical cases the author has resorted to black and white line drawings. To illustrate bone structure of the appendicular skeleton, roentgenographs are included, as well as one of the thoracic vertebrae.

An extensive bibliography is included.

Apart from academic interest, the practical purpose of this investigation was to provide data by means of which meat hygiene regulations can be carried out, and not only species, but also sex and age of fallow deer can be determined.

From the academic aspects some interesting general conclusions are drawn concerning the evolutionary status of Dama vis-a-vis that of domesticated small ruminants.

H.P.A. DE BOOM

**BOOK REVIEW** **BOEKRESENSIE**

## CLINICAL MICROBIOLOGY AND INFECTIOUS DISEASES OF THE DOG AND CAT

C.E. GREEN

W.B. Saunders, Philadelphia 1984 pp. xviii + 967, Figs 512, Tables 186. ISBN 0-7216-4251-9 Price R133,34

This much needed comprehensive textbook on microbiology and infectious diseases of dogs and cats cannot be too strongly recommended to undergraduate veterinary students, private practitioners and academics in these fields. The book is very well written and to the point with excellent figures and precise schematic illustrations where necessary. The tables used complement the text and act as text summaries or give additional information. What is much appreciated is the practical approach to, for example, specimen collection for the various types of infections as well as mentioning the pitfalls that may be encountered by both the clinician and the microbiologist when dealing with the various infectious agents.

The chapter on antimicrobial therapy is an excellent review on all aspects of antimicrobials and their uses with warnings against their misuses and dangers. A number of chapters deal with the more common infections of the various organ systems. The authors of these chapters are obviously experts in their fields and up to date with the most recent developments, and once again the systematic practical approach and sound principles applied throughout must be commended.

It is gladdening to see that use is being made of the most recent references and that "newer" diseases and conditions are dealt with inclusive of most recent knowledge.

A comprehensive chapter on immunoprophylaxis and immunotherapy is much appreciated due to the full coverage of vaccines, vaccination recommendations for specific diseases in dogs and cats as well as for exotic carnivores.

After the introductory chapters mentioned above each disease is dealt with in its entirety including a brief history, complete discussion on the aetiological agent, epizootiology, pathogenesis, clinical signs, diagnosis, pathology, therapy, prevention and control. Where applicable, public health considerations are also taken into account. The last chapter in the book deals with zoonoses giving appropriate definitions and extensive tables with the necessary data.

To end off, a number of appendices have been included dealing amongst others with vaccinations, antimicrobial therapy and doses, and laboratory techniques.

If most students and qualified veterinarians apply the basic principles stressed in this book, veterinary science will be practised as it should be practiced.

A.L. LANGE

# BLOOD CHEMICAL PARAMETERS IN FREE-LIVING WHITE RHINOCEROS *CERATOTHERIUM SIMUM*

J. VAN HEERDEN*, R.H. KEFFEN**, J. DAUTH***, and M.J. DREYER***

ABSTRACT: Van Heerden J.; Keffen R.H.; Dauth J.; Dreyer M.J. 1985 **Blood chemical parameters in free-living white rhinoceros *Ceratotherium simum*.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 187-189 (En). Department of Medicine, Faculty of Veterinary Science, Medical University of Southern Africa, 0204, Medunsa, Republic of South Africa.

Serum concentrations of sodium, potassium, chloride, total protein, albumin, aspartate transaminase, creatine kinase, lactate dehydrogenase, gamma-glutamyltranspeptidase, alkaline phosphatase and alanine transaminase were determined in free-living white rhinoceroses *Ceratotherium simum* (n = 20). Single serum cortisol (n = 20), oestradiol-17 Beta (n = 14) and progesterone (n = 14) concentrations are also presented. Low serum sodium (129,6±4,2 mmol/ℓ) chloride (94,2±3,05 mmol/ℓ) and albumin (26,1±3,71 mmol/ℓ) as well as high globulin (alpha 1, alpha 2, beta and gamma) concentrations were outstanding features.

Key words: Serum biochemistry, steroid hormones, *Ceratotherium simum*

## INTRODUCTION

Very limited information on baseline laboratory data for the white rhinoceros *Ceratotherium simum* has been published. This paper presents data on the basic blood chemistry and serum hormone concentrations in the free-living white rhinoceros.

## MATERIAL AND METHODS

Twenty free-living rhinoceroses, 8 males and 12 females of which 16 were adults and 4 subadults were immobilized with varying dosages of etorphine hydrochloride (M99, R & C Pharmaceuticals), azaperone (Stresnil, Janssen) and fentenyl (Fentenyl, Janssen). Animals were immobilized between 07h06 and 11h05 and blood specimens were collected in evacuated tubes (Vac-u-test, Radem Laboratory Equipment, Wijnberg) from an ear vein between 5 – 80 min after administration of the immobilizing agent (Table 1). The blood was centrifuged within 1,5 h of collection and the serum subsequently stored at −4°C until analyzed in the laboratory.

Serum specimens were analysed for sodium (Na), potassium (K), chloride (Cl), aspartate transaminase (AST), creatine kinase (CK), lactate dehydrogenase (LDH), gamma-glutamyltranspeptidase (GGT), alkaline phosphatase (ALP), alanine transaminase (ALT), albumin (Alb) and total proteins (TP) as described[7].

The serum levels of cortisol, progesterone and oestradiol-17 Beta were determined by radioimmunosays utilizing the following kits: Clinical Assays Gamma Coat™($^{125}$I) Cortisol Radioimmunosay Kit (Division of Travenol Laboratories, Inc., Cambridge, Massachusetts); Coat-A-Coat$^{R}$ Progesterone (Diagnostic Products Corporation 5700 West 96th Street, Los Angeles, Ca 90045) and EIR radioimmunoassay (Radio Isotopen Service, Eidg Institut für Reaktorforshung, 5304 Würenlingen/Schweiz).

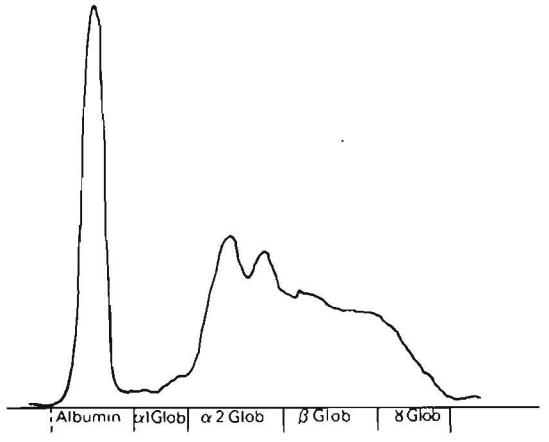


**Fig. 1:** Densitometric scan of serum proteins of the rhinoceros

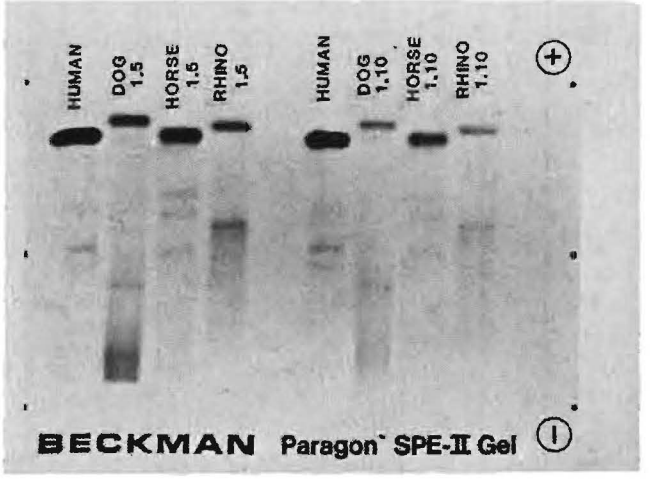


**Fig. 2:** Serum electrophoretic patterns of the dog, human, horse and rhinoceros

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## RESULTS

The results of serum chemical analyses are presented in Table 2. Serum enzyme concentrations (AST, CK, LDH, GGT, ALP) showed different degrees of individual variation. A very high concentration of CK (1800) was measured in one animal which was darted 4 times before it was eventually immobilized. Unusually high concentrations of GGT (> 3 350 and 165 U/l) were recorded in two animals. The densitometric scan of the serum proteins is presented in Fig 1. The cellulose acetate membrane on which serum protein electrophoresis of the rhinoceros is compared to that of the dog, human and horse is presented in Fig. 2. The different globulin fractions in the rhinoceros could not be clearly identified and were empirically designated as alpha, beta 1, beta 2 and globulin fractions.

The results of assays for cortisol, oestradiol-17 Beta and progesterone are presented in Table 3. The highest concentration of cortisol was recorded in animal # 22 which was darted twice before eventually immobilized. Low but detectable concentrations of oestradiol-17 Beta and progesterone were found in the serum of males.

Table 1: Time darted, time lapse between darted and blood collection of blood specimens and age of white rhinoceroses

| Animal No | Sex | Age class | Time | Time lapse between darted and blood collection (min) | Remarks |
|---|---|---|---|---|---|
| 4 | 0 | A | 11h05 | 5 | |
| 5 | 0 | S | 09h57 | 21 | |
| 6 | 0 | A | 07h47 | 23 | |
| 7 | 0 | S | 08h12 | 13 | |
| 9 | ♂ | A | 08h12 | 16 | |
| 10 | 0 | A | 07h55 | 22 | |
| 12 | 0 | A | 08h56 | 16 | |
| 13 | 0 | S | 07h15 | 25 | |
| 14 | 0 | A | 09h07 | 33 | |
| 15 | 0 | A | 09h32 | 28 | |
| 16 | 0 | A | 07h15 | 45 | |
| 17 | 0 | A | 09h58 | 17 | |
| 18 | 0 | A | 07h41 | 14 | |
| 19 | 0 | A | 07h31 | 19 | |
| 20 | 0 | A | 07h54 | 21 | |
| 21 | 0 | A | 07h41 | 80 | 4 darts used; profuse sweating, respiratory rate 20/min; pulse rate 150/min |
| 22 | 0 | A | 07h36 | 69 | 2 darts used; profuse sweating, heart rate 156/min |
| 23 | 0 | S | 07h06 | 39 | |
| 24 | 0 | A | 07h50 | 18 | |
| 26 | 0 | A | 08h20 | 14 | |

A = Adult
S = Subadult

Table 2: Concentrations of serum chemical constituents in white rhinoceroses

| | n | $\bar{x}$ | SD | range |
|---|---|---|---|---|
| Na (mmol/ℓ) | 20 | 129,6 | 4,2 | 122 – 138 |
| K (mmol/ℓ) | 20 | 5,4 | 2,6 | 4,8 – 8,7 |
| Cℓ (mmol/ℓ) | 20 | 94,2 | 3,05 | 90 – 101 |
| AST (U/ℓ) | 20 | 40 | 14,6 | 23 – 93 |
| CK* (U/ℓ) | 17 | 48 | 14,1 | 24 – 72 |
| LDH (U/ℓ) | 20 | 526 | 126,1 | 335 – 925 |
| GGT** (U/ℓ) | 18 | 7,6 | 2,8 | 2 – 13 |
| ALP (U/ℓ) | 20 | 127 | 33,2 | 66 – 189 |
| ALT (U/ℓ) | 20 | 8,6 | 3,7 | 2 – 20 |
| TP g/ℓ | 20 | 92,7 | 9,0 | 75 – 107 |
| Alb g/ℓ | 20 | 26,1 | 3,7 | 17,8 – 31,3 |
| alpha 1 g/ℓ | 20 | 2,3 | 1,1 | 0,4 – 4,0 |
| alpha 2g/ℓ | 20 | 32,0 | 10,5 | 3,9 – 43,1 |
| beta g/ℓ | 20 | 23,6 | 6,7 | 13,5 – 30,7 |
| gamma g/ℓ | 20 | 16,0 | 7,1 | 7,3 – 41,1 |

*three animals with CK concentrations of respectively 200,559 and 1800 U/ℓ were excluded
**two animals with GGT concentrations of respectively >3350 and 165 U/ℓ were excluded

Table 3: Serum cortisol, oestradiol-17 Beta and progesterone concentration in white rhinoceroses

| Animal No | Cortisol (nmol/ℓ) | Oestradiol-17 (pmol/ℓ) | Progesterone (nmol/ℓ) |
|---|---|---|---|
| 4 | 5,7 | 13,7 | 7,4 |
| 5 | 17,5 | 10,9 | 0,4 |
| 6 | 20,9 | – | – |
| 7 | 10,3 | 6,8 | 0,8 |
| 9 | 16,7 | – | – |
| 10 | 9,1 | 8,6 | 0,5 |
| 12 | 10,2 | – | – |
| 13 | 5,9 | 8,0 | 8,0 |
| 14 | 50,1 | 85,7 | 81,7 |
| 15 | 4,7 | 17,9 | 2,9 |
| 16 | 19,8 | 17,2 | 86,8 |
| 17 | 6,7 | 50,4 | 62,7 |
| 18 | 32,3 | – | – |
| 19 | 22,0 | 15,2 | 5,9 |
| 20 | 13,9 | 22,1 | 106,2 |
| 21 | 14,6 | – | – |
| 22 | 122,5 | 23,8 | <0,3 |
| 23 | 109,6 | – | – |
| 24 | 17,0 | 1,5 | 7,7 |
| 26 | 15,4 | 17,2 | 9,8 |

## DISCUSSION

The presented serum chemistry results as well as serum cortisol concentrations may be regarded as baseline values for free-living white rhinoceroses immobilized as described.

The relatively low serum sodium (129,6 ± 4,2 mmol/ℓ), serum chloride (94,2 ± 3,1 mmol/ℓ) as well as relatively high total protein (92,7 ± 9,0 g/ℓ) concentrations are interesting findings. In the horse and mountain zebra *Equus zebra zebra*, related Perissodactyls, average concentrations for sodium, chloride and total proteins are in the order of respectively 140 mmol/ℓ, 100 mmol,ℓ and 70 g/ℓ [6]. Seal et al.[4], however, reported an average serum sodium concentration of 139 mmol/ℓ, an average serum chloride concentration of 95 mmol/ℓ and an average serum total protein concentration of 76 g/ℓ

in captive white rhinoceros. The average serum albumin concentration in this investigation (26,1 g/ℓ) is in agreement with the values published by Seal et al.[4] and Hattingh et al.[2]. The major part of the serum proteins consisted of globulins (73,85 g/ℓ) and these may perhaps play a relatively more important role in plasma oncotic pressure than in most other mammals. Hattingh et al.[3], however, could not find a significant statistical correlation between the colloid osmotic pressure and the albumin concentration, total serum protein concentration and the albumin globulin ratio. An investigation into the physiology of the circulatory system of this massive barrel-shaped mammal which may have a body mass of 2 300 kg[5] may well explain these interesting blood chemistry findings.

The presented peripheral serum cortisol concentrations are in agreement with those reported by Seal et al.[4]. These values are low in comparison to values reported in horses and mountain zebra. It has been suggested by Seal et al.[4] that cortisol may not be the predominant adrenal corticosteroid in the rhinoceros. Two individuals, however, in this investigation had serum concentrations considerably higher than the rest. Blood specimens in these animals were also collected slightly longer after immobilization than in most of the other animals and one individual was also stressed to a greater extent in that it was darted twice. It is, however, interesting to note that # 21 which was immobilized four times and from which blood was only collected after 80 minutes, had a very low peripheral serum cortisol concentration. Knowledge of what had happened to the rhinos before they were immobilized could perhaps have clarified the situation.

Serum oestradiol-17 Beta and progesterone concentrations are presented in full realization of the fact that the technique employed human serum and that single hormone assays are of extremely limited value. Assays were, however, undertaken in the hope that they could be of help in making a clinical diagnosis of pregnancy. Pregnancy was suspected in females 14 and 17 because of the comparatively high concentrations of oestradiol-17 Beta and progesterone. This assumption was based on extrapolation of data in mares where certain stages of pregnancy are characterized by relatively high circulating concentrations of oestradiol-17 Beta and progesterone[1]. Pregnancies were subsequently confirmed in females 14, 16, 17 and 20 by known calving dates in the field. When subtracting immobilization dates from a 16 month gestation period, these females were respectively 10, 12, 10 and 14 months pregnant at the time of capture. Systematic investigation is, however, needed to clarify serum hormonal fluctuations in the white rhinoceros.

## ACKNOWLEDGEMENTS

The Bophuthatswana National Parks Board is thanked for allowing the samples to be collected during the capture programme. The assistance of Mr F F Kuhn, Mrs L R Boyes and B B Lentz is appreciated.

