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BERIA

ADDRESS **VOORLESING**

THIRD FACULTY DAY, FACULTY OF VETERINARY SCIENCE, UNIVERSITY OF PRETORIA: OPENING SPEECH

C.M. VEARY*

I am honoured, Professor Le Roux, to be invited to address this the third Faculty Day and to open the proceedings. Thank you for the invitation. I am invited as immediate past President of the South African Veterinary Association and in which capacity I might feel secure in hiding behind Charles Dickens' words in "Sketches by Boz" — "a smattering of everything and a knowledge of nothing". However, in my particular field of expertise that is not true, and I stand before you mindful of the controversy which surrounds my appointment and humble in the knowledge that I am still a "new boy" in the Faculty and a novice in the field of research. I know little about the ins and outs of research in South Africa as yet, and run the risk of having this speech judged as the poet Philip Larkin judged modern novels: "many have a beginning, a muddle and an end". Complaints about obscurity in literature are not new and you might recall what King James I said of the poet John Donne

> "Dr Donne's verses are like the peace of God;
> they pass all understanding"

I record my grateful thanks to Mrs Van der Westhuizen and her library staff who assisted me so ably and patiently in researching this opening speech, which is really a review article. I recall recently in documents presented to the AGM of the South African Veterinary Association that members were warned against plagiarism. I found interesting the words of the humorist Wilson Mizner

> "When you take stuff from one writer, it's plagiarism;
> but when you take it from many writers, it's research"

Today's theme is research and it appears that the above statement is not true when I look at the wide variety of original topics to be presented at this, the show window of research, by members of this Faculty. I am rather tempted to say that the motto of Faculty Day could be the words of Francis Bacon in "Religious Meditations: "Nam et ipsa scientia potestas est — knowledge itself is power".

As a novice in the field of research I must resort to Albert Einstein's words of wisdom on science

> "Imagination is more important than knowledge"

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I imagined that I would find a wealth of knowledge in the literature about research in South Africa. If the maxim is 'publish or perish' I imagined that I would find a review of veterinary research publications which would indicate on a quantitative basis the trend in veterinary scientific output. I imagined that I would find direct information published on the ways in which faculty activities relate to sources of funds and I imagined that I would have ease of access to information on the source and value of funds made available for research. Soon I stopped imagining and started wondering — wondering where to start.

Then I met the baby and the bathwater, for this is how Mr Don Haxby[2] approached the Norbrook plenary lecture delivered at the Association of Veterinary Teachers and Research Workers' meeting earlier this year. This is how he described research, education and science, which he considered should be of the highest quality to prevent, control and contain disease and in so doing ensure the welfare of animals committed to our care. He poses the question: is research, teaching and science, in which he finds difficulty in drawing a line between, consistently of a high standard? Furthermore, is it a fault of the system that promotional prospects depend on the number of papers published or a higher degree, rather than maybe the quality of the science or the teaching.

Research is the scientific base for modern veterinary medicine[8] and in his interview with Tukkievaria, Prof Smit[11], Vice Rector: Research said that teaching and research supplement one another. If the two are so inextricably interlinked then what is the future of veterinary medicine from the perspective of academic veterinary medicine. This was the theme of a talk presented by George Shelton[10], Dean of the College of Veterinary Medicine, Texas A & M University. As in America, the future of our profession projects an image of supply and demand of veterinary manpower — a sensitive issue here and in the UK and a subject currently enjoying much discussion and debate. Let me highlight some points made by George Shelton[10] and you decide whether or not they sound familiar

* veterinary practice is linked to the general economy and both are experiencing a protracted low
* the family farm is being swallowed up by corporate-type enterprises — a fact confirmed in South Africa by the annual congress of control boards — Agrocon — earlier this year. As the number of farms reduce, the demand for veterinary services declines
* corporate-type farms present new challenges which move the emphasis away from animal disease and

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place it on disease prevention and health management — the herd and flock health management approach. This in turn requires greater knowledge of animal reproduction, genetics and breeding, nutrition, environmental requirements and economics: fields in which the animal scientist, agricultural engineers and economists all seem far better equipped to handle the problem. In the short term the picture looks bleak.

I pause here to dwell on genetics for a moment. I recall how Dr R. Bigalke, Director of the Veterinary Research Institute, Onderstepoort saw expansion and dramatic developments in the field of biotechnology when he talked at that Institute's 75th anniversary. Certainly DNA has been stripped of its privacy by restriction endonucleases with "genesplicing" companies developing exciting new products like interferon. Monoclonal antibodies have aided in immunopurification and given us hope in cancer treatment and DNA sequencing has led to inter alia improved vaccines against foot-and-mouth disease. There are many other advantages and examples, but I found interesting the final words of Sir William Henderson[3] in his Sir William Weipers Commemorative Lecture published in late 1984 — The Scientific and Social Impacts of Recent Advances in Biotechnology. He said "The control of recombinant DNA technology was not left to the scientists and I shall be surprised if the control of human embryo transplantation technology will be left to the medical profession". What exactly he meant I do not know, but E C Melby[5] Vice President, Research and Development, SmithKline Animal Health Products, reports in looking at the changes and challenges facing the veterinary profession in the USA, as follows: The Deans of the Association of American Veterinary Medical Colleges agreed that "veterinary medicine has expanded into a bio-medical science of such breadth that its members are now amongst the best equipped to deal effectively with the complex interrelationships among human beings, animals and the environment".

But I deviate from George Shelton[10] who also touches on the thorny subject of whether or not we are producing too many veterinarians. As in South Africa and the UK, the education of the health professional and in particular the veterinarian is very highly subsidised. How do you decide on a possible oversupply when you take delayed feedback into consideration and do we have legal or moral authority to restrict educational programmes? The Monopolies Board would not be impressed. George Shelton[10] quotes a statement attributed to Dr Richard Fink of California, which I repeat here

"It is probably wrong to artificially restrict the opportunity for a person to seek a career in veterinary medicine. A solution should be sought by

1. designing effective programmes that will increase demand for the services the profession can offer, and
2. study means of better distribution of the supply of veterinarians".

But how does Shelton[10] see it in the long term? Veterinarians continue to provide an essential and important service to the animal industry — food, fibre and companion. We are in a position to assume a greater role in environmental health and as private practitioners and State or semi-State employed, we should participate in the traditional aspects of public health. Lastly, we should make major contributions to laboratory animal medicine, zoo and wildlife medicine, military medicine, biomedical research, industrial veterinary medicine and epidemiological research methods. As Melby[5] says, the challenge before us is to identify our goals and objectives, then proceed to meet them without the encumbrance of tradition. We must re-curriculate to prepare young vets to be flexible, knowledgeable and prepared to handle change. Emphasis should be placed on business management, client education and the professional marketing of veterinary services. J E Goyan[1], Dean of the School of Pharmacy, University of California, attributes the success of California in offering high technology to youth. He says that the youth are less distracted by the past. Like the Californians, perhaps the time has come for us to strike out in new directions.

In South Africa two Commissions, the Holloway (1953) and Van Wyk de Vries (1974) Commissions have stressed that the prime function of the University is to teach fundamental principles. Agreement was reached, however, that Universities could also concern themselves with teaching the practical applications of the principles. Does this mean that we must look at ourselves primarily as a teacher with but a peripheral interest in research? Does this lead to research being considered as a minor responsibility? Perhaps, for when S J Saunders[9], Vice-Chancellor and Principal of the University of Cape Town addressed the Medical Faculty of the University of the Witwatersrand in October 1984, he regarded research as very much the business of a University and suggested that it was a challenge yet facing universities in South Africa. Prof Smit[11] himself said that research efforts must be intensified. He also said that in respect of contract research and the obtaining of funds from the private sector we fare reasonably well. He warned, however, that valuable contract research does not necessarily result in scientific publications. Goyan[1] shares this view, fearing that basic sciences as a whole will suffer when funds are targeted to specific problems and the free flow of information could be restricted by industrial relationships. In't Veld[4] of the Ministry of Education and Sciences, the Netherlands says that there are two principles involved when contract research is considered. Firstly, the advancement of knowledge should not be tampered with by the requirements of contracts and secondly, universities should never loose their independence in programming their own research. He says that universities produce graduates and new knowledge which is spread throughout society — the knowledge transfer. But more than that, these graduates are the only independent system critics in society now.