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**BOOK REVIEW** **BOEKRESENSIE**

## GRUNDLAGEN DER FISCHPATHOLOGIE

R.J. ROBERTS and H.-J. SCHLOTFELD

1st Edn Verlag Paul Parey, Berlin and Hamburg, 1985 pp 425, illustrations 353 and numerous tables, Price not given (ISBN 3-489-62516-1)

The book is an updated German translation of Fish Pathology by R.J. Roberts, 1978 Bailière Tindall, to which several new chapters have been added. Although the histopathology of the different conditions in particular is dealt with in excellent detail, this is not essentially a book on the pathology of fishes but rather on fish diseases, including clinical aspects as well as treatment and prevention of cold and warm water, fresh and sea water species.

Four introductory chapters deal with the aquatic environment, anatomy and physiology, pathophysiology and systematic pathology and immunology. Seven further chapters give detailed accounts of viral infections, bacterial diseases, mycoses, parasites of fish, tumors, nutritional diseases and other noninfectious conditions. These are followed by three chapters on therapy, management and disease and laboratory methods and toxicity tests. Finally the appendix contains 40 pages of literature references, a polyglot list of fish species in German, Latin, English, French and Spanich and an index.

Generally the book is well written and well readable, although in some instances the text appears to have suffered from the translation and becomes difficult to understand. This is sometimes compounded by the use of unexplained abbreviations (e.g. BSA, p 103). The chapter on Anatomy does not describe certain features on the lymphatic system mentioned in the chapter on Immunology (p 105).

Both the paragraph on *Streptococcus* B and that on *Bothriocephalus acheilognathi* ignore the reported occurrences in South Africa, whereas the chapter on Mycoses follows the illogical tradition of other European fish disease books by including *Aphanomyces astaci* and the deadly disease of fresh water crayfish it causes.

Some of the protozoan diseases receive much less attention than their viral counterparts. This is particularly noticeable in the description of Whirling Disease, where recent knowledge on the role of *Tubifex* in the lifecycle of the causative agent *Myxosoma cerebralis* was not included in the process of updating. It is also a pity, that in a book which has to classify the various diseases by their main cause, the truly multifactorial nature of most fish diseases cannot be emphasized sufficiently.

Generally, however, the amount of data presented, their presentation, the quality of most illustrations and the wide scope covering all aspects of fish diseases and pathology make this book an outstanding source of information in a new field of veterinary endeavour, which is rapidly increasing in importance.

F.W. HUCHZERMEYER

**BOOK REVIEW** **BOEKRESENSIE**

## ANIMAL STRESS

GARRY P. MOBERG (Ed.)

1st Edn. American Physiological Society, Bethesda, Maryland 1985 pp viii and 324. Price not known. (ISBN 0-683-06101-1)

This book contains the proceedings of a symposium on Stress in Animals which was sponsored by the College of Agriculture and Environmental Sciences at the University of California, Davis, in July 1983 to examine the issue of animal welfare in terms of the effect of stress on the behaviour and health of laboratory animals. The conference provided an opportunity for experts in animal behaviour, physiology, nutrition, immunology and human and animal medicine to discuss the problems involved in defining and measuring stress in animals and suggest possible avenues for future research. This multi-authored book is divided into four sections. The first of these is concerned with determining animal well being and includes viewpoints on what it constitutes, the evolution and ontogenetic determinants of animal suffering and the biological response to stress as a key to the assessment of animal suffering. This is followed by five articles on stress in animals, how it is defined and assessed on the basis of behavioural and physiological responses and the assessment of pain in animals. The effects of stress on the well being of animals in relation to disease processes, immunomodulation, immunosuppression, reproduction and protein metabolism are also presented and discussed by specialist contributors. The final section is devoted to papers on regulations and guidelines for laboratory animal care, associated problems and future concerns and the definition of laboratory animal environmental conditions.

This book is an outstanding contemporary statement on many issues associated with the welfare of laboratory and domesticated animals. It will be of interest to laboratory animal scientists, physiologists, animal productionists and animal welfare workers who are concerned with the science of animal suffering. The seventeen specialist articles are well supported with references and the book is a valuable reference text for persons who are concerned with the biology of animal stress.

J.C. AUSTIN

ARTICLE ARTIKEL

# COMPARISON OF THE EFFECT OF ANTIBIOTIC DRY COW TEAT CANAL AND INTRAMAMMARY DRY COW THERAPY OF DAIRY COWS ON THE PREVALENCE OF TEAT CANAL AND INTRAMAMMARY INFECTIONS AT CALVING

J.H. DU PREEZ* and A.S. GREEFF**

ABSTRACT: Du Preez J.H.; Greeff A.S. **Comparison of effect of antibiotic dry cow teat canal and intramammary dry cow therapy of dairy cows on the prevalence of teat canal and intramammary infections at calving.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 191-194 (En). Department of Veterinary Public Health, Faculty of Veterinary Science, University of Pretoria, P.O. Box 12580, 0110 Onderstepoort, Republic of South Africa.

The specific therapy of bacterial colonization of the teat canals of dried-off dairy cows by means of small amounts (33 mg/0,25 ml and 14 mg/0,1 ml) of a procain benzyl penicillin-dihydrostreptomycin sulphate combination has been investigated. Of 36 teat canals treated with 0,25 ml antibiotic preparation each, 24 (66,6%) were infected at the beginning of the dry period, whereas at its termination only 7 (19,4%) showed bacteriologically positive swab cultures. By treating a further 43 quarters with 0,1 ml quantities of an antibiotic preparation each, the prevalence of infection dropped from 32,5% to 14%. Untreated controls (20 quarters) showed no significant change. Cultures of teat canal swabs were generally twice as sensitive for indicating the presence of bacteria compared to foremilk sample cultures. *Staphylococcus aureus* was the most commonly isolated organism, followed by *Streptococcus agalactiae, Corynebacterium bovis* and *Staphylococcus epidermidis.*

Key words: Dry cow teat canal therapy, teat canal infections.

## INTRODUCTION

The skin of the udder and teats constitutes an important source of *Staphylococcus aureus* which is most commonly involved in udder infection[13 14]. However, these and other organisms first have to establish themselves in the teat canal by colonizing it, before they can enter the teat cistern. It has thus been shown that most udder infections associated with *S.aureus, Staphylococcus epidermidis* and *Streptococcus agalactiae* originate in the teat canal[14].

The incidence of udder infections reaches peak values at 2 main events during the lactation period, i.e. the beginning of lactation (around parturition) and particularly at its termination (around drying-off)[12].

For reducing new and existing udder infections at drying-off and during the dry period, and because of other practical problems during lactation (e.g. limited antimicrobial efficacy of intramammary therapy and antibiotic residues in milk), antibiotic dry cow therapy may be used very effectively[2 7].

However, up to the present time the efficacy of such intramammary administrations against infections residing primarily in teat canals, have not been investigated.

In the light of this situation, various problems related to dry cow therapy (e.g. costs, large dosages of antibiotics, intramammary tissue compatibility), the usually high prevalence of teat canal infection[5 10], its importance in bovine mastitis[8 9] and its possible very close association with the sharply increased incidence of udder infections at drying-off[12], we deemed it necessary to investigate the feasibility of an antibiotic dry cow teat canal therapy.

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The aim of our investigation was to determine at drying-off and calving the prevalence of teat canal infections in cows which were subjected at drying-off, to teat canal therapy with minimal dosages of antibiotics administered for the purpose of reducing the source and occurrence of new udder infections during the dry period.

## MATERIALS AND METHODS

The investigation was performed on experimental groups 1-4 consisting of 11, 9, 21 and 5 cows, respectively, selected at random and kept on a zero grazing system in the same dairy herd. All the cows were milked by machine. Teats were washed and dried with sterile disposable paper towels, disinfected with cotton wool and 70% alchohol immediately before sampling or, prior to dry cow teat canal/standard dry cow therapy, after milking.

### Dry cow teat canal therapy

*Group 1:* Procain benzyl penicillin and dihydrostreptomycin sulphate was diluted in glycerine and methyl paraben (K-Y lubricating jelly, Johnson and Johnson, East London) to a concentration of 6 mg and 8 mg of the antibiotics, respectively, per 0,1 ml diluent. Therapy consisted of direct deposition of 0,1 ml quantities of the appropriately diluted antibiotics into each of the 43 teat canals of 11 cows.

*Group 2:* 0,25 ml of a preparation containing 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin sulphate, was used respectively. In both instances (Group 1 and 2) the relevant quantities of prepared antibiotics were instilled by depositing the antibiotic into all the teat canals by means of a tuberculin syringe.

### Dry cow therapy

*Group 3:* Cows received standard drying-off therapy: 10


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g of a preparation containing procain benzyl penicillin (4,9% m/m) and dihydrostreptomycin sulphate (6,5% m/m) was deposited in the quarters' gland cisterns of all the quarters via the teat canal.

*Group 4:* Untreated controls

## Collection of foremilk and teat canal swab samples:

*Sampling routine:* After discarding the initial 3 jets of foremilk, a quarter milk sample was aseptically collected into a sterile 5 ml tube (Monoplast, Labotec, Johannesburg) following the standard procedure[11].

The teat canal was then swabbed by means of a miniature swab prepared in advance and handled as follows: The swabs were made by wrapping good quality, highly absorbent cotton wool for a distance of 3-4 mm around the tip of 3,5 cm long, slim wooden toothpicks. Swabs were wrapped in aluminium foil and sterilised in an autoclave. For sampling, a swab was removed from the storage container and extracted from its aluminium foil wrapping. The cotton wool tipped miniature swab was inserted into the teat canal for a distance of 3-4 mm whereafter it was extracted and placed in a sterile 5 ml 'Monoplast' tube to facilitate transport.

Foremilk and teat canal swab samples were obtained immediately before milking and administration of antibiotics and again 1-5 days after calving (see below) for bacteriological analysis. Before implementation of our sampling routine we established the effectivity of the disinfection process by swab sampling and culturing 50 teat tips subsequent to disinfection (99% were bacteriologically negative). All samples were transported on ice and analysis proceeded within 6 hours of sampling.

## Isolation and identification of bacteria

Facultative and microaerophilic bacteria were isolated by streaking a loopful (± 0,01 ml) of foremilk sample onto each of two blood triptose (BT) plates. Both plates were incubated at 37°C for 48 h, one of them under microaerophilic conditions. The swabs were similarly streaked and cultured. In each case a loopful (± 0,01 ml) of foremilk sample and the aseptically removed tip of swabs were separately enriched by incubation in 5 ml serum broth. This served as a back-up in those cases where no growth materialised on BT-plates. Speciation was done according to the methods and criteria described by Cowan & Steel[3].

Specific culture of anaerobic bacteria was excluded for practical reasons.

For the purpose of this report it is assumed that the presence of bacteria in a quarter foremilk sample indicates intramammary infection (IMI) and in teat canal swab sample teat canal infection (TCI).

## Statistical evaluation

The log-linear model was used for statistical analyses[6].

# RESULTS

No significant difference was found between foremilk quarter samples analysed before and after treatment (percentage bacteriologically clean foremilk: 90,7% and 93%, respectively). Swab culture showed the percentage bacteriologically clean teat canals, to have improved from 67,5% to 86% (not statistically significant).

A significant improvement ($P<1\%$) in the bacteriological status of both quarters and teat canals was accomplished with 14 mg procaine benzyl penicillin and 19 mg dihydrostreptomycin per 0,25 ml dose dry cow teat canal therapy (Table 2). Bacteriologically clean quarter milk samples increased from 66% to 94,4% and teat canal swabs from 33% to 80,5%.

Table 3 reveals that standard dry cow therapy did not significantly improve the prevalence of bacteriologically clean quarter milk samples (66,3% to 68,8%). However, the prevalence of clean teat canal swabs improved from 42,2% before treatment to 59,1% thereafter (not statistically significant).

Group 4 cows: The 5 cows in this group with IMI and TCI in the same quarters were used as untreated controls.

The results recorded in Table 4 indicate that comparatively little change took place in the relevant IMI and TCI in the same quarters of the untreated control quarters. Although 65% of foremilk samples were bacteriologically negative 1-5 days after calving as compared to 60% at drying-off only 30% of the teat canals were clean at calving compared with 35% at drying-off.

In contrast to the control group as well as Groups 1 and 3, Group 2 cows showed a significant improvement in terms of bacteriologically clean teat canals (see Table 5 and Discussion).

Table 1: Group 1 cows: Effect of dry cow teat canal therapy with 0,1 ml pen-strep* mixture on intramammary (IMI) and teat canal infections (TCI) of the same 43 quarters

| Type of Sample | Before Therapy, at Drying-off | | | | After Therapy, 1-5 Days After Calving | | | |
|---|---|---|---|---|---|---|---|---|
| | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | |
| Prevalence | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) |
| Bacteriological Status of Quarters/Teat Canal | 4(9,3) | 39(90,7) | 14(32,5) | 29(67,5) | 3(7) | 40(93) | 6(14) | 37(86) |
| Bacteria Isolated: | | | | | | | | |
| *S. aureus* | 2(4,7) | | 9(20,9) | | 3(7) | | 4(9,3) | |
| *S. agalactiae* | 2(4,7) | | 3(7) | | | | 1(2,3) | |
| *Corynebacterium bovis* | | | 1(2,3) | | | | 1(2,3) | |
| Mixed infections | | | 1(2,3) | | | | | |

One cow developed clinical mastitis in 1 quarter 1-5 days after calving

* = 6 mg procain benzyl penicillin and 8 mg dihydrostreptomycin sulphate per 0,1 ml dose

+ = bacteria present

− = bacteria absent

Table 2: Group 2 cows: Effect of dry cow teat canal therapy with 0,25 ml pen-strep* mixture on intramammary (IMI) and teat canal infections (TCI) of the same 36 quarters

| Type of Sample / Prevalence | Before Therapy, at Drying-off | | | | After Therapy, 1-5 Days After Calving | | | |
|---|---|---|---|---|---|---|---|---|
| | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | |
| | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) |
| Bacteriological Status of Quarters/Teat Canals | 12(33,3) | 24(66,6) | 24(66,6) | 12(33) | 2(5,5) | 34(94,4) | 7(19,4) | 29(80,5) |
| Bacteria Isolated: | | | | | | | | |
| *S. aureus* | 11(30,5) | | 17(47,2) | | 2(5,5) | | 5(13,8) | |
| *S. agalactiae* | | | 3(8,3) | | | | 1(2,8) | |
| *C. bovis* | | | 1(2,8) | | | | | |
| *S. epidermidis* | | | 1(2,8) | | | | | |
| Mixed infections | | | 2(5,6) | | | | 1(2,8) | |

None of these cows developed clinical mastitis between days 1-5 after calving
* = 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin per 0,25 ml dose
+ = bacteria present
− = bacteria absent

Table 3: Group 3 cows: Effect of standard dry cow therapy with 10 g intramammary application of pen-strep* mixture on intramammary (IMI) and teat canal infections (TCI) of the same 83 quarters

| Type of Sample / Prevalence | Before Therapy, at Drying-off | | | | After therapy, 1-5 Days After Calving | | | |
|---|---|---|---|---|---|---|---|---|
| | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | |
| | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) |
| Bacteriological Status of Quarters/Teat Canals | 28(33,7) | 55(66,3) | 48(57,8) | 35(42,2) | 26(31,3) | 57(68,7) | 34(40,9) | 49(59,0) |
| Bacteria Isolated: | | | | | | | | |
| *S. aureus* | 11(13,2) | | 23(27,7) | | 10(12) | | 10(12) | |
| *S. agalactiae* | 3(3,6) | | 3(3,6) | | 3(3,6) | | 3(3,6) | |
| *C. bovis* | 7(8,4) | | 9(10,8) | | 8(9,6) | | 10(12) | |
| *S. epidermidis* | 2(2,4) | | 8(9,6) | | 1(1,2) | | 6(7,2) | |
| *E. coli* | 4(4,8) | | 3(3,6) | | 3(3,6) | | 3(3,6) | |
| Mixed infections | 1(1,2) | | 2(2,4) | | 1(1,2) | | 2(2,4) | |

One cow developed clinical mastitis in 1 quarter 1-5 days after calving
* = 4,9% (m/m) Procain benzyl penicillin and 6,5% (m/m) dihydrostreptomycinsulphate per 10g dose
+ = bacteria present
− = bacteria absent

Table 4: Group 4 cows, untreated controls: Bacteriological status of quarters/teat canals (n = 20 quarters)

| Type of Sample / Prevalence | At Drying-off | | | | 1-5 Days After Calving | | | |
|---|---|---|---|---|---|---|---|---|
| | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | |
| | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) |
| Bacteriological Status of Quarters/Teat Canals | 8(40) | 12(60) | 13(65) | 7(35) | 7(35) | 13(65) | 14(70) | 6(30) |
| Bacteria Isolated: | | | | | | | | |
| *S. aureus* | 6(30) | | 7(35) | | 5(25) | | 7(35) | |
| *S. agalactiae* | 2(10) | | 2(10) | | 2(10) | | 2(10) | |
| *C. bovis* | | | 1(5) | | | | 1(5) | |
| *S. epidermidis* | | | 2(10) | | | | 3(15) | |
| Mixed infections | | | 1(5) | | | | 1(5) | |

+ = bacteria present
− = bacteria absent

Table 5: Summary of bacteriological data from intramammary (IMI) and teat canal infections (TCI) of experimental groups 1-4

| Type of Sample Prevalence | Group | Number of cows | Before Therapy, at Drying-off | | | | After therapy, 1-5 Days After Calving | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | | Quarter Foremilk (IMI) | | Teat Canal Swabs (TCI) | |
| | | | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) | + (%) | − (%) |
| Bacteriological Status of Quarters/Teat Canals | 1 | 11 | 4(9,3) | 39(90,7) | 14(32,5) | 29(67,5) | 3(7) | 40(93) | 6(14) | 37(86) |
| | 2 | 9 | 12(33,3) | 24(66,6) | 24(66,6) | 12(33) | 2(5,5) | 34(94,4) | 7(19,4) | 29(80,5) |
| | 3 | 21 | 28(33,7) | 55(66,3) | 48(57,8) | 35(42,2) | 26(31,3) | 57(68,7) | 34(40,9) | 49(59,0) |
| | 4 | 5 | 8(40) | 12(60) | 13(65) | 7(35) | 7(35) | 13(65) | 14(70) | 6(30) |

## DISCUSSION

It is evident from the results obtained in this study that considerable improvement in the bacteriological status of quarters and teat canals can be accomplished during the dry period by curative therapy of teat canals at drying-off, using minimal quantities of appropriate antibiotics as with antibiotic dry cow therapy[2 7]. We found that a single instillation of 0,25 ml of a preparation containing 14 mg procain benzyl penicillin and 19 mg dihydrostreptomycin into the teat canal increased the number of bacteriologically clean quarters, as monitored by foremilk samples, by 43% (66% to 94,4%) over the dry period. The increase in the number of bacteriologically negative teat canals, as evidenced by teat canal swab examination, was even more remarkable: a change from 33% to 80,5% representing an improvement of 144%.