Dr Robert Heaney, Vice President for Health Sciences at Creighton University in a paper entitled "Paradigm Shifts in Higher Education" (quoted by Goyan)[1] made the important observation that the university is in the knowledge business and not the education business. Students are an important knowledge user group, but other groups include government bodies and industry. He sees members of faculty as the knowledge merchants and the role of administrators that of linking these faculty-knowledge experts with those who want or need their knowledge or problem solving skills. In this knowledge business interactions between universities and industry can take the form of consulting, affiliate programmes, contracts, extra-departmental research and development, exchange of scientists, research agreements and the involvement of venture capital companies. The idea of ex-

change of scientific personnel between industry and universities has been agreed to in the Netherlands with the aim at quality improvement on both sides and the idea is challenging.

I now want to share with you four main changes in the structure for financing universities instituted by the Dutch government, as outlined in a talk "From Flywheel to Dovetail" by In't Veld[4] at the opening of the new Centre for Bio-Pharmaceutical Sciences at Leiden University

1. previously, educational costs were subsidised in terms of cost per student unit per year; now, education is financed for those who have passed the introductory selective year
2. previously, research was financed within a block grant system as a proportion of educational costs quite independent of quality or needs; now, conditional financing of approved research programmes has introduced quality and output of research as decisive parameters in general research funding
3. by shrinking and concentrating, more funds could be revolved as an incentive for research
4. deregulation enabled universities to save external income out of contract education or contract research to spend it on future activities.

I suggest that the previous in The Netherlands is the present here. But let me look at Prof Smit's[11] concern about the decreasing trend in scientific publications. I have already said that I could find no review of veterinary research publications in South Africa. Imagine my delight therefore when the July/August 1986 British Veterinary Journal came to hand with an article "Changes in World Veterinary Output of Publications"[7]. This paper surveys data from the Veterinary Bulletin for the years 1966, 1975 and 1985 and I present the tables from this report as printed.

Table 1: USA and the EEC as % world output

Year	USA	UK	GFR	FR	IT	NL	Total EEC
1966	23,8	13,3	8,5	3,2	2,3	1,7	32,0
1975	24,6	13,7	7,0	3,6	1,8	1,7	31,2
1985	26,9	10,4	6,4	4,5	2,6	2,3	30,4

Table 2: Commonwealth countries as % world output

Year	Australia	Canada	India	(S. Africa)	N.Zealand
1966	4,9	1,9	1,8	1,5	1,1
1975	4,1	3,2	3,0	0,9	1,1
1985	4,7	3,4	3,6	1,5	1,0

Table 3: Various countries as % world output

Year	USSR	E.Block	Japan	S.America	China
1966	7,3	19,8	2,3	1,7	0,6
1975	6,0	16,6	3,5	2,4	0,0
1985	3,6	12,1	4,6	2,0	0,6

Table 4a: Publications in subjects as % world output

Year	Bacterio-logy	Virology	Immuno-logy	Patho-logy	Pharmaco-logy
1966	20,3	17,7	2,4	6,4	3,3
1975	16,8	15,0	2,5	8,6	6,1
1985	23,3	15,3	3,2	9,0	6,0

Table 4b: Publications in subjects as % world output

Year	Helminths	Protozoa	Nutri-tional and metabolic disorders	Repro-duction	Physio-logy	Toxi-cology
1966	7,0	6,1	6,1	5,7	8,5	4,5
1975	6,9	5,3	3,9	2,4	8,0	4,9
1985	4,7	4,4	3,1	2,4	5,2	3,9

Tables 1-4 are reproduced from Payne and Payne (Changes in world veterinary output of publications. British Veterinary Journal. Volume 162, pp 301-306, 1986).

In my inexperience I can only conclude with my impressions. These on research, I fear, must be likened unto Samuel Johnson's impressions of the wisdom of Scots

> "Their learning is like bread in a beseiged town;
> every man gets a little, but no man gets a full meal"

Funds appear to be available, so what is it that prevents a full meal on research? Could it be the present student — lecturer ratio? Could it be an overburden of administration? Is it over-regulation? Is it lethargy? Is it outside interest or involvement? I am hardly qualified to answer these questions and will therefore conclude by congratulating those who will contribute to this, the Third Faculty Day research report back and declare the proceedings open.

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ADDRESS **VOORDRAG**

FACULTY OF VETERINARY SCIENCE, MEDICAL UNIVERSITY OF SOUTHERN AFRICA: THE FIRST FIVE YEARS

N.C. OWEN*

The Medical University of Southern Africa (MEDUNSA) has its origin in the recognition of the need to qualify black health professionals: medical, dental and veterinary.

Various departmental committees constituted by government during the sixties and early seventies investigated the need to qualify black health science professionals and made recommendations within the prevailing political constraints. Available evidence suggests that the siting of the medical school was heavily influenced by the fact that a large service hospital was being built to serve the Garankuwa district some 30 kilometers North-West of Pretoria[1]. The veterinary requirements were the subject of a similar investigation which culminated in the so-called Jansen Report in April 1973, wherein for the first time, the establishment of a health science university to train all categories of medical, dental and veterinary personnel was documented[2].

The incorporation of a Faculty of Veterinary Science into a health science university offers both advantages and disadvantages for veterinary education. Undifferentiated teaching in certain first and second year subjects is more cost effective, but delays the onset of veterinary specific courses and thus tends to extend the overall curriculum.

The department of physiology and the sub-department of pharmacology are integrated with their respective counterparts from the faculties of medicine and dentistry. The appointment of senior veterinary staff to head the veterinary divisions of these interfaculty departments, ensures our educational interests. In addition, interfaculty departments militate against academically sterile units often found in small faculties. The sharing of resources and manpower provide for scientifically stimulating environments which foster optimal teaching and research output.

Besides these formal co-operative structures, the faculty has access to the extensive and sophisticated diagnostic and research laboratories of especially the Faculty of Medicine. This has already resulted in several interfaculty publications which would otherwise not have been possible. Moreover, the cross-pollination of ideas and technology between faculties stimulates the "one-medicine" concept and the assistance of human specialist ophthalmologists, anaesthetists, maxillo-facial surgeons, radiologists and others, has resulted in the adoption of new ideas and approaches within the faculty. An example of this co-operation has been the use of experimental laser technology in animal surgery.

The active role of faculty staff in research is evidenced by our contribution to the scientific programme of this congress and by the fact that some 18 scientific articles were published by staff during 1985.

A further advantage of our close association with medical education is our inevitable involvement in laboratory animal science which provides the models for medical research. The introduction of a specialist degree in laboratory animal medicine by the faculty can be linked directly to this interdependence.

The generally superior service conditions enjoyed by medical and dental health professionals, have also enabled the faculty to negotiate improved service conditions for teaching staff, technologists and nurses. We believe that this advance should be exploited by others to achieve improved employment conditions for academic and supportive staff elsewhere.

A disadvantage of siting a veterinary faculty at a health science university, would be the lack of an animal production infrastructure, classically provided by a faculty of agriculture. This has now been circumvented by the recent commissioning of a modern, comprehensive farm animal unit comprising production and research facilities for poultry, pigs, horses, sheep and cattle. This facility, built at a cost of approximately three million rand, provides for practical training and research into animal management, housing, breeding, nutrition, parasitology, obstetrics, gynaecology, embryo transfer, artificial insemination, disease prevention and other disciplines; to name but a few. In addition, the unit is eminently geared for the faculty to expand its involvement in non-formal adult education of black farmers and supportive personnel. To this end, a trust fund has been established and several successful short courses have already been presented.

Besides the interfaculty departments, the faculty has separate departments of anatomy, animal health and production, infectious diseases and public health, pathology, medicine, surgery, theriogenology and applied practice; the latter an innovation in veterinary education in this country. The faculty has pioneered the introduction of veterinary epidemiology into undergraduate teaching, as well as the offering of a PhD-degree programme at the postgraduate level.

All senior staff hold advanced academic qualifications and to date no undue recruitment difficulties have been experienced. The total academic staff complement is at present 38 members: 14 professors; 21 senior lecturers, and three clinical assistants. Student enrolment,

* Address presented to the Biennial National Congress, Johannesburg, 13-16 August 1986 by the Dean of the faculty, P O Medunsa 0204, Republic of South Africa