The smaller amounts of penicillin-streptomycin mixture (6 mg and 8 mg, respectively) improved the prevalence of clean teat canals by only 27,4%. Similarly, standard dry cow therapy improved the prevalence of clean teat canals by only 40% although antibiotic dry cow therapy has been used very effectively by others[2 7].

One of the cows in Group 1 (Table 1) and one from Group 3 (Table 3) developed clinical mastitis at calving. None from Group 2 (Table 2) developed clinical mastitis between days 1-5 after calving. It thus appears from these results that the lower antibiotic dosage (Table 1) and the standard dry cow treatment (Table 3) gave comparable results in eliminating colonization of the teat canal during the dry period. The higher dose (0,25 ml) of antibiotic (Table 2), however, improved both the bacteriological status of sampled quarter milk and the teat canal swabs. Because most udder infections caused by *S. aureus, S. epidermidis* and *S. agalagtiae* originate in the teat canal[1 4] therapy of teat canal infections is of paramount importance in mastitis control. Furthermore, no cases of mastitis were recorded for this group during the first few days after calving. This aspect, however, will have to be studied in greater detail.

Since the dry cow teat canal therapy investigated have shown that the higher antibiotic dose (0,25 ml) required for effective control of an important source of udder infections is about 60 times lower than that of conventional dry cow preparations, the economic benefits, coupled to the high efficacy of this approach, supercedes that of the traditional intramammary dry cow therapy.

Until such time as a suitable applicator syringe and formulation for dry cow teat canal therapy is available, existing TCI can be treated and new ones prevented by modifying the method of administration of the standard dry cow therapy. For this, an estimated 0,25 ml of a standard dry cow remedy is deposited in the teat canal before completely withdrawing the nozzle of the syringe or tube from the teat canal. While it is so that the available amount of standard dry cow therapy preparatoin will inevitably enter the teat canal during standard methods of administration of dry cow therapy it is essential that a therapeutically effective quantity of the preparation be deposited precisely within the teat canal.

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**RESEARCH NOTE** **NAVORSINGSNOTA**

# SIMULTANEOUS ISOLATION OF ANAEROBIC BACTERIA FROM UDDER ABSCESSES AND MASTITIC MILK IN LACTATING DAIRY COWS

A.S. GREEFF* and J.H. DU PREEZ**

ABSTRACT: Greeff A.S.; Du Preez J.H. **Simultaneous isolation of anaerobic bacteria from udder abscesses and mastitic milk in lactating dairy cows.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 195-197 (En). Department of Medical Microbiology, Medical University of Southern Africa, 0204 Medunsa, Republic of South Africa.

A variety of non-sporulating anaerobic bacterial species were isolated from udder abscesses in 10 lactating dairy cows. Fifty percent of the abscesses yielded multiple anaerobic species and the other 50% only 1 species. The anaerobic bacteria, however, were always accompanied by classical facultative anaerobic mastitogenic bacteria. In four of the five cows also afflicted with mastitis in the quarters with abscesses, the anaerobic and facultative anaerobic bacteria were identical. *Peptococcus indolicus* was the most commonly isolated organism followed by *Eubacterium* and *Bacteroides* spp.

*Bacteroides fragilis* was resistant to penicillin, ampicillin and tetracycline.

Key words: Anaerobic bacteria, abscesses, bovine mastitis.

## INTRODUCTION

There are numerous reports regarding the importance of obligate anaerobic species of bacteria in clinical infections in humans[1 8 9]. Human infections in which anaerobes are commonly found or in which they are the predominant pathogens are: abscesses in the breast, lung, liver and brain, puerperal sepsis, appendicitis and various other conditions[9]. Love[14 15] isolated various anaerobes from subcutaneous "fight wound" abscesses in cats. Berkhoff & Redenbarger[3] cultured anaerobes from abscesses, joint fluids, foot rot swabs and other specimens from diseased animals. Anaerobic bacteria were also isolated from pneumonic lungs of cattle[4] and abscesses in pigs[2].

In recent investigations on mastitic milk of South African dairy cattle, *Bacteroides fragilis, Bacteroides eggerthii, Peptococcus indolicus, Eubacterium lentum, Eubacterium aerofaciens, Eubacterium combesii, Propionibacterium granulosum, Propionibacterium acnes, Fusobacterium necrophorum, Clostridium sporogenes* and a *Peptostreptococcus* sp. were isolated from sporadic cases of bovine mastitis[6 7]. Hirsh et al.[10] isolated various anaerobes from non-specified abscesses, joints, genital tracts and various other sites from animals.

We report here our findings on the isolation of a variety of anaerobic and facultative anaerobic bacterial species from sporadic udder abscesses, and normal and mastitic milk samples from clinical and subclinical mastitic cases from the same udder quarters of lactating dairy cows.

## MATERIALS AND METHODS

### Animals

The animals consisted of 10 lactating Friesian dairy cows each with an udder abscess in one quarter, encountered in 6 dairy herds on the Transvaal Highveld. According to criteria of the International Dairy Federation[12] 2 of the cows had clinical and 3 subclinical mastitis, respectively, in the quarters in which the abscesses occurred.

### Collection of anaerobic milk samples

Milk samples were obtained from each of the 10 quarters which had an abscess. After disinfection of the teats, all milk samples were taken anaerobically via the teat canal from the teat or gland cistern of the udder by means of a 150 mm x 1,0 mm catheter attached to a 10 ml disposable syringe. The syringe and catheter were preflushed with an anaerobic gas mixture consisting of $N_2$ (80%): $CO_2$ (10%): $H_2$ (10%) on a volume basis to remove all traces of atmospheric oxygen from the system. Samples were immediately injected into 100 x 30 mm vaccine bottles, fitted with crimped butyl rubber sealers and containing an atmosphere of oxygen-free $CO_2$. Samples were transported on ice, and analysis was initiated within 6 hours after collection.

### Anaerobic collection of pus from udder abscesses

Pus from udder abscesses was aspirated under similar conditions as the collection of anaerobic milk samples by means of a 19-gauge needle and 10 ml disposable syringe after disinfection of skin that covered the abscess. The pus samples were handled in the same manner as the milk samples.

### Bacteriology

The anaerobic and facultative anaerobic bacteria isolated from milk and pus samples were cultivated and identified according to methods previously described[5 7 11].

### Antimicrobial sensitivity

The susceptibility of the anaerobic organisms to concentrations of penicillin-G (10 units/ml), ampicillin (4 μg/ml), cephalothin (6 μg/ml), clindamycin (3,2 μg/ml), chloramphenicol (12 μg/ml), tetracycline (10 μg/ml), erythromycin (3 μg/ml) and metronidazole (6 μg/ml) was determined by a broth-disc method according to Wilkins & Thiel[18].

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## RESULTS

### Isolation of anaerobic and facultative anaerobic bacteria (Table 1)

Although 6 (60%) cows were treated by their owners before sampling with various types of antibiotics (chloramphenicol, penicillin, streptomycin or tetracyline or combinations thereof) intramuscularly and Cows 6 and 10 also intramammary, a wide range of anaerobic and facultative anaerobic bacteria was isolated from the udder abscesses. The abscesses in all of the 10 lactating dairy cows yielded anaerobic bacteria. In the case of Cows 1, 2 and 6, three different anaerobic bacterial species and in Cow 10, four were isolated from the udder abscesses while the rest revealed only 1 or 2 species. Five abscesses (50%) revealed only 1 anaerobic bacterial species. In the case of Cow 10, three facultative anaerobic bacterial species were isolated in combination with the 4 anaerobic bacterial species to give a total of 7 bacterial species from 1 abscess. The mean number of bacterial species isolated from an abscess lies between 3 and 4. In the cases of Cows 6 and 10 with clinical mastitis and Cows 4 and 7 with subclinical mastitis, in the same quarters where the abscesses occurred, the anaerobic and facultative bacteria isolated from the mastitic milk were identical to those isolated from the udder abscesses. In the case of Cow 1 with SCM only, *S. aureus* was isolated from the mastitic milk from the same quarter in which the abscess occurred. *P. indolicus* was isolated most frequently from udder abscesses, followed by *E. lentum*.

### Antimicrobial sensitivity

The susceptibility of some anaerobic bacterial isolates isolated from udder abscesses to commonly used antimicrobial agents is recorded in Table 2. Whereas the majority of anaerobic bacteria were sensitive to all the antimicrobials tested, *B. fragilis* was resistant to penicillin, ampicillin and tetracycline.

## DISCUSSION

As in humans, species of obligatory anaerobic bacteria appear to play an important role in clinical veterinary medicine[10]. In humans anaerobes are the bacteria responsible for most brain abscesses. The organisms usually found are *Peptostreptococcus, Fusobacterium* and *Bacteroides* spp. Not infrequently, only anaerobes are isolated, or are found in combination with facultative anaerobic bacteria[1 9]. We consistently isolated anaerobes from udder abscesses and 2 cases of clinical mastitis concurrently with facultative anaerobic bacteria which are known to be associated with bovine mastitis[6 7].

This report demonstrates the large number and variety of species of anaerobes that can be recovered from udder abscesses with or without clinical mastitis and

Table 1: Anaerobic and facultative anaerobic bacteria isolated concurrently from udder abscesses in lactating dairy cows

| Cow No. | Herd No. | Udder abscess | Mastitis | Anaerobic bacteria | Facultative anaerobic bacteria | Antibiotic therapy before sampling |
|---|---|---|---|---|---|---|
| 1 | 1 | + | SCM** | *Bacteroides eggerthii*<br>*Eubacterium combesii*<br>*Propionibacterium acnes* | *Corynebacterium pyogenes*<br>*Staphylococcus aureus* | No |
| 2 | 2 | + | NP | *Eubacterium alactolyticum*<br>*Megasphaera elsdenii*<br>*Peptostreptococcus anaerobius* | *C. pyogenes* | Yes |
| 3 | 2 | + | NP | *Peptococcus asaccharolyticus*<br>*P. anaerobius* | *C. pyogenes* | Yes |
| 4 | 2 | + | SCM* | *Peptococcus indolicus* | *Escherichia coli*<br>*Streptococcus agalactiae* | Yes |
| 5 | 2 | + | NP | *Eubacterium lentum* | *C. pyogenes* | No |
| 6 | 3 | + | CM* | *Clostridium cadaveris*<br>*E. lentum*<br>*P. anaerobius* | *C. pyogenes* | Yes |
| 7 | 4 | + | SCM* | *P. indolicus* | *C. pyogenes* | No |
| 8 | 5 | + | NP | *P. indolicus* | *C. pyogenes* | No |
| 9 | 5 | + | NP | *P. indolicus* | *C. pyogenes* | Yes |
| 10 | 6 | + | CM* | *Bacteroides fragilis*<br>*E. lentum*<br>*Eubacterium aerofaciens*<br>*P. indolicus* | *C. pyogenes*<br>*S. aureus*<br>*S. agalactiae* | Yes |

SCM = subclinical mastitis
NP = not present
CM = clinical mastitis

\+ = present
* = anaerobic and facultative anaerobic bacteria isolated from mastitic milk are the same as those isolated from udder abscesses
** = only *S. aureus* have been isolated from mastitic milk

Table 2: Antimicrobial sensitivity of some anaerobic bacterial isolates from cases of udder abscesses

| Anaerobe | Cow No. | Antimicrobial agent | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Pen | Amp | Cep | Cli | Chl | Ery | Met | Tet |
| *B. eggerthii* | 1 | ± | + | + | + | + | + | + | + |
| *B. fragilis** | 10 | − | − | + | + | + | + | + | − |
| *Cl. cadaveris* | 6 | + | + | + | + | + | + | + | + |
| *E. lentum** | 6 | + | + | + | + | + | + | + | + |
| *E. lentum* | 5 | + | + | + | + | + | + | + | + |
| *E. combesii* | 1 | + | + | + | + | + | + | + | + |
| *E. aerofaciens** | 10 | + | + | + | + | + | + | + | + |
| *E. alactolyticum* | 2 | + | + | + | + | + | + | + | + |
| *M. elsdenii* | 2 | + | + | + | + | + | + | + | + |
| *P. asaccharolyticus* | 3 | ± | + | + | + | + | + | + | + |
| *P. indolicus* | 4 | ± | + | + | + | + | + | + | + |
| *P. anaerobius* | 3 | + | + | + | + | + | + | + | + |
| *P. acnes* | 1 | + | + | + | + | + | ± | + | + |

Pen = penicillin – G
Amp = ampicillin
Cep = cephalothin
Cli = clindamycin
Chl = chloramphenicol
Ery = erythromycin
Met = metronidazole
Tet = tetracycline
− = resistant
± = partial resistance
\+ = sensitive
*Sensitivity was the same for those isolates from mastitic milk

subclinical mastitis in the same quarters of lactating dairy cows. Similar findings have been reported for abscesses and this may indicate the reason why it has been given such prominence in the literature on anaerobes which play a role in bovine mastitis[6 7 17].

The most frequent combination of anaerobic and facultative anaerobic bacteria in this study involved *P. indolicus* and *C. pyogenes*. This corresponds with previous findings in cases of clinical mastitis[7 17]. The isolation of identical anaerobic and facultative anaerobic bacteria from clinical and subclinical mastitic milk and abscesses from the same quarters (Table 1) suggests at least a secondary role for the anaerobic isolates in bovine udder health.

The propensity of anaerobes to act as primary pathogens in nature is still unclear. In infections where both anaerobes and facultative anaerobic bacteria are present, it is not always possible to ascribe roles to all the organisms present or to state categorically that one or the other organism is the pathogen and that the others are of no consequence[15]. All the organisms of both the anaerobic and facultative anaerobic bacterial species described in this paper may be considered to play a part in the clinical infections from which they were isolated[6 7]. The similarity in anaerobic flora from 2 cases of clinical mastitis and 2 of subclinical mastitis and their corresponding abscesses may be indicative of a pathogenic role for anaerobes found in mastitic quarters.

*B. fragilis* was both penicillin and tetracyline resistant[16] whereas the rest of the isolates were sensitive to all the antimicrobials tested. Although the majority of cows had received antibiotic treatment before sampling a wide range of anaerobes could still be isolated from abscesses. Because of reduced blood supply as well as the penetration barrier created by abscess formation, the efficacy of the antibiotics used may have been reduced.

ACKNOWLEDGEMENTS

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**BOOK REVIEW** **BOEKRESENSIE**

# VETERINARY LAW

## Ethics, Etiquette and Convention

D.C. BLOOD

1st Edn. The Law Book Company Limited, North Ryde 2113, NSW pp ix and 368, numerous tables and figures. Price $29.50 (ISBN 0-455-20560-4)

This book sets out to fill the gap which exists in the veterinary literature, and to assist veterinarians in particular to find answers to some of the many questions which arise almost daily in the course of their work. To this end the author has included an extensive index for reference purposes. Measured against these objectives, the book is certainly a valuable contribution and should find wide acceptance within the profession.