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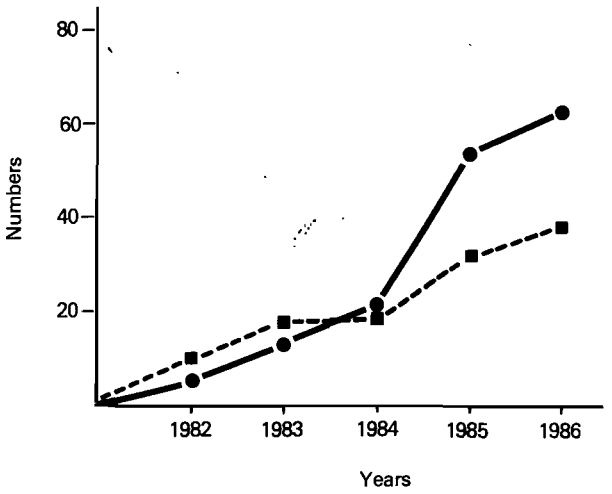


Fig. 1: Total student enrolment (● — ●) and teaching staff appointments (■– – –■)

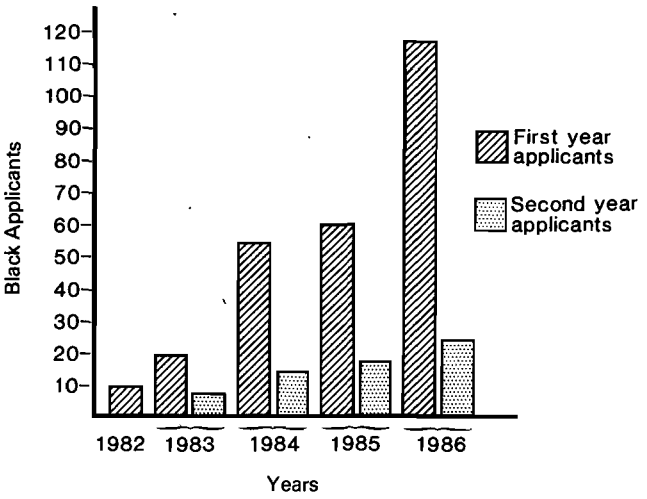
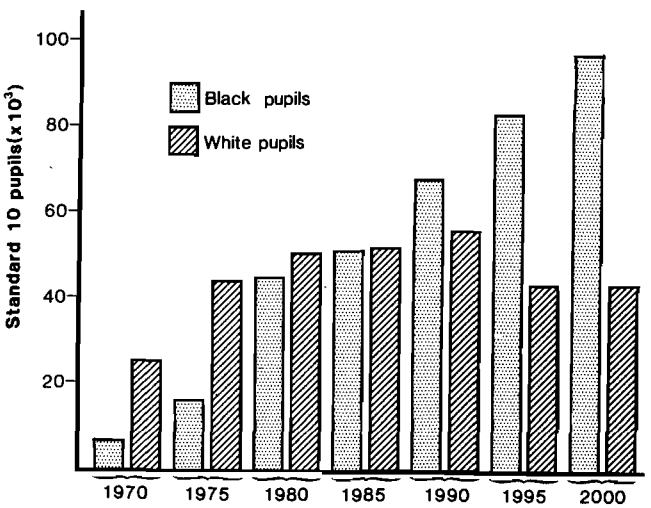


Fig. 3: Applications for admission to first and second study years



(Source: National Manpower Commission: 1985)

Fig. 2: Numbers of standard 10 pupils to year 2000

currently 63, has increased steadily since 1982 when the first five black veterinary students were admitted.

Given the unique circumstances, the growth has been satisfactory and is expected to increase as the numbers of black matriculants increase annually.

The faculty is considering the introduction of BSc and MSc degrees in such subjects as veterinary anatomy, physiology, microbiology, parasitology etc., in order to provide for adequately trained research manpower to underpin veterinary research. Likewise, the provision of training for black persons as veterinary nurses is receiving attention.

Several extraordinary limiting factors had to be addressed in the development of a faculty which was to provide veterinary education for an underdeveloped community. First, the largely negative image of the profession, no doubt due to the almost exclusive contact with regulatory veterinary activities in the past, had to be overcome. This required special endeavours on our part, to present the true scope of the profession to black society. The rapid growth in the numbers of applicants for admission to the faculty since 1982 may, at least in part, be ascribed to these endeavours.

Secondly, notwithstanding the vast numbers of black children at school, currently about six million if the TBVC* countries are included, the quality of primary and secondary education is such that only approximately 10 percent of those who sit the school leaving examination, satisfy university entrance requirements. In addition, the poor educational preparation of those who do qualify, virtually excludes them from admission to the health science professions, where admission is based solely upon an open academic selection process. This contention is amply illustrated by the dismal failure of universities to produce black health professionals with such admission policies; even before restrictions were imposed by government. The point is further illustrated by the fact that the University's medical faculty has, since starting to qualify black doctors in 1982, already qualified 20 percent of all black doctors produced in the history of this country.

The admissions policy at Medunsa, where preference is given to deserving black candidates, is fully justified and will remain so until the educational disadvantages affecting blacks have been overcome. The academic quality of students admitted to the veterinary faculty has improved steadily and is at present an average matriculation pass mark of 56 percent in physical science and mathematics on the higher grade. Whilst this is meaningfully lower than that of corresponding white students, the subsequent performance of the Medunsa students — medical, dental or veterinary — is on a par with that of their counterparts at other universities. We look forward to the time when all education is of equal quality for all people of this country, and candidates may compete for open selection on the basis of equal educational opportunity.

Thirdly, whilst the need for veterinary services by the black community is patently obvious, the demand that could be expected from this low income community had to be gauged and developed. To this end the original "Club House" building of the golf course, which is now the university campus, was converted into a temporary

* Republics of Transkei, Bophuthatswana, Venda and Ciskei.

animal hospital and opened to the public in April 1983. This small, but well equipped and staffed facility, limits the intake of undergraduate students for the present, to approximately 10 in the clinical years. The response from the community and the growth in demand for services has exceeded all expectations and is reflected by the numbers of patients treated, which now total approximately 1000 per month. We are satisfied that we have sufficient clinical material to train our current limited number of students and that the supply can be increased to meet the demands of future expansion.

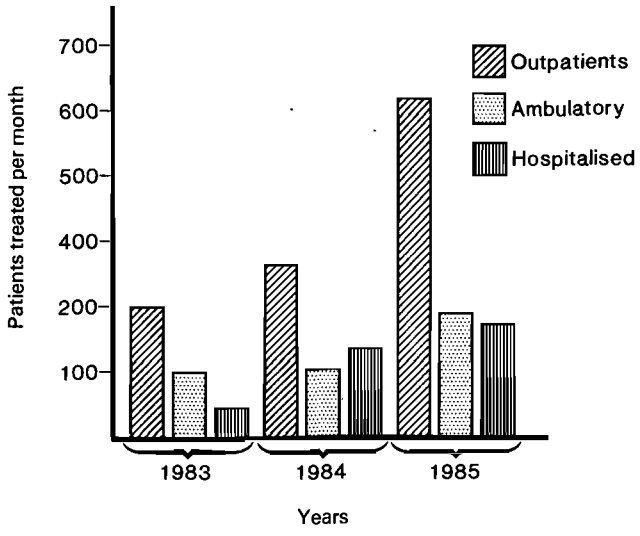


Fig. 4: Numbers of patients treated per month 1983 - 1985

The faculty operates an outpatient clinic, hospitalisation of patients and an ambulatory service at subsidised cost to indigent members of the community. In addition, 918 patients were treated at an outlying clinic at Maboloka in the Republic of Bophuthatswana during 1985. An ongoing herd health programme on farms ensures adequate access to farm livestock.

Table 1: Expansion of Diagnostic Services (Excluding Chemical Pathology)

	1984	1985
Autopsy	406	448
Histopathology	2 980	7 700
Microbiology	44	549
Parasitology	–	330
Haematology	744	7 387
TOTALS	4 174	16 414

The services provided by our diagnostic laboratories are expanding rapidly and in addition, a comprehensive service is provided by the Department of Chemical Pathology of the Faculty of Medicine.

In summary, the faculty has made significant progress in terms of facilities, staffing, student enrolment and in securing clinical material from its target community.

Finally, I am of the opinion that the Medical University of Southern Africa is succeeding in its attempts to address the changing demands for the services of health professionals brought about by the rapid urbanisation of black persons. These changes together with the urgent need to create stable job opportunities in the rural section, convinces me that the Faculty of Veterinary Science at Medunsa has a vital role to play in the future of the veterinary profession. I can come to no other conclusion, but that the future expansion of the veterinary profession lies both in the rural and urban development of the black community and it is herein that we perceive our relevence and our future contribution.