Although the work is based upon the laws and practices pertaining to Australia, which in itself is complicated by state autonomy in a federated system, the author has sought to impart universality by extensive use of international literature and comparative analysis. In this the author has succeeded and as such, the South African reader will find much that is applicable locally. In fact, many of the problems and difficulties currently being addressed in this country are covered by the author's exposition of analogous situations under Australian jurisprudence. Thus, those concerned with the problem of specialities should find the role of the Australian College of Veterinary Scientists of particular interest. Likewise, the adoption of a code of ethics as a condition of membership of the Australian Veterinary Association may find application in this country.

The book covers virtually all legal, ethical and behavioural aspects of a veterinarian's daily activities; grouped into eleven chapters. These in turn are sub-divided into a large number of topics for ease of reference. In consequence a degree of repetition has been unavoidable. The style is reminiscent of concise notes prepared for lecturing purposes and should therefore suit the busy practitioner seeking rapid answers to problems as they may arise.

The author stresses the fact that the book should not be seen as a do-it-yourself manual, but that expert legal advice should be sought where necessary. This advice is especially prudent to the South African reader as both our laws and our legal system differ in details from those pertaining to Australia.

Nevertheless, the book can be recommended to veterinarians in all branches of the profession as a general guide and should constitute a useful basis for the teaching of veterinary jurisprudence and professional conduct.

N.C. OWEN

**BOOK REVIEW** **BOEKRESENSIE**

# CLINICAL LABORATORY MEDICINE

DONALD D. HOLMES

1st Edn. The Iowa State University Press, Ames, Iowa, 50010. 1984 pp v and 138. Price R33,00 (ISBN 0-8138-0328-4)

This book has been written to provide a convenient reference manual on the biology, husbandry, diagnosis and treatment of disease in laboratory mammals and reptiles. It comprises chapters on mice, rats, Mongolian gerbils, guinea pigs, rabbits, ferrets, non-human primates and aquatic and terrestial reptiles. These are supplemented with appendices on normal biological data on reproductive, physiological, haematological and biochemical features on the species covered. The book is supported with source references for much of the information which it contains.

It serves as an excellent introductory text for persons who are entering laboratory animal science as technicians or clinicians or for veterinarians who have to treat small mammals, rodents and reptiles in their practices.

The book has been reproduced from a typewritten manuscript and presented in a ring binder format on good quality paper.

While it is not intended to be a comprehensive source of information on the species it covers, it is a valuable source of information in a condensed form for biomedical science students, laboratory animal technologists and veterinarians who are involved with laboratory animal care.

J.C. AUSTIN

SHORT COMMUNICATION KORT BERIG

# THE ROLE OF HORNED CATTLE IN BEEF CARCASE BRUISING AT CATO RIDGE ABATTOIR

P.M. KRETZMANN, H.G. WALLACE and D.B. WEAVER*

ABSTRACT: Kretzmann P.M.; Wallace H G; Weaver D B. **The role of horned cattle in beef carcase bruising at Cato Ridge abattoir.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 199-200 (En). Division of Veterinary Services, Department of Agricultural Economics and Marketing, Cato Ridge Abattoir, P O Box 206, 3680 Cato Ridge, Republic of South Africa.

During the month 3-3-1983 to 4-4-1983 14 008 cattle slaughtered at Cato Ridge abattoir yielded 32 182 kg of bruised tissue excised from carcases at secondary inspection. Polled animals comprised 56,5% of all the cattle, those with horn stumps 13,9%, those with short horns 10,8% and those with long horns 18,8%. No less than 83,3% (26 812 kg) of the bruised meat condemned was trimmed from 38,8% (5 437) of the cattle and these were animals that either had long horns or were penned with long horned animals.

Key words: Horns, cattle, horned cattle, bruising, bruised meat, abattoir.

## INTRODUCION

Bruising of cattle remains a major problem facing beef marketeers in the RSA. The approximate economic loss to the industry in 1981 was R9,7 million (SA Meat Board report 1982). At Cato Ridge abattoir approximately one third of all beef carcase condemnations are due to this condition. For the year ending December 1983 out of a total kill of 212436 cattle slaughtered at this abattoir, 1326 (0,62%) bruised carcases were condemned.

It is an established fact that a high incidene of carcase bruising is seen in groups of horned cattle. Shaw et al.[4], in Australia, showed that bruising is almost doubled in groups of horned cattle when compared with polled controls.

The bruising incidence due to the horn factor is, however, linked to variables such as horn size and shape, the inherent aggressive nature of certain breeds, the size, sex, age and temperament of the cattle and many managemental factors[1]. The presence of these variables makes it difficult to apply Shaw's figures to South African conditions.

The aim of this article, therefore, is to indicate the extent of the problem at Cato Ridge abattoir.

## MATERIALS AND METHODS

During the period 3-03-1983 to 4-04-1983 the horn status of 14008 cattle arriving at the abattoir was evaluated and recorded as follows:

Type 0 = polled animals
Type 1 = cattle with horn buds or stumps visible
Type 2 = cattle with short horns (up to ± 20 cm in length)
Type 3 = cattle with long horns (longer than ± 20 cm in length)

In order to achieve as objective an appraisal of horn size as possible, the cattle were visually evaluated by one of the authors on the day of arrival and a second opinion obtained the following morning by a different examiner. The cattle were penned at the abattoir for a period not exceeding 72 hours. Large consignments were split and placed in two or more pens but members of one consignment were never mixed with other cattle.

The method of inspection at this abattoir has been described by Wallace et al.[5]. Small superficial lesions were excised at primary inspection. These were not weighed as they only constituted a small proportion of the total mass of bruised meat condemned. The amount of bruised meat condemned at secondary inspection was weighed and recorded and the figures presented are based on these recordings.

## RESULTS

The number of cattle in each horn category is indicated in Table 1. It is noteworthy that cattle with Type 3 horns accounted for nearly twenty percent of the cattle sampled.

Table 1: The horn structure of cattle sampled.

| Cattle Type(1) | No. of Cattle | % of Total |
|---|---|---|
| Type 0 | 7 913 | 56,5 |
| Type 1 | 1 950 | 13,9 |
| Type 2 | 1 517 | 10,8 |
| Type 3 | 2 628 | 18,8 |
| Total | 14 008 | 100,0 |

(1) 0 = Polled
1 = Horn buds or stumps
2 = Short horns
3 = Long horns

The 14008 cattle yielded 32182 kg of bruised meat at secondary inspection of the carcases. This represents an average of 2,3 kg bruised meat condemned from each carcase.

During this survey 1539 pens were utilized to hold the cattle prior to slaughter. The bruising record of cattle

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categorised according to the various mixtures of horn types within each pen is represented in Figure 1.

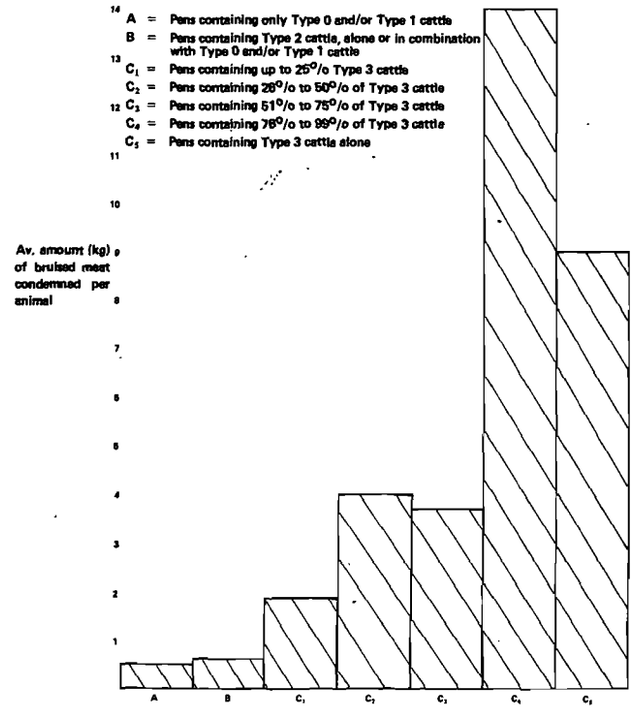


**Fig. 1:** Histogram showing the average amount of bruised meat condemned per animal from pens of cattle categorised according to the mixing of the various horn types.

Table 2 indicates that whilst only 38,8% of the cattle were either horned or mixed with horned cattle in the pens prior to slaughter, 83,3% of bruised meat originated from these cattle.

## DISCUSSION

The results indicate that a large proportion of beef carcase bruising originates from groups of horned cattle. Bruised meat condemned during this survey at secondary inspection from cattle with long horns (or from pen mates of long horned cattle) had a total financial value of at least R52 524 (this figure is based on the average price for Grade 3 cattle at this abattoir for the year 1983/1984 of 195,9 cents/kg and works out at an average of R9,66 lost per animal). The total economic loss from these animals is considerably greater if factors such as bruised meat excised at primary inspection, the down-grading of moderately bruised carcases, viscera condemnations and the decrease in hide quality are taken into consideration.

The relative drop in the average amount of bruised meat condemned from groups containing only long horned cattle compared with those comprising 76 to 99% long horned cattle (Fig. 1) could be ascribed to the inability of polled or short horned cattle to defend themselves from their potentially dangerous pen mates when placed in a confined area. A contributory factor could also be that mixed groups are likely to comprise strange animals recently mixed at sales or in similar circumstances. Animals in groups comprising only long horned cattle are often of uniform type and it is likely that they were raised as a group.

Consignments of polled cattle, conversely, show a relatively small bruising incidence. The majority of these cattle originate from intensive feeding systems where progressive management procedures are usually practised. Consequently, a bruise, when it does occur, is usually small and localised. After excision of this bruised tissue at inspection, however, the carcase may be downgraded resulting in an additional financial loss to the producer. These producers constitute a considerable pressure group demanding investigation into the finer details of the bruising problem and techniques are currently being researched to determine, amongst other things, the age of the bruised tissue[2,3] (W Gertenbach 1984, University of Natal, Personal communication).

It is clear from the results, however, that in order to effectively reduce the amount of bruised meat being condemned as unfit for human consumption at Cato Ridge abattoir, fundamental managemental deficiencies on the part of the errant producer, will have to be rectified.


### ACKNOWLEDGEMENTS

The authors are grateful to the Allerton and Cato Ridge members of the Laboratory Liaison Committee for their guidance and criticism of the article, to Mrs D Hook for typing the manuscript, to the staff at Cedara Agricultural College who were responsible for the histogram and to the Director of Veterinary Services for allowing the publication of the article.


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**Table 2:** The number of pens with and without Type 3 cattle, the number of animals therein and the amount of bruised meat originating from these pens.

| Pen composition | Number of pens | Number of cattle | Percentage cattle | Bruised meat (kg) | Percentage bruised meat |
|---|---|---|---|---|---|
| Pens containing Type 0, 1 and/or 2 cattle only | 904 | 8 571 | 61,2 | 5 370 | 16,7 |
| Pens containing Type 3 cattle either mixed with others or alone | 635 | 5 437 | 38,8 | 26 812 | 83,3 |
| Total | 1 539 | 14 008 | 100,0 | 32 182 | 100,0 |

**SHORT COMMUNICATION** **KORT BERIG**

# A COMPUTERISED EXPERIMENTAL FILE

J. SCHRÖDER* and D.J. GOOSEN*

ABSTRACT: Schröder J.; Goosen D.J. **A computerised experimental file.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 201-203 (En). Roodeplaat Research Laboratories, P O Box 13873, 0129 Sinoville, Republic of South Africa

A commercially available program which integrates word processing, spreadsheet, data base, and graph facilities, is used on a microcomputer to write a proforma for an experimental file. The proforma file contains empty forms for all envisaged documentation collected during the experiment's duration. This includes an outline protocol, cost estimate, literature search, detailed protocol, data collection forms, project account, and final report. The program allows linking of spreadsheets, thus for instance enabling date and time information entered on the daily log of events to be automatically transfered to the labour cost form. Introduction of this concept has greatly reduced the amount of time spent on research documentation and the risk of data adulteration through repeated transcription. It has also improved control over research expenses and standardization of trial document formats.

Key words: Computerization, experimental file.

## INTRODUCTION

Veterinarians in general, and those in research in particular, are notorious for their lack of enthusiasm in documenting their observations. We contend that in research, as in other fields of endeavour, the job is not complete until the paper work has been done. This is particularly true in the field of contract research, where the sponsor cannot be expected to pay unless he has received a detailed trial report.

Having indentified this need, we proceeded to envisage all the possible documents that could eventually add up to what we call a trial/project/experiment file/folder. We decided that the microcomputer would contribute significantly to our ability to handle this documentation cost-effectively (accurately and rapidly, with the least expenditure of manpower) and in a standardised format.

## MATERIALS AND METHODS

### Software

An integrated program with word-processing, database, spreadsheet, and graph facilities, in which information from text, database, spreadsheet, and graph files can be combined, is required. Examples of such software packages available today are ELECTRIC DESK (Alpha Software Corporation), FRAMEWORK (Ashton-Tate) and OPEN ACCESS (Software Products International).

### Hardware

These programs are mostly written for the IBM PC, and thus require IBM compatibility. According to the publishers' manual, FRAMEWORK, which we use, requires 384kb (1kb = 1 024 bytes) random access memory (RAM) capacity for convenient and full utilization of the program's capabilities. Through the addition of printed circuit memory boards in multiples of 128kb, our machines have been upgraded to 640kb RAM and this enables us to load both the program and files occupying up to 360kb.

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### The file

The list of documents in the file are shown in Table 1. Unnecessary documents can easily be deleted, and others created in response to the requirements of the particular project.

Data with financial implications are collected on spreadsheets, which are linked to other spreadsheets on which the actual monetary values are calculated for accounting purposes. The database mode is used for cumulative information requiring future sorting and searching, such as the project register entry, literature search, and internal orders. These are then integrated with the company databases for projects, literature references, and internal orders.

Table 1: List of contents of the proforma project file

| Document | Program mode* |
|---|---|
| 1. Project registration | (D) |
| 2. Outline protocol | (W) |
| 3. Cost estimate | (S) |
| 4. Quotation | (W) |
| 5. Literature search | (D) |
| 6. Project protocol | (W) |
| 7. Internal order | (D) |
| 8. Data collection, eg. | |
| a. Daily log of events | (S) |
| b. Consumables used | (S) |
| c. Live mass, allocation and treatment list | (W) |
| d. Haematology | (S) |
| 9. Project account, eg. | |
| a. Labour cost | (S) |
| b. Travel cost | (S) |
| c. Consumables | (S) |
| d. Invoice | (W) |
| 10. Reporting, eg. | |
| a. Interim report | (D) |
| b. Project report | (W) |

*D = Database mode
W = Text
S = Spreadsheet


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Table 2: Part of the project register database in tabular form

| Record | Project | Objective | Species | Compound | Sponsor | Start |
|---|---|---|---|---|---|---|
| 1 | 85/001 | Babesia eff | Dog | Trypan | Acme | 85/01/23 |
| 2 | 84/017 | Muscle irrit | Rabbit | Tetracyncline | Biostat | 84/09/01 |
| 3 | 8/024 | Production | Cattle | Vit A | Smith | 85/02/14 |

## Procedure

Each project team leader has a copy of this file on magnetic disk (removeable floppy or fixed hard disk, depending on the machine). When a new project is planned, the file is loaded into the computer's memory (without erasing the original on disk), re-identified with a unique name (this will eventually be the project number), and all known items of information entered in the appropriate spaces. All unnecessary documents and explanatory notes in this copy of the original file are deleted so as to make available more storage space on the disk. The new project file is then stored to disk for subsequent re-use.

Table 3: One record from the project register database in interim report form

| Project | Objective | | |
|---|---|---|---|
| 85/001 | Babesia efficacy of trypan blue in dogs | | |
| Species | Compound | Sponsor | Start |
| Dog | Trypan blue | Acme | 85/01/23 |
| **Work completed**<br>First group of dogs treated, blood smears taken to day +21<br>Dead dogs necropsied<br><br>**Work to be done**<br>Histopathology | | | |
| **Expected**<br>85/11/15 | **Completion** | | **Updated**<br>85/07/31 |
| Man-hours<br>112 | Expenses<br>R6 025 | Income<br>nil | Cost estimate<br>R10 235 |

## DISCUSSION

Each transcription of data, be it from the raw data recording form to a table prior to calculation of group totals and averages, or from the first handwritten draft to the typed version, carries with it the risk of inadvertent alteration (so-called "transcription errors"). The fact that the different facilities in these programs can be combined makes it a powerful tool for generating trial reports with minimal manipulation (through transcription or otherwise) of the raw data.

The database mode is useful for storing accumulations of records, such as a project register, the literature reference collection, and a list of internal orders, because it allows for easy and rapid searching and sorting. The structure of each database is designed to suit the particular need. In our program the display and printout format of the database can be changed from tabular for the entire database to one page for each record. This ability has provided us with an easy method to generate trial progress reports by simply altering the format of the project register entry for a particular trial (Tables 2 & 3).

Elementary statistical values, such as means and standard deviations can be obtained in the spreadsheet mode with very few key strokes. More involved formulas can also be calculated, but occupy more memory space, leaving less space for data storage. Being able to link different spreadsheets, for example allows the date, person and manhours spent for an event entered on the daily log of events, to be transferred to the labour cost form where the time is multiplied with the hourly tariff for that particular person (Tables 4 & 5).

Part of the planning process in our research projects is the decision on the list of information to be collected and the subsequent design of appropriate data recording forms. Our proforma file thus does not include data forms for every eventuality, but continually grows as

Table 4: Example of a Log of daily events (in spreadsheet mode, linked to Labour and Travel cost forms)

Roodeplaat research laboratories
Log of daily events

Location:..... Project No: ...../...../...../.....

| Date | Day | Event | Dist (km) | Person | Time (h) |
|---|---|---|---|---|---|
| 84/11/03 | −3 | Test animals weighed | 120 | ANO | 4,5 |
| 11/06 | 0 | Animals allocated, treated | 120 | ANO | 2 |
| do | | do | 0 | HPL | 2 |
| do | | do | 0 | BJM | 2 |
| 11/07 | 1 | Blood samples drawn | 120 | HPL | 3,25 |
| 11/08 | 2 | do | 120 | HPL | 3,25 |
| 11/09 | 3 | Blood samples, Ophthalmoscp | 120 | ANO | 4 |
| do | | do | 0 | HPL | 4 |
| 11/10 | 4 | Blood samples drawn | 120 | HPL | 3,5 |
| 11/16 | 10 | First replicate necropsied | 120 | ANO | 5,5 |
| do | | do | 0 | HPL | 5,5 |
| do | | do | 0 | BJM | 5,5 |

Table 5: Example of a Labour cost form, with underlined data automatically transferred from the Log of daily events in Table 4, tariff rates for each person enterd manually, and cost calculated automatically

Roodeplaat Research Laboratories
Labour cost form
Project No: .../../.../...

| Date | Person | Time (h) | Tariff | Cost |
|---|---|---|---|---|
| 84/11/03 | ANO | 4,5 | 55 | 247,50 |
| 11/06 | ANO | 2 | 55 | 110,00 |
| do | HPL | 2 | 40 | 80,00 |
| do | BJM | 2 | 40 | 80,00 |
| 11/07 | HPL | 3,25 | 40 | 130,00 |
| 11/08 | HPL | 3,25 | 40 | 130,00 |
| 11/09 | ANO | 4 | 55 | 220,00 |
| do | HPL | 4 | 40 | 160,00 |
| 11/10 | HPL | 3,5 | 40 | 140,00 |
| 11/16 | ANO | 5,5 | 55 | 302,50 |
| do | HPL | 5,5 | 40 | 220,00 |
| do | BJM | 5,5 | 40 | 220,00 |

new needs arise and new forms are designed. Examples of data recording forms are given in Tables 6 & 7.

The program is user-friendly in the sense that different options are easily selected from a menu. Advice relative to any immediate problem is readily available through the "HELP" key. All of which means that very rudimentary computer literacy is required to start using the program.

In the several projects where we have used this file on the microcomputer, we have experienced a notable reduction in the administrative manhours needed to complete the trial documentation. This can mainly be ascribed to the fact that there is now very little duplication of effort in the writing, typing and correction of project reports. There is also a substantial reduction in the amount of transcription of raw data to tables prior to calculation of group means and other values for statistical evaluation. We are confident that reduced transcription provides us with more reliable project reports.

Table 6: Part of a data recording form for ectoparasite counts

Roodeplaat Research Laboratories
Ectoparasite count recording form
Test animal: ..... Project No: .../.../.../...
Locality: ..... Date: .../.../...

| Animal | Parasite species and count | | | | |
|---|---|---|---|---|---|
| | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... |

Table 7: Part of a data recording form for trial animal particulars

Roodeplaat Research Laboratories
Trial animal particulars
Animal species: ..... Project No: .../.../.../...
Breed: ..... Date: .../.../...

| Animal | Sex | Age | Live mass (kg) | Remarks |
|---|---|---|---|---|
| ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... |
| ..... | ..... | ..... | ..... | ..... |

**BOOK REVIEW** **BOEKRESENSIE**

## TEXTBOOK OF SMALL ANIMAL SURGERY

D.H. SLATTER (Ed.)

1st Edn. W.B. Saunders Company, West Washington Square, Philadelphia, PA 19105. Vol. I pp. XXXIV and 1430, Vol. II pp. XXXIV and 1431 – 2718, numerous figures and tables, Price R285 per volume (ISBN 0-7216-8348-7)

This book is comprehensive and comprises two volumes with 99 chapters in Volume I and 98 chapters in Volume II. It was written by 190 authors, all accepted authorities in their respective fields. The book is well illustrated with line drawings, photographs and radiographic reproductions. Throughout the book excellent bibliographies are provided at the end of each chapter, with as many as a hundred or more references listed at the close of some chapters.

The book is divided into two volumes. Volume I is made up by 11 sections and Volume II by nine sections, each section being edited by a section editor. The first three sections comprising 22 chapters deal with basic principles and procedures. A wide field is covered in this introductory part of the book starting with a chapter on the development of veterinary surgery. The second section deals with tissue regeneration and healing, the use of drugs in surgery, haemostasis and blood transfusion, metabolism of the surgical patient, fluid therapy and shock, resuscitation, surgical inplants, surgical immunology and epidemiology, parenteral nutrition and the pre-operative consideration of the surgical patient. The third section describes surgical methods including sterilization, pre-operative and post-operative care, surgical facilities, suture materials, dressings and other materials. A chapter on endoscopy is also included. The remaining part of Volume I is devoted to eight sections. The skin and adnexa, alimentary, respiratory, cardiovascular, haemolymphatic and nervous systems are dealt with as separate systems. Hernias and the body cavities are discussed in separate chapters.

Volume II includes sections on the eye and adnexa, male and female reproductive systems, the ear, oncology and anaesthetic considerations in surgery. An appendix with normal laboratory values concludes this volume. Before the surgical conditions are described the pathophysiology and anatomy are considered to provide the reader with the basic knowledge necessary for further understanding of the study material.

The editor states that, as in other specialities, the volume of new information in surgery is awesome and the authors attempted to distill clinically and scientifically relevant material in one place. The fact that it is such a voluminous work may be the main criticism against this book. It starts with basic knowledge, proceeds to cover the various organ systems and also includes 118 pages on various aspects of anaesthesiology.

The book is a good book and is well written. It should be a valuable asset to the veterinary student and to the veterinary practitioner. It should also prove to be a comprehensive reference to the surgeon in training. In spite of a price which may appear prohibitive, I can recommend it without reservation to those who can afford it and it should be available in libraries as a reference work for students at all levels, academics and practicing veterinarians.

D.G. STEYN

**BOOK REVIEW** **BOEKRESENSIE**

## VETERINARY PROTOZOOLOGY

NORMAN D. LEVINE

1st Edn. The Iowa State University Press, Ames Iowa, 500100. 1985. pp IX and 414, illustrations 72. Price not given. 50 (ISBN 8138-1861-3)

This book is based on the well known publication, "Protozoon Parasites of Domestic Animals and of Man" first published in 1961 and a second edition in 1973. This book is shorter than the other editions but in the words of the author, no essential information has been eliminated.

Following an introduction chapter to the protozoa there are 12 chapters discussing the individual protozoa and finally a useful chapter on the laboratory diagnosis of protozoon infections. Reference lists are included at the end of each chapter.

Each chapter starts with the general characteristic of the parasite under discussion followed by a discussion of the genera and then a more detailed discussion of each species which occurs in domestic animals.

The book gives a good description of the classification, morphology and life cycle of the protozoa. Under the heading 'pathogenesis' a description is given of clinical signs and necrospy finding. Diagnostic methods and specific treatment are included for each parasite.

The epidemiology and description of the disease caused by protozoa which cause disease on the North American continent are well covered e.g. coccidiosis, whereas diseases which are limited to Africa e.g. *Theileria* are less well covered and South African veterinarians would find these sections lacking in depth.

Throughout, the text is concise and clear and well illustrated. Veterinary Protozoology is a useful basic textbook and should be of great value to practitioners, students and researchers in this field.

C.G. STEWART

**SHORT COMMUNICATION** **KORT BERIG**

# OVINE BRUCELLOSIS: REPEATED VACCINATION WITH REV 1 VACCINE AND THE PREVALENCE OF THE DISEASE IN THE WINBURG DISTRICT

J.A. ERASMUS* and E.C. BERGH

ABSTRACT: Erasmus J.A.; Bergh E.C. **Ovine brucellosis: Repeated vaccination with Rev 1 vaccine and the prevalence of the disease in the Winburg district.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 205-208 (En). Veterinary Laboratory, P.O. Box 625, 9500 Kroonstad, Republic of South Africa.

The effect of repeated vaccination of ram lambs with *Brucella melitensis* Rev 1 vaccine was studied in relation to complement fixation titres. The presence of *Brucella* organisms in semen and changes in neutrophil densities of the semen were also studied. A survey of the incidence of ovine brucellosis in the Winburg district on the basis of a clinical examination of rams and the complement fixation test is also reported on.

Repeated vaccination of ram lambs with Rev 1 vaccine resulted in high complement fixation titres for *Brucella abortus* in all cases and slight *Brucella ovis* titres in some cases. Neither *Brucella* organisms, nor increased numbers of neutrophils could be found in semen samples collected from the experimental animals. The incidence of ovine brucellosis in commercial and stud flocks in the Winburg district was in the order of 2%. As a fairly high incidence of brucellosis occurred in 2 stud Döhne merino flocks where ram lambs are vaccinated with Rev 1 at weaning, the administration thereof in this breed should take place at an earlier age. A second dosage at weaning should not have any disadvantageous effects. In order to protect newly vaccinated ram lambs from contracting brucellosis from older, infected cases, the separation of age groups is essential.

The incidence of clinically detectable testicular lesions in rams from the Winburg district was in the order of 2%.

Key words: Rev 1 vaccination, ovine brucellosis

## INTRODUCTION

Different techniques, which include the microscopical and bacteriological examination of semen and the serological examination of blood serum, are available for diagnosing ovine brucellosis. Since normal semen should not contain any leukocytes, the presence of neutrophils in a semen smear can be regarded as indicative of specific genital infection (E.M. van Tonder 1982, presented at post-graduate refresher course; sheep, University of Pretoria). Semen smear examination can, therefore, be considered as one of the most important methods for detecting genital infection. The detection of infection in semen by direct smear examination or by bacteriological methods is limited in rams with intermittent excretion of *Brucella ovis* organisms in their semen[7], and in rams suffering from occlusion of the epididymal duct. The complement fixation test (CF) appears to be one of the most satisfactory techniques for diagnosing *B. ovis* infection in rams with bacteriologically negative semen[7].

False positive CF reactions might be the result of vaccination with *B. ovis* vaccine, contact with the organism which has not resulted in the establishment of the disease, possible contact with other organisms inducing antibodies which cross react with *B. ovis* antigen and other unknown causes[14 15]. False negative reactions, on the other hand, could be expected in some chronically infected rams or during the incubation period of the disease[14 15].

*Brucella melitensis* Rev 1 vaccine is used to control ovine brucellosis in the Republic of South Africa[3]. High CF titres to *Brucella abortus*[13 16] and very low titres not exceeding 1:10 to *B. ovis*[6], are induced by vaccination. The practical value of Rev 1 vaccine as a prophylactic against ovine brucellosis, has been tested in various countries of the world up to 1967[1]. From the literature no indication could, however, be found as to the effect of repeated administration of the vaccine on rams. Two aspects of ovine brucellosis were consequently investigated: Firstly the effect of successive administration of Rev 1 vaccine in young rams on clinical changes of the testes, the excretion of neutrophils and *Brucella* organisms in the semen and CF titres towards *B. abortus* and *B. ovis* and secondly, a survey of its incidence in the Winburg district of the Orange Free State. In this survey palpation of the tesicles and the CF test with *B. abortus* and *B. ovis* antigens on blood samples of selected rams were used for the diagnosis of brucellosis. Where a CF reation for *B. ovis* was obtained, semen was collected from the particular ram to establish the presence of *Brucella* organisms.

## MATERIALS AND METHODS

### Repeated administration of Rev 1 vaccine

Ten Döhne merino ram lambs, aged 12 – 14 months, were examined for the presence of epididymitis on their arrival at the laboratory. Blood samples were collected from the jugular vein into sterile Vacutainer tubes void of any anticoagulant. Semen samples were collected by electro-ejaculation[12]. Serum obtained from the blood samples was tested for the presence of CF antibodies employing *B. abortus* and *B. ovis* antigens in the technique described by Van Tonder[11]. Semen smears prepared from the semen samples were stained with the modified Ziehl-Neelsen technique[10] and examined microscopically for the presence of neutrophils and acid fast organisms. The density of neutrophils on a smear was evaluated according to the scheme described by De Wet & Erasmus[5]. A bacteriological examination was conducted on every semen sample. Semen was plated onto chocolate agar[4] and incubated in the presence of 10 % $CO_2$ for 4 days at 37°C. *Brucella* organisms isolated, were identified, using standard techniques[2].

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After these preliminary examinations the rams were inoculated 5 times at 4 weekly intervals with Rev 1 vaccine. At fortnightly intervals they were examined for the presence of epididymitis, and blood and semen samples were collected for laboratory examination. The last samples were collected 4 weeks after the fifth dosage of Rev 1 vaccine.

### Brucellosis survey

A total of 1070 rams from 22 commercial and stud flocks in the Winburg district were examined for the presence of epididymitis and other testicular abnormalities. Blood samples were also collected for the CF test. Semen samples for microscopic and bacteriological examinations were collected from rams revealing a CF reaction of ≧ 1:10 for *B. ovis*.

## RESULTS AND DISCUSSION

### Repeated administration of Rev 1 vaccine

Results of this trial are summarized in Table 1. Although Rev 1 vaccine was administered 5 times in succession, no signs of clinical epididymitis could be found in any of the rams, nor could any significant increase in the neutrophil density in any of the semen smears be noted. All semen cultures remained negative for *B. melitensis* and *B. ovis*. Significant changes, however, occurred in the CF titres. Titres for *B. abortus* increased

Table 1: Changes observed in rams receiving repeated doses of Rev 1 vaccine

| | 6.3.84 | 20.3.84 | 3.4.84 | 17.4.84 | 1.5.84 | 16.5.84 | 29.5.84 | 12.6.84 | 26.6.84 | 24.7.84 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of rams | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 5 |
| Number with epididymitis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rev 1 administered | + | | + | | + | | + | | + | |
| Density of neutrophils in semen smears* | 1–2 | 1–3 | 1 | 1 | 1 | 1–2 | 1–2 | 1 | 1 | 1 |
| Numbers of cultures positive for: | | | | | | | | | | |
| *B. ovis* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *B. militensis* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C.F. titres – | | | | | | | | | | |
| *B. ovis* | <1:10 (10)** | | <1:10 (10) | | <1:10 (10) | | <1:10 (10) | | <1:10 (10) | 1:10 (2) |
| *B. abortus* | <1:10 (10) | | <1:10 (10) | | ≧1:80 (10) | | ≧1:80 (10) | | ≧1:80 (10) | ≧1:80 (5) |

*Neutrophil densities evaluated according de Wet & Erasmus[5]
**Figure in brackets = number of rams

Table 2: Serological and cultural results of rams included in the survey

| Farm no. | Type of Farming | Number of rams tested | Number of rams with *B. ovis* titre of | | | | | Number of rams with *B. abortus* titre of | | | | | Number of rams with *B. ovis* organisms in semen |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | <1:10 | 1:10 | 1:20 | 1:40 | ≧1:80 | <1:10 | 1:10 | 1:20 | 1:40 | ≧1:80 | |
| 1 | Commercial | 16 | 16 | | | | | 16 | | | | | |
| 2 | | 23 | 21 | 1** | 1 | | | 21 | 1 | 1 | | | 0 |
| 3 | | 37 | 36 | | 1 | | | 34 | 2 | | | | Not done |
| 4 | | 31 | 25 | 2 | 1 | | 3 | 28 | 1 | 1 | 1 | | 2 |
| 5 | | 30 | 29 | 1 | | | | 30 | | | | | 0 |
| 6 | | 19* | 19 | | | | | 14 | 4 | | | 1 | |
| 7 | | 18 | 17 | 1** | | | | 17 | | | | 1 | 0 |
| 8 | | 11 | 11 | | | | | 10 | 1 | | | | |
| 9 | | 17* | 13 | | 3 | 1 | | 17 | | | | | 0 |
| 10 | | 103 | 98 | 3 | 1 | 1 | | 103 | | | | | No done |
| 11 | | 22 | 22 | | | | | 22 | | | | | |
| 12 | | 45 | 40 | 5 | | | | 45 | | | | | 0 |
| 13 | | 57 | 56 | 1 | | | | 56 | 1 | | | | 0 |
| 14 | Stud | 81 | 81 | | | | | 80 | | | 1 | | |
| 15 | | 41 | 41 | | | | | 23 | 4 | 8 | 5 | 1 | |
| 16 | | 54 | 54 | | | | | 49 | 3 | 2 | | | |
| 17 | | 92* | 92 | | | | | 90 | 1 | 1 | | | |
| 18 | | 87 | 87 | | | | | 87 | | | | | |
| 19 | | 31 | 31 | | | | | 31 | | | | | |
| 20 | | 38 | 38 | | | | | 38 | | | | | |
| 21 | | 62* | 60 | | 1 | 1 | | Not done | | | | | 0 |
| 22 | | 155* | 149 | | 3 | 1 | 2 | Not done | | | | | 0 |
| TOTAL | Commercial | 429 | 403 | 14 | 7 | 2 | 3 | 413 | 10 | 1 | 3 | 2 | 2/289 |
| | Stud | 641 | 633 | 0 | 4 | 2 | 2 | 398 | 8 | 11 | 6 | 1 | 0 |
| % | Commercial | | 93,9 | | 6,1 | | | 96,3 | | 3,7 | | | 0,7 |
| | Stud | | 98,7 | | 1,4 | | | 93,8 | | 6,1 | | | 0 |

*Döhne merino sheep; meticulously vaccinated at weaning
**Vaccination reactions

Table 3: Clinically detectable testicular lesions of rams in the Winburg district

| Farm No. | Type of farming | Epididymitis | Atrophy | Subcutaneous abscess | One testicle | Number of rams examined |
|---|---|---|---|---|---|---|
| 1 | Commercial | – | – | – | – | 16 |
| 2 | | – | – | – | – | 23 |
| 3 | | 1 | 2 | – | – | 37 |
| 4 | | – | 1 | – | – | 31 |
| 5 | | – | – | – | – | 30 |
| 6 | | – | – | – | – | 19 |
| 7 | | 1 | – | – | – | 18 |
| 8 | | – | – | – | – | 11 |
| 9 | | – | 1 | – | – | 17 |
| 10 | | 1 | 2 | – | – | 103 |
| 11 | | 1 | – | – | – | 22 |
| 12 | | 1 | 2 | 1 | – | 45 |
| 13 | | – | – | – | – | 57 |
| 14 | Stud | – | 1 | – | – | 81 |
| 15 | | – | – | – | – | 41 |
| 16 | | – | 1 | 1 | – | 54 |
| 17 | | – | – | 1 | – | 92 |
| 18 | | – | 1 | – | – | 87 |
| 19 | | – | – | – | – | 31 |
| 20 | | – | 1 | – | – | 38 |
| 21 | | – | – | – | – | 62 |
| 22 | | 5 | – | – | 1 | 155 |
| Total | Commercial | 5 | 8 | 1 | 0 | 429 |
| | Stud | 5 | 4 | 2 | 1 | 641 |
| % | Commercial | 1,2 | 1,6 | 0,2 | 0 | |
| | Stud | 0,8 | 0,6 | 0,3 | 0,2 | |

from $<$ 1:10 to $\geqq$ 1:80 within 8 weeks of the first dosage of Rev 1 vaccine, remaining at that level throughout the rest of the experimental period. *B. ovis* titres remained at a level of $<$ 1:10 up to the last sampling when 2 rams revealed CF titres of 1:10. The sharp increase in CF titres for *B. abortus* was to be expected[13,16]. Due to the complete absence of neutrophils and *Brucella* organisms in the semen samples, the high CF titres of *B. abortus* and the low titres for *B. ovis*, this overall reaction must be attributed to the effect of Rev 1 vaccine.

## Survey results

A summary of the serological and bacteriological data is given in Table 2. When CF titres for *B. ovis* are considered, a 1:10 reaction should be taken as suspicious and a $\geqq$ 1:20 reaction as positive (T.F.W. Bolton, Veterinary Laboratory P.O. Box 502, 9300 Bloemfontein, Rep of South Africa, personal communication), while *B. abortus* titres should remain $\leqq$ 1:10 (Table 1). Based on this information, the incidence of ovine brucellosis in commercial and stud flocks examined was 2,8% and 1,2%, respectively. The presence of *B. ovis* organisms could be demonstrated in the semen of 2 rams only, while *B. abortus* titres indicate the widespread use of Rev 1 vaccine in both types of flocks in the district (Table 2).

The Döhne merino Breeders Association of South Africa enforces the vaccination of Döhne merino ram lambs with Rev 1 vaccine at weaning. It is noteworthy that high CF titres for *B. ovis* were found in the stud Döhne merino flocks of farms 21 and 22 (Table 2). On both properties regular vaccination with Rev 1 is practised. As immunity resulting from vaccination with Rev 1 is not absolute (B.C. Jansen, Veterinary Research Institute, Onderstepoort, 0110 personal communication), use of the vaccine only would not prevent spreading of ovine brucellosis. In order to protect Döhne merino lambs against invasion of *B. ovis*, Rev 1 vaccine should be applied before weaning. As newly vaccinated ram lambs could still contract brucellosis from older, infected rams, the separation of age groups is an essential step in preventing the spread of the disease.

The occurrence of clinically detectable lesions in the testes of the selected rams, is given in Table 3. Clearly, the incidence of epididymitis in all rams was less than 1%. It is important to note that all infected rams were free from clinically detectable lesions. Other causes for the epididymitis detected, should therefore be sought. With regard to the development of epididymitis and orchitis in rams, Jansen[8,9] noted that this type of lesion developed mostly in the more vigorous and virile young ram lambs showing the most rapid growth rate when kept in an intensive system on a high plane of nutrition. As extensive sheep farming with natural veld and dry land lucerne as source of nourishment is practised in this district, the negligible incidence of clinical epididymitis could thus be expected.

Other testicular lesions such as atrophy, subcutaneous abscessation and cryptorchidism were found in only 1,4% of rams (Table 3).

Where rams were repeatedly injected with Rev 1 vaccine, no apparent infiltration of the testicular tissue by the avirulent strain of *B. melitensis* could be noted. Serologically, a marked increase in *B. abortus* titres in all rams and a slight increase in the *B. ovis* titres in some rams occurred, indicating that repeated administration of Rev 1 vaccine would not result in deleterious effects on the recipients.

The incidence of ovine brucellosis based on CF titres in the Winburg district was in the order of 2%, while less than 1% of the rams examined, suffered from clinically detectable epididymitis. A serious shortcoming of the line of investigation followed, is that some

chronically infected rams may lose their CF titres, and may show no signs of epididymitis[15]. The incidence of brucellosis could thus have been greater than actually diagnosed during this survey.

Due to a high incidence of brucellosis in Döhne merino rams which were vaccinated with Rev 1 vaccine at weaning, an obvious suggestion would be to vaccinate ram lambs of this breed at an earlier age. In order to protect such newly vaccinated ram lambs completely, the separation of age groups must be regarded as being of the utmost importance. A second vaccination with Rev 1 vaccine at weaning could be administered optionally.

Possibly due to extensive sheep farming practices in the area, the incidence of epididymitis could be ignored.

## ACKNOWLEDGEMENTS

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**SHORT COMMUNICATION** **KORT BERIG**

# SEX DETERMINATION OF THE SOUTH AFRICAN OSTRICH (*STRUTHIO CAMELUS*)

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ABSTRACT: Gandini G.C.M.; Keffen R.H. **Sex determination of the South African ostrich (*Struthio camelus*).** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 209-210 (En). National Zoological Gardens of South Africa, P.O. Box 754, 0001 Pretoria, Republic of South Africa.

The sexing of ostrich chicks at various weights and ages by cloacal examination was found to be a reliable method. Two hundred and twenty seven chicks were examined by one of three different techniques. The possible difficulties that might be encountered are described and discussed. Photographs and tables are given as aids in the sex determination of young ostriches.

Key words: Ostrich chicks, sexing, *Struthio camelus*.

## INTRODUCTION

The ostrich (*Struthio camelus*) shows no sexual dimorphism until the age of about two years. At this stage the plumage of the male changes from a grey brown colour to the typical black and white plumage of the adult bird. The female ostrich, on the other hand, remains a drab grey colour throughout her life[4].

The anatomy of the cloaca is different in the two sexes and the male and female anatomic features are visible even in the young chick[1]. The ostrich has three distinct cloacal chambers[1,2]. The coprodaeum, which receives the rectum, is separated from the urodaeum by a copro-urodeal fold. The urodaeum, which contains the opening of the ureters and urogenital ducts, is centrally located in the cloaca and is separated from the proctodaeum by a uroproctodeal fold. The proctodaeum is the terminal chamber of the cloaca. On the ventral wall of the cloaca a penis, in the male, and a clitoris, in the female, are present.

In the ostrich farming areas of South Africa sub-adult birds and young chicks are often sold unsexed because of a lack of knowledge of sexing techniques. A reliable and easy sexing technique would therefore be of benefit in the identification and grouping of birds intended especially for breeding purposes. Furthermore the technique of sexing ostriches at a young age, when the birds are easily handled, is desirable in zoological gardens.

Although sexing young sub-adult ostriches by fibre-optic proctoscopy and digital manipulation of the cloaca has been reported[3], no data or techniques are available for younger chicks.

## MATERIALS AND METHODS

In this study, a total of 227 ostrich chicks of the domesticated South African hybrid were sexed by cloacal examination. Their body mass ranged from 0,8 kg to 54 kg and their age varied from 4 days to 8 months. During the study period, 45 birds that died from various pathological conditions (i.e. proventricular impaction, white muscle disease and metabolic bone disease) were autopsied. At autopsy the previous antemortem sexing results could be confirmed. Cloacal examination techniques and restraint methods are given as follows for each size-class of birds.

### A) Birds from 0,8 kg to 6 kg body mass (n = 62)

For ostriches of up to 6 kg a seated examiner placed the bird's legs between his knees, with the head of the bird facing him. This allowed his hands to be free to perform the cloacal examination. Sixty two chicks were sexed by eversion of the cloaca. With this technique the caudal portion of the ventral wall of the cloaca was everted by manipulating the lower area of the vent and rotating it in a circular motion caudally and ventrally. With the other hand, the dorsal lips of the vent were pulled dorsally and cranially with leverage on the tail.

### B) Birds from 6 kg to 15 kg body mass (n = 47)

Birds of this size were held in a sitting or standing position by one or two assistants. A modification of the previously described techniques was used to obtain cloacal eversion. In this instance the examiner introduced a lubricated finger into the vent. By hooking the area cranial to the penis or clitoris and gently pulling caudally and ventrally it was possible to evert and examine the organ.

### C) Birds from 15 kg to 54 kg body mass (n = 118)

With birds of this size one or more assistants were required to restrain the animal. The examiner introduced a finger into the vent and inspected the ventral wall of the cloaca for the presence of a penis or a clitoris. If confusion arose, the cloaca then was everted using the technique already described for birds of 6 to 15 kg to allow a visual examination.

## RESULTS

Two hundred and twenty seven birds were sexed using the three techniques described. The birds were restrained for 15 to 30 seconds to carry out the sexing procedure. Following eversion of the cloaca, in the male chick the penis was evident as a visible conical organ, grooved on its upper surface and situated along the ventral wall of the cloaca (Fig. 1). Cranially the groove was continuous with the folds of the lips of the orifice between the urodaeum and the coprodaeum. This muscular organ was often turgid, reddish in colour and

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**Fig. 1** Penis of a three week old male ostrich chick. Note the conical shape and the turgid appearance of the organ.

**Fig. 2** Clitoral appendage of a three week old female ostrich chick. Note the smaller size and the laterally compressed shape.

visible blood vessels were sometimes observed. The female chick had a clitoral appendage which is a smaller organ than the penis, laterally compressed and without a prominant dorsal groove (Fig. 2). The clitoris is a non-turgid light pink organ without visible blood vessels.

Manual inspection of the cloaca was found to be an accurate technique, especially in the larger birds. With limited experience, it was possible to feel a penis. The absence of the penis and the presence of a much smaller thickening of the ventral wall of the cloaca indicated a female. The penile and clitoral sizes for birds of various body weight, are presented in Table 1.

Table 1: Size of penis and clitoris of ostrich chicks (cm)*

| Sex | Number in sample | Body mass range (kg) | Clitoris length range (mean) | Penis length range (mean) |
|---|---|---|---|---|
| ♀ | 5 | 1,8 – 3 | 0,2 – 0,4 (0,3) | |
| ♂ | 8 | 1,5 – 3 | | 0,5 – 0,8 (0,66) |
| ♀ | 8 | 18 – 29 | 0,6 – 0,8 (0,66) | |
| ♂ | 11 | 17 – 32 | | 1,3 – 2,4 (1,83) |

*The length of the organs was measured on the lateral surface from the base to the tip.

Forty five birds were also examined at autopsy at which the accuracy of the sexing techniques was verified and found to be accurate in all cases. There was some doubt about the sex of 10 birds weighing 7 to 12 kg. They displayed a structure resembling a penis which, however, was pale, nonturgid and comparably smaller in size. An accurate examination of the presented anatomical features removed the doubt of the sex of all but 3 birds. In two of the birds a partial prolapse of the cloaca was evident one day after sexing. No treatment was attempted and the prolapse were no longer evident 2 days later.

## DISCUSSION

The sexing techniques described for the three size-groups were found to be reliable. The rapidity of the techniques and the elimination of instrumental aids justify their use in the field. If doubt exists about the sex of a bird, it should be compared with a positively identified male and female. Cloacal prolapse has been recorded as a possible risk factor with manual eversion of the penis[3]. Our results, however, indicate that with gentle manipulation and proper care, the cloacal mucosa is not irritated and the number of prolapses negligible.


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# GELOOFWAARDIGHEIDSVEREISTES: SPESIALISVOORLIGTER VERSUS WYKSVOORLIGTER*

J.H. V.D. WESTHUIZEN**

ABSTRACT: V.d. Westhuizen J.H. **Credibility requirements: The specialist extension agent versus the area extension agent.** *Journal of the South African Veterinary Association* (1985) **56** No. 4, 211-214 (En). Department of Agriculture, Moorreesburg, Republic of South Africa.

The credibility requirements of the general area extension agent and the specialist extension agent will be outlined in this paper.

## INLEIDING

In landbouvoorligting is die sentrale objek van bemoeïenis die mens. Waar ons met die mens as komplekse wese te make het, bestaan daar ook 'n verskeidenheid van probleme. Dit kom so duidelik na vore in die internasionale politiek. Die ganse mensdom smag na vrede – wêreldleiers vergader gereeld rondom die konferensietafels en tog is die resultaat steeds toenemende geweld en onrus. Dit alles dui op die ingewikkeldheid en by tye die onverstaanbaarheid van die mens. Die vraag kan met reg gevra word of hierdie eienaardige toedrag van sake nie in 'n mate toe te skryf is aan 'n gebrek aan geloofwaardigheid nie? Mense glo mos nie meer mekaar nie en gevolglik bestaan daar ook nie meer wedersydse vertroue nie.

Aan die ander kant is 'n leier wat oor geloofwaardigheid beskik, in staat om sy volgelinge feitlik tot in die "afgrond" te lei – dink maar aan die Tweede Wêreldoorlog en alles rondom Hitler tot kort voor sy val. Geloofwaardigheid is dus baie belangrik – 'n mens wil amper sê magtig. Trouens as 'n leier oor geloofwaardigheid beskik, sal hy mense aan die beweeg kry. Enige aksie wat daarop gemik is om mense aan die beweeg te kry, het geloofwaardigheid as bousteen nodig. Die beste beplande voorligtingsaksie sal sonder geloofwaardigheid onsuksesvol wees.

Hierdie referaat handel oor die geloofwaardigheidsoorwegings van die spesialisvoorligter versus dié van die wyksvoorligter. Gevolglik sal die volgende uitgangspunte vir die doel van die bespreking geld.

- Die siening en standpunte wat hierna gehuldig word, is gebaseer op die siening en ondervinding binne die Departement van Landbou.
- Die term spesialisvoorligter, word beskou as ekwivalent aan die Departementele siening van die bedryfsvoorligter.
- Die aktiwiteite van die voorligter en spesialisvoorligter moet as 'n span gesien word. Erasmus (1982) stel dit as 'n wanopvatting dat die twee vorms van voorligting as teenoorgesteldes of mededingende komponente gesien word. Daarom is die geloofwaardigheidsvereistes en -oorwegings van die voorligter en spesialisvoorligter so na aan mekaar dat daar in der waarheid slegs aksentverskille is. Dit sal gepoog word om hierdie aksentverskille uit te lig.

## GELOOFWAARDIGHEIDSOORWEGINGS VAN WYKSVOORLIGTER EN SPESIALISVOORLIGTER

Geloofwaardigheid is volgens Rogers en Shoemaker (1971) ". . . the degree to which a communication source or channel is perceived as trustworthy and competent by the receiver".

Die elemente wat geloofwaardigheid van die voorligter volgens Rogers en Shoemaker (1971) beïnvloed, is dus:

- Die bron (voorligter); en
- die kanaal (onder andere die voorligtingsboodskap).

Burger (1971) sê weer dat die eienskappe van 'n goeie voorligter sentreer rondom:

- Kennis;
- samewerking;
- karakter; en
- kommunikasie

Aansluitend by die voorafgaande kan die gemeenskaplike geloofwaardigheidsoorweging by die voorligter en die spesialisvoorligter bespreek word aan die hand van:

- Kennis;
- goeie boodskap;
- korrekte voorligtingskanale;
- goeie kommunikasie; en
- goeie menseverhoudings.

Die aksentverskille sal by elkeen van die elemente uitgelig word.

### 1. Kennis

Die belang van goeie vaktegniese kennis word deur Burger (1971) soos volg beskryf: "If you do not believe a person you certainly will not accept his advice. . . .Having content (knowledge) is probably the single most important attribute of the effective extension agent. Obviously this refers to the messages which the agent conveys to his clientele, in other words, the level of agricultural/technical knowledge at his disposal. . . . No extension agent can therefore hope to be effective, in the sense as defined without having a high level of expertise in the fields of agriculture applied in his area . . . He must remain a student."

Die eerste en belangrikste geloofwaardigheidsoorwe-

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ging by die voorligter en die spesialisvoorligter is dus kennis op vaktegniese gebied. Hierdie kennis verseker geloofwaardigheid en dit gaan bepaal of 'n voorligtingsaksie gaan slaag of nie. Daarvan is in die praktyk afdoende bewys.

Die spesialisvoorligter moet op sy vakgebied, bv. chemiese onkruidbeheer, 'n spesialis wees – nie net 'n spesialis op akademiese terrein nie, maar ook op die toepassingsvlak. Dit beteken derhalwe dat hy in staat moet wees om teorie en praktyk absoluut te versoen. Hy moet dus steeds kontak behou met die praktyk en met sy kollega in die veld (wyksvoorligter).

Die wyksvoorligter moet aan die ander kant weer 'n gebiedspesialis wees. Hy moet 'n kundige wees van sy boerderygebied ten opsigte van:

(i) Die hulpbronne (natuurlike sowel as menslike hulpbronne):
(ii) die vlak van huidige bedryfsvoering en knelpunte wat bestaan; en
(iii) die korrekte boerderybedryfsvoering wat in die geheelprobleem, oftewel heelplaas-verband, geimplementeer behoort te word.

Waar die spesialisvoorligter 'n spesialis is op sy bepaalde vakgebied, moet die voorligter 'n spesialis wees in die korrekte integrering van aangepaste bedryfstakke in 'n geheelprobleem-benadering. Laasgenoemde beteken dus dat die voorligter op 'n kundige wyse in staat moet wees om die natuurlike hulpbronne, na korrekte interpretasie en vertolking, te integreer met basiese korrekte akkerboupraktyke, met basiese korrekte veldbestuurspraktyke, met basies korrekte veebestuurspraktyke, wat uiteindelik sal lei tot 'n basiese korrekte fisiese en ekonomiese plaasplan vir 'n totale plaas van 'n boer. Hierbenewens moet die voorligter 'n spesialis wees op die gebied van die menskundige wetenskappe sodat hy die boer as mens kan oorreed om praktyke soos hierbo genoem, te aanvaar en toe te pas. Hy moet dus 'n kenner van die boer en mens wees.

Rogers en Shoemaker (1971) sê die volgende van die voorligter. "Change agent success is positively related to his empathy with clients". Die outeurs gaan dan verder en sê dat dit die vermoë van die voorligter is om homself in die skoene van die boer te plaas.

As die voorligter op sy gebied (op totale produksievlak) en die spesialisvoorligter op sy gebied (vak-gespesialiseerde vlak) spesialiste is, is reeds baie ten opsigte van geloofwaardigheid bereik. As hierdie twee persone mekaar nog verder in alle opsigte kan aanvul, wat 'n gedugte span kan dit nie wees nie.

Dit spreek nou vanself dat om hierdie beamptes in staat te stel om hul vlak van kennis op die gewenste peil te bring en te hou, sal doelgerigte indiensopleiding volgens behoeftes van die beroepe voorsien moet word. As die boer die voorligter sowel as die spesialisvoorligter as kundiges beskou, sal hy meer vertroue in hulle hê en sal hulle geloofwaardigheid uitgebou word.

## 2. Boodskap

'n Geloofwaardigheidsvereiste by die voorligter is dat hy in staat moet wees om 'n boodskap te formuleer wat vir die boer logies en verstaanbaar is. Hierin moet die spesialisvoorligter hom behulpsaam wees. Dit moet in gedagte gehou word dat 'n boer op 'n plaas met verskillende bedryfstakke kan boer en dat 'n boer as volwassene die problematiek van sy boerdery in totaliteit waarneem. Die boodskap moet dus vir die boer sinvol inpas in sy totale boerderysituasie en in 'n logiese volgorde na hom kom. Sodoende kan aan 'n belangrike geloofwaardigheidsoorweging voldoen word.

Ons het ons as voorligters in die verlede dikwels skuldig gemaak aan 'n los en vas wyse van boodskapoordraging – boodskappe wat na willekeur gekies is. Rogers en Shoemaker (1971) sê in hierdie verband. "The discontinuance of an innovation is one indication that the idea was not integrated into the practice and way of life of the receivers".

Die spesialisvoorligter se groot taak is veral om die voorligter nie net met die aanvanklike formulering van sy voorligtingsboodskap behulpsaam te wees nie, maar om voortdurend die voorligter op hoogte te hou van die jongste ontwikkelings op landboukundige gebied. Hierdie inligting sal die voorligter gebruik om sy voorligtingsboodskap aan te vul en/of aan te pas. Die boodskap aan die voorligter wat van die spesialisvoorligter kom, moet dus ook logies, verstaanbaar bevredig en inpas by die boodskap wat hy aan die boer oordra.

Een van die belangrikste take van die spesialisvoorligter is om hom te vergewis van die voorligter se behoeftes en hy moet poog om daarin te voorsien. Die spesialisvoorligter moet nie van mening wees dat net die voorligter verantwoordelik is vir die oorreding van boere tot gedragsverandering nie – die spesialisvoorligter is medeverantwoordelik, maar net op 'n ander terrein. Hy is medeverantwoordelik vir die formulering van die boodskap en waar nodig, vir die oordra van gedeeltes daarvan aan die boeregemeenskap. 'n Goed geformuleerde voorligtingsboodskap dra by tot groter geloofwaardigheid.

## 3. Voorligtingskanale

Die voorligter moet in staat wees om die mees doeltreffende voorligtingskanaal vir 'n bepaalde boodskap of 'n gedeelte daarvan te kies. Die suksesvolle voorligter is dié een wat verskillende voorligtingskanale en tegnieke kan aanwend met die oog op die grootste impak tydens boodskapoordraging. As die voorligter homself in die boer se situasie kan visualiseer en hom kan voorstel wat dit is wat die grootste indruk op hom as boer maak, sal hy in staat wees om die beste keuse van voorligtingskanale vir boodskapoordraging te maak.

Die kanale wat die spesialisvoorligter moet gebruik in die oordra van sy boodskap aan die voorligter is van dieselfde belang. Dit sal geensins effektief wees om jaarliks die joernale van die Gewasproduksievereniging, Weidingsvereniging, Veekundige vereniging ens. waarin die jongste navorsingsbevindings en tendense saamgevat is, aan die voorligter te stuur nie. Hierdie kanale is hopeloos ondoeltreffend. Ons weet dat hierdie joernale gebêre word met die beste bedoelinge om dit te bestudeer soos die tyd dit toelaat, maar weens omstandighede nooit daarby uitgekom kan word nie.

Die spesialisvoorligter moet op hoogte wees van die voorligter se boodskap en wat dit behels, hy moet homself vergewis van die knelpunte en probleme in die praktyk wat die aanvaarding van verbeterde boerderypraktyke teenwerk en hy moet bewus wees van welke navorsingsbevindinge die voorligter se boodskap kan aanvul of versterk. Dit beteken dat dit onder meer die spesialisvoorligter se taak is om alle toepaslike navorsingsbevindings, insluitende bogenoemde joernale, jaarliks deur te werk en daaruit te haal dit wat hy weet die voorligtingsboodskap in elke voorligtingswyk kan versterk. Die spesialisvoorligter se doeltreffende voorligtingskanaal kan wees om hierdie verbeterings of aan-

passings wat in die voorligtingsboodskap aangebring moet word, met die voorligter persoonlik te bespreek. Navorsingsbevindings en tendense kan ook deur middel van kortkursusse aan voorligters oorgedra word.

Beide voorligter en spesialisvoorligter kan hul geloofwaardigheid verhoog deur aan boere te toon dat hulle die boodskap wat verkondig word, ook in die praktyk kan implementeer. Waar die boodskap by wyse van koöperatiewe demonstrasies verpraktiseer kan word, word geloofwaardigheid verseker omdat dit vir die boer belangrik is om te kan waarneem.

## 4. Kommunikasie

Kommunikasievermoë, is veral by die voorligter een van die belangrikste geloofwaardigheidsoorwegings. By goeie kommunikasievermoë word die geskrewe en gesproke woord ingesluit. 'n Departementele kollega het by geleentheid gesê: "Die geskrewe en gesproke woord het 'n geweldige impak. Die wêreldgeskiedenis toon dat dit meestal woorde en idees was wat situasies geskep en verander het. Dikwels was dit nie die waarheid wat geseëvier het nie, maar dit wat die mense gedink het – of laat glo is".

In 1 Korinthiërs 14 vers 8 en 9 word die belangrikheid van goeie kommunikasie so treffend saamgevat: "En as die beuel 'n onduidelike sein gee, wie sal vir die geveg gereed maak? As julle ongewone tale of klanke gebruik en nie 'n verstaanbare woord praat nie, hoe sal 'n mens weet wat daar gesê word?"

Kommunikasievermoë is vir die voorligter stellig belangriker as vir die spesialisvoorligter. Laasgenoemde sal hoofsaaklik met voorligters kommunikeer en dit beteken dus dat kommunikasie tussen mense met min of meer dieselfde vlak van ontwikkeling plaasvind. Aan die ander kant moet die voorligter in een totale voorligtingstrategie enersyds met 'n bepaalde boodskap/kanaal/tegniek met boere op 'n hoër aanvaardingsvlak kommunikeer en andersyds weer met 'n andersoortige boodskap/kanaal/tegniek met boere op 'n laer aanvaardingsvlak kommunikeer. Die voorligter moet hom dus by omstandighede van sy gehoor kan aanpas.

Dit word bevestig deur die volgende aanhaling uit Rogers en Shoemaker (1971): "Change agent success is positively related to his client orientation rather than change agency orientation."

Voorligting beteken in der waarheid kommunikasie en 'n kommunikator moet oortuig en besield wees. Burger (1971) sê die volgende in verband met hierdie aangeleentheid: "Even with the best technical knowhow in the world at your instant disposal, you are not likely to be believed if you are unable to convey that message with conviction to your farmers . . . 'Credibility-wise, therefore, you will be sunk if, in spite of having content, you are unable to communicate effectively . . . If you do not develop expertise in communication you will not be credible and your effectiveness will suffer as a result." Hoewel mense opgelei en gevorm kan word om oor die eienskappe van goeie kommunikasie te beskik, wonder 'n mens soms saam met Düvel (1978) of dit in die lig van die veelvuldige vereistes vir die suksesvolle beoefening van voorligting enigsins moontlik is om dit aan te leer, en of hierdie beroep nie beperk moet wees tot mense wat 'n natuurlike gawe daartoe het en "gebore voorligters" is nie.

Vanweë die belangrikheid van sekere persoonlikheidskenmerke in die voorligtingsberoep het dit dalk ook tyd geword om veral in die Departement van Landbou mense uit te ruil tussen verskillende beroepsgroepe (byvoorbeeld tussen navorsing en voorligting), ten einde die beste en mees geskikte persoon op die regte plek te kry.

Baie mense, waarvan sommige invloedryk, is van mening dat goeie kommunikasie eintlik beteken om 'n ingewikkelde en hoogdrawende taal te besig. Nee, goeie kommunikasie beteken juis om jou so uit te druk dat wat jy sê of skryf, vir die hoorder of leser te alle tye verstaanbaar is.

## 5. Menseverhoudings

By menseverhoudings word onder andere ingesluit die elemente van samewerking en karakter, soos deur Burger (1971) gestel. Samewerking is, volgens hom, 'n beskrywing van: ". . . a group of qualities which all have to do with the ability and natural desire on the part of the extension agent to co-operate with others in their own pursuits, and to obtain in turn, their enthusiasm and participation in projects which he himself initiates."

Samewerking tussen voorligter en spesialisvoorligter is 'n belangrike geloofwaardigheidsoorweging – sowel uit die oogpunt van hierdie persone onderling as dié van die boeregemeenskap. Die aksies van die spesialisvoorligter vorm 'n integrale deel van die voorligter se kommunikasieprogram en hy moet derhalwe nie net baie nou met die navorsers skakel ter wille van bedryfs- en vakkennis is, maar hy moet ook in die ware sin van die woord by voorligting inskakel. Die spesialisvoorligter dien as 'n belangrike wetenskaplike skakel tussen voorligting en navorsing. Dit wil sê 'n skakel wat enersyds, voorligters behulpsaam is met die formulering en verfyning met verloop van tyd van die tegniese/ekonomiese boodskap en hulpverlening met die uitdra daarvan. En 'n skakel wat, andersyds, navorsers op die hoogte hou van bedryfsknelpunte en navorsers behulpsaam is met die daarstel van navorsingsprioriteite.

'n Baie belangrike geloofwaardigheidsoorweging by die spesialisvoorligter is ook die hele kwessie wat handel oor indiensopleiding. 'n Spesialisvoorligter wat sy sout werd is, sal voortdurend toesien dat die voorligters vir wie hy verantwoordelik is, in diens opgelei word. Hy sal met ander woorde deurentyd toesien dat voorligters ingelig word ten opsigte van die jongste ontwikkelinge of tendense in landbou en landbounavorsing in soverre dit sy vakgebied raak. Hy sal dus nie net die voorligters voorsien van wetenskaplike verslae en/of joernale in hierdie verband nie, maar hy sal dit self "deurwerk" en in 'n reeds "verteerbare" vorm aan die voorligter beskikbaar stel. Goeie samewerking is van die uiterste belang vir 'n doeltreffende voorligtingsdiens.

Volgens Rogers (1962) dra bekendheid, eerbare motiewe, gereelde persoonlike kontak en goeie menseverhoudings grootliks by tot die geloofwaardigheid van voorligters. In hierdie opsig val die aksent dus groter op die menseverhoudings van die wyksvoorligter wat in die boeregemeenskap staan as dié van die spesialisvoorligter.

Vir die skep en behoud van goeie menseverhoudings moet voorligters die volgende karaktertrekke openbaar:

- Die voorligter moet te alle tye nederig wees. Dit beteken egter nie dat hy nie sy saak sterk en met oortuiging moet stel nie. Die mens in die algemeen, en die boeregemeenskap in die besonder, verkies 'n nederige persoon.
- Die voorligter moet hom nie slim hou nie. Die boere moet nooit die indruk kry dat die verskil in kennis opvallend groot is nie.

- Moet nooit vir 'n boer sê hy boer verkeerd nie. Sê liewer hy doen baie goed, maar jy wonder of daar nie terreine is waarop verbeter kan word nie.
- Die indruk moet nooit by boere gelaat word dat die voorligter nie geneë is om van hulp te wees nie. Die boere moet altyd die indruk kry dat die voorligter hulpvaardig is.
- Geloofwaardigheid van die voorligter word verhoog indien die boer homself met die voorligter op kerklike en kulturele gebied kan vereenselwig.
- Die voorligter moet volle begrip vir die boer en sy probleme hê (empatie) en dit ook so laat blyk.
- Die voorligter moet nooit sinies of afbrekend van enige boer praat nie.
- Die voorligter moet steeds die indruk laat van 'n persoon met 'n standvastige karakter. Ons weet hoe diep teleurgesteld mens raak as jou leiers jou in hierdie opsig teleurstel.
- Die voorligter moet nooit tussen boere kant kies nie.

Dit is uit die voorafgaande duidelik dat wat die voorligter en die spesialisvoorligter betref, die geloofwaardigheidsoorwegings feitlik ooreenstem, hoewel daar sekere aksentverskille is. Dit is voorts belangrik om te onthou dat doeltreffende voorligting wedersydse hulp vereis.

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# ZOOTECHNOLOGY OF COMPANION ANIMALS*

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An overview is presented of the developments in the zootechnology of companion animals. This development is constituted by the recognition of the importance of companion animals for modern human society and by the need for expert guidance in the breeding, feeding and caretaking of companion animals. The need for guidance by veterinarians is based on health impairments resulting from intensive breeding practices in dogs.

Key words: Zootechnology, companion animals, dog breeding.

## INTRODUCTION

Domesticated animals have already been kept several thousands of years around the settlement of mankind[19]. Most of these animals were kept for utility purposes such as farm animals for labour and dogs and cats for herding, guarding and combating other animals species.

In the past century the improvement of farm animals has been intensified and efforts have been concentrated mainly on efficient animal production. These developments have on the one hand been due to the capacities and the activities of pioneers in this field who had the competence to face new perspectives and to develop methods for animal production, and on the other, have been encouraged strongly by their economic output.

Improvements in dogs and cats have not followed this direction and have also not been exercised with the same intensity. The use of these species of animals for utility purposes has gradually been reduced in the past century and the naming of "pet animals" has slipped in as an indicator of how people have started to look at dogs and cats. Dogs and cats are partly still being utilized for the pleasure of breeding and showing animals and for specific tasks such as hunting and guarding. The majority of dogs and cats are, however, nowadays kept as animals without specific functions. Norling[13] reported that 85% of the dogs in Sweden are purely kept as pet animals. Under these circumstances it is understandable that the input of science and technology up to date for the improvement in the knowledge on breeding, feeding and behavioural aspects of dogs and cats has been rather limited.

Currently it can be stated, however, that the described points of view are no longer static. Recent developments in several Western European and Northern American countries are demonstrating that there is a remarkable change in the way in which people look at pet animals and in the way in which people are beginning recognising the real value of these animals in our modern human society[1]. These developments became more apparent at the celebration of the 80th birthday of the Nobel prize winner on ethology, Dr. Konrad Lorenz, in Vienna in 1983[5]. At that occasion the Society for Companion Animal Studies organised an international symposium on human-pet relationships. At this conference psychologists, psychiatrists, paediatricians, ethologists, geneticists and veterinarians elucidated the role of pet animals in conditions in which the lack of social comfort for people is not sufficiently covered by human society. Various authors, and notably Scott & Fuller[16], Glasser[3] and Katcher[5], already prior to this symposium had reported on the comforting effect that the presence of dogs and cats had on patients in psychiatric clinics and on people with heart- and/or blood pressure problems. Even more impressive were the reports of Messent and several other reporters at this symposium[15] on the effect of pet animals on desolate and isolated people and on children with a reduced ability to develop their personality in contacts with friends.

The majority of dogs and cats have left the barn and shed and have moved into the house[17]. They have now become part of the households and to a greater or lesser degree, members of the family. Dogs and cats are increasingly being taken up into families which are for various reasons depleted and in which case they serve as companions compensating for the loss.

From the point of view of these developments, and in particular of the recognition of these developments, it has become evident that there is a deficiency in the development of zootechnology of companion animals. In several Western European countries initiatives are nowadays in progress to fill this gap. The Veterinary Faculty in Utrecht, the Netherlands, therefore decided to establish a chair for teaching and research in this field.

In this report we will concentrate on one important aspect of the zootechnology of companion animals namely, the breeding of dogs. Breeding practices have resulted in a variety of impairments of the health of these animals and we intend to outline the areas in which veterinary sciences may participate to improve this situation.

## HISTORY OF DOG BREEDING

The breeding of dogs hitherto has resulted in some 325 internationally recognised breeds of dogs[7]. Diversity in body size, body construction, coat type, coat colour and behavioural traits demonstrate the diversity within the species[8]. On the basis of this diversity it has for a long time been assumed that dogs originated from a variety

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of different species of animals like wolves, jackals, coyotes and even foxes[4]. Further development in the understanding of genetics, physiology and ethology have shown, however, that these assumptions are not acceptable any longer and that dogs have originated from wolves[19]. Dogs should in fact, be considered as domesticated wolves (*Canis lupus domesticus*). This conclusion forces us to explain the variety within the species on another basis.

Thenius[19] and Senglaub[17] recently offered valuable contributions to this explanation. They have demonstrated that natural variation within the species can be explained on the basis of natural selection in the various parts of Eurasia and Nothern America. In the course of time the populations of pole wolves, *Canis lupus arcticus*, with their heavy coat, thick underwool, and heavy and strongly muscled body construction have adapted themselves to the north pole climate and to their large prey animals like reindeers and even bears. The population of desert wolves, *Canis lupus pallipes* and *Canis lupus desertus*, with their relatively light coat and their slender and longlegged body construction have adapted themselves to the Asian desert areas and to their prey animals, antilopes and gazelles. More of these examples could be mentioned. They support the development of variation as a result of natural selection which can thus be considered as the first step in the development of variation in the species of wolves and dogs. On this basis, artificial selection has further enlarged this variation.

The step in artificial selection was taken some 12 000 to 15 000 years ago with the process of domestication of wolves[7]. Relics of the Assyrian and Egyptian culture are demonstrating which types of dogs were held in those periods and for what purposes. More detailed information on the subject has been presented by Fiennes & Fiennes[4] and recently by Perfahl[14]. In those periods dogs were kept mainly for hunting and for assistance in the army. During that time, the still more or less nomadic living people and the wolves had common aims, the hunting of prey animals; in countries like Assyria and Egypt mainly the rather small and speedy herbivores. Following on this association, humans started to make a selection of their co-workers. With the settlement of farmers, special wolve tribes started to associate with human populations. At first, they started living in the neighbourhood and later on within the human settlements. They were allowed to stay there when they could serve specific purposes like guarding, herding and fighting other species of animals. The types of dogs selected in the various countries depended upon the type of wolves present in those areas and also upon the work that they could do. These developments have gradually led to a situation in which practically each country, or at least, each geographic area, had its own type of hunting dog, herding dog and, depending upon the needs, also guarding and fighting dogs. On this basis, the selection of dogs was continued and specific breeding to improve the dogs for their specific work was started.

In the past the emergence of various breeds of dogs was not always restricted to the selection and breeding within specific populations. Ethnic groups of people migrating across the continents moved various populations of dogs along with them[14] thus causing an intermingling of breeds. Individual dogs were taken along for pleasure and also for special breeding purposes. Tschudy[20] and Hanek[8] described how originial dog populations have been influenced by the introduction of genetic material from other sources. Various new dog breeds like Great Danes, Bull terriers and Dobermann Pinschers have been established in the past ages on the basis of cross-breeding between originally quite different populations of dogs.

Throughout this first stage of artificial selection dogs were held and were bred exclusively for utility purposes. Dogs not fulfilling these requirements were disregarded[4]. Dogs with insufficient disease resistance or with disabilities in movement or behaviour in many cases did not even reach the reproductive age. Through the past the selection has been purposive and with little or no consideration for the animals. A large number of quite different populations of dogs thus developed. Towards the turn of the previous century and especially in the more recent decennia the importance of the utility purposes has, as we have already seen, been reduced considerably. Other criteria for selection have gradually been introduced. First of all criteria for good looking animals with so-called sound body constructions, became important. The breeding of dogs with well-defined, and in some cases, highly attractive characteristics reached a high level of development. In several instances the satisfaction of breeding nice-looking animals has now resulted in extreme efforts of breeding to participate in international championships with their dogs. With these developments a second stage in the process of artificial selection has been entered. The entrance into this new stage has also coincided with the introduction of a series of rules for the breeding of dogs within populations.

## BREEDS OF DOGS

The transition of the original populations of dogs to officially recognised dog breeds has been caused mainly by:

- the registration of the origin of the animals, and recording the pedigree of the dogs
- the registration of breed standards in which the main characteristics of the breeds are described and on
- pure breeding within populations, meaning that no genetic material from outside is allowed to be entered in the breeds.

These decisions, as they were taken for the majority of breeds some 100 years ago, have enabled breeders to start pure breeding. Upon that basis the desired characteristics of breeds could be fixed and the undesired characteristics could be eliminated. In many of the breeds these aims have been reached fairly well for a number of the desired characteristics. The predictive value of the young dogs has been raised and because of this the disappointments in breeding have been reduced considerably for most of the breeds. At present 325 breeds of dogs have been established and are officially recognised by the Féderation Cynologique Internationale.

A comparison of these breeds shows an enormous diversity in composition. Some of the breeds for example German Shepherds and Labrador Retrievers are distributed over a large number of countries and consist of over 100,000 living animals. Other breeds count only some 1 000 animals. They may still be distributed over the world, like Rhodesian Ridgeback, Basenji's etc. There is also a relatively large number of so-called national or even regional breeds, composed of some 100 or even less animals, of which the Dutch Kooikerhondje is

a typical example[2]. Some of the breeds, for example the German Shepherd breed, have a very large breeding basis. Others like the Leonberger dog have a small basis for breeding. The breed of the Saarloos Wolfhond has been set up on the basis of the breeding of one German Shepherd bitch with one male wolf. Some generations later one female wolf was added to this breeding stock. Some of the breeds have been kept separated fairly well through the centuries and have been pretty well purebred over many generations. Hounds like Saluki's and Sloughi's are examples of such breeds. Others have been established rather recently. Breeds of Dobermann Pinschers, Bull terriers etc. are 100 – 200 years old by now. These examples demonstrate the diversity in the composition of the breeds. The diversity in genetically determined characteristics is still more striking.

The various steps of natural and artificial selection have resulted in an enormous diversity in body size and body weight, the latter varying from 1 – 3 kg in dwarf-breeds like the Chihuahuas to 80 kg and more in giant breeds like St. Bernards. Variation in bone length and bone structure can be observed when hounds like the Borzoi's are compared with pet animals like the Pekingese.

In the most breeds the length of the bones is proportional for the whole body but it can also be disproportional. Scottish terriers have short legs, Dachshunds have short and bent legs and bulldogs are short-jawed as well. A comparison of the almost naked Chinese crested dog with the heavy coated Chow-chow shows some of the extremes in coat structure. Closer studies of these coat structures reveal that more than 25 different types of coat structures can be distinguished in the various breeds[9]. Comparisons of some details like the size and the position of eyes and ears sufficiently demonstrate that a comparative diversity can be found in several of the details of the animal body.

In the breeding of dogs the selection has not been restricted to the body characteristics. The various tasks in hunting, guarding etc. did require specific abilities for these various types of work. The results of the selection on the behaviour traits are nowadays demonstrating that also in this respect a high level of selection response has been reached. Extremes in this respect can be observed when the outlook of the timid, introvert and somewhat supercilious Saluki is compared with open-minded impulsiveness of the Dobermann Pinscher. Further extremes can be found when the very well-balanced and sophisticated outlooks of the English bulldogs are compared with the keen alertness of the small terrier.

This short review on data on the diversity of dog breeds has demonstrated that dog breeding in the past has resulted in a wonderful benefaction for modern mankind. People all over the world can now make their choice of a companion animal. They can choose on the basis of a large variety of characteristics in body conformation and behaviour and they can be certain that the characteristics of the breed have a high rate of reliability.

The coin of dog breeding has two sides, however, and veterinary science is mostly confronted with the backside of this coin.

## HEALTH IMPAIRMENTS

Some 100 years ago it was decided that dogbreeds should be closed, meaning that no foreign genetic material was allowed to be entered into the breeds. On this basis it was possible to fix and often to improve the desired characteristics of the breeds and at the same time to eliminate the undesired traits.

The elimination of undesired traits in a population of animals, however, cannot be executed without loss. Elimination of traits means elimination of genes. Genes are located on chromosomes in linkage groups. This means that with the process of selection not only the genes in question but also the more or less closely linked genes are removed from the population as well. When selection is carried out successfully it involves a progressive loss of genetic information with each new generation. Loss of genes in populations of animals can be observed first of all in characteristics like vitality and fertility. Breeding experiments with laboratory animals and excessive pure breeding programmes in stocks of poultry and pigs have offered clear examples. Vitality and fertility are influenced by the action of large numbers of different genes, by the mutual interaction of these genes and by the interaction of the genes with the environment[22]. It stands to reason that the vitality of the animals decreases when the number of different genes is reduced. In several breeds of dogs, specially in numerical small breeds and in breeds with a relatively small breeding basis, certain signs of loss of vitality can quite easily be observed. The young animals may show a elegant body conformation but they have the tendency to remain small and tender. The susceptibility for diseases is usually increased and – very markedly for breeding dogs – they die at a younger age. In several breeds, particularly when pure breeding is exercised, the fertility can also be seriously affected. In those breeds or varieties of breeds many of the dogs have more or less lost their interest in mating. The bitches show their heat periods very weakly and in many cases, irregularly. Their litters are usually small and irregular and constituted by some extremely large and some small and weak puppies[2,23].

In the first stage of artificial selection several of the principles of natural selection have been preserved. In particular the principle of the survival of the fittest. This principle is partly lost, however, in the second stage of artificial selection. Weak young puppies, animals not able to serve their utility purposes and also animals with evident health impairments can still look nice, can still be very dear and can still bring an income to the breeder. The pressure of selection against undesired features has been gradually reduced in dog breeding in the past decennia. It must be admitted here that the increase in respect and in appreciation for the animals on the one hand, and the developments in veterinary science on the other hand, have greatly contributed to this reduction in selection pressure.

Partly as a result of the lack of selection pressure, but partly also, however, as a result of the breeding methods as they are exerted, a relatively large number of defect genes is nowadays present in a large number of dog breeds. Metabolic disorders, disturbances in locomotion, drop-outs of functions of the blood and of the nervous system and defects, for example the laryngeal paralysis in the Bouviers as described by Venker-Van Haagen[21] and the cataract in Dobermann Pinschers as reported by Stades[18], have been investigated in great detail. For many of the others it must be stated, however, that a great deal of research on the mode of inheritance and especially also on the detection of carriers

of the defect genes, must still be carried out. Hip dysplasia, the most serious genetically determined disorder in dogs, is probably the best example of our lack in knowledge in this field. Although we have been able to define a variety of factors involved in the disturbance in the development of the hip joint, most of these factors are still to be investigated[3].

Hip dysplasia is probably the best example to show that several of the health impairments are not just accidentally distributed through the breeds of dogs. Aims for breeding and the selection of specific features, can strongly influence the development of disturbances. The disturbance in the development of the hip dysplasia is not the only example, however. Developments of disc disease in teckels, entropion, ectropion and problems with the skin and the ears are in most cases strongly influenced by the standard selection criteria.

The selection of excessive out of proportion features as practised for several breeds, is seriously endangering the health and the welfare of dogs. Extremely large and small body sizes, short legs and jaws, small and deep-set and large and protruding eyes are examples of these traits. The second stage of artificial selection has in these cases led to a situation in which the care for a healthy composition of the animal body is overshadowed by the urge to be recognised as a breeder or as an exposant of dogs.

## VETERINARY ZOOTECHNOLOGY

In the introduction of this overview a considerable backlog in the zootechnology of companion animals has been pointed out. The explanation for this phenomenon can be found in the fact that pet animals have until recently been considered as a matter of minor importance. The expansion of zootechnical knowledge on farm animals was based on economic objectives and has been developed mainly by ministeries for agriculture and by agricultural institutes and schools. Zootechnology of companion animals has so far lacked these sources of support.

In this report we have endeavoured to demonstrate that the appreciation for dogs has been changing rather drastically in the past decennia and that these animals are nowadays often serving as social partners. Schools for Veterinary Science are likely places for developments in zootechnology. Since further developments in breeding, feeding and care may quite easily disturb the balance in the morphology, physiology and the behaviour of the animals, Veterinary Schools most certainly have responsibilities in this field.

In this report we have concentrated on the breeding of dogs and on the negative side effects of this breeding. Comparable developments are taking place, however, in other parts of the field of zootechnology of companion animals. The extensive and well-documented new manual on the nutrition of companion animals by Meyer[12] is a very good example in this respect. Although the studies on the behaviour of companion animals may still be somewhat lagging in comparison to that of breeding and feeding, the recent study by Knol[11] on abnormal behaviour of dogs, has demonstrated that further progress is also being achieved in this field.

The challenge to participate in the developments of the rapidly expanding field of zootechnology of companion animals is not restricted to the Veterinary Institutes and Schools. The disturbances resulting from erroneous breeding and feeding, care and training are first of all observed in the veterinary practice. The practitioner should be able to recognise the clinical signs, to understand their aetiology and to pass these data on to breeders, organisations and research institutes.

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