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NATIONAL DISASTERS AND THE VETERINARIAN

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ABSTRACT: Pefans S.M.; Du Preez J.H. **National disasters and the veterinarian.** *Journal of the South African Veterinary Association* (1987) 58 No. 2, 63-69 (En). Department of Veterinary Public Health, Faculty of Veterinary Science, University of Pretoria, P/Bag X04, 0110 Onderstepoort, Republic of South Africa.

A general introduction detailing background information concerning the term "disaster" is presented. A discussion of pertinent legal guidelines and an overview of the possible role of the veterinarian, firstly as a paramedical assistant and secondly as a veterinary public health official, is presented.

Key words: Disaster, legal guidelines, paramedical assistant, veterinarian.

INTRODUCTION

Disaster relief planning has become a topic of major interest in the world. The earth is buffeted both by natural disasters such as tornadoes and earthquakes and man-made disasters. The advent of nuclear power has brought to the fore an alarming picture of the potential for the ultimate disaster[10 12]. In South Africa, as the prospects of civil war, politically inspired violence and natural disasters loom ahead, there is a great need for purposeful planning in the field of disaster relief[10]. It is in this climate that various professions have been motivated to investigate their specific role in the advent of a disaster[10]. We, as veterinarians, although not recognised as qualified to practice medicine on the human patient[3], are well qualified to practice medicine on animals[2]. Veterinary public health is one of the major subjects lectured in the final year of the undergraduate veterinary course. Further training in public health is available in the form of a diploma in community health from the Faculty of Medicine of the University of Pretoria[8]. The veterinarian's knowledge of public health coupled with his understanding of medicine enables the veterinarian to act as a suitably equipped paramedical assistant to his medical colleagues[13].

GENERAL DISASTER INFORMATION

The definition of a disaster

Garb & Eng[6] define this term as: "A disaster is great and sudden misfortune resulting in loss of life, serious injury and property loss.. To be more specific, we will use the term to refer to a sudden occurrence which results in death or serious injury to 25 or more persons". Three important results implied by the above definition are: loss of life, serious injury and property loss. A broader definition of "disaster" is that of Chaimowitz[10] who defines a disaster as "...an act of nature or man, of sufficient magnitude and severity to create in the community a situation where the normal patterns of life are suddenly disrupted posing serious and immediate threats to public health". Gillet[7] defines a disaster as "...a harmful event caused by nature or by man which is of sudden or gradual origin and results in material damage and considerable health problems, thus creating an emergency situation with which the stricken community cannot cope". This last definition is the best definition in our opinion in that it covers both disasters of sudden origin (e.g. tornadoes) and disasters of gradual origin (e.g. drought).

The classification of disasters

Disasters may be grouped into two basic types[3 5 10]: natural disasters, e.g. floods, earthquakes and droughts; and man-made disasters, e.g. physical, chemical and biological. Within this basic framework, a further subclassification can be made according to four criteria: size, location, ease of evacuation from the site and cause of the disaster[6].

Classification of disasters according to size refers to the number of victims involved in the disaster[6]. Tables 1 & 2 were compiled during retrospective epidemiological studies, utilising available data from hospitals near to which recent disasters had taken place[7].

The indices of seriousness contained in Table 2 make it possible to estimate the scale of relief to be planned (read the three figure numbers as follows: The first figure corresponds to the index of seriousness of the injured, the second to the homeless, the third to the dead). (Compiled from Gillet[7].)

The data reflected in Table 2 show that the major factor affecting the scale of relief, is the number of people injured and homeless.

Further information gained in these studies included the following points: 1. Hospitilisation graphs show that admissions for traumatism are at their highest for three days following the actual disaster. Thereafter trauma admissions fall off rapidly to return to practically normal within a week. 2. The trauma cases following an earthquake can be subdivided into: large tissue wounds (30-45%), cranial traumatism (15-37%), fractures of long bones (17-22%), rachidian traumatisms (3-5%), thoracic traumatisms (+ 4%), pelvic traumatism (2-4%), and abdominal traumatism (1%). 3. There was no marked increase in hospital admissions for infectious diseases following an earthquake[4 8 14]. The above analyses supply sufficiently detailed information for purposes of planning the organisation of staff in the likelihood of an earthquake. Similar studies could be us-

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Table 1: Indicates the indices of seriousness according to the number of injured, homeless and dead

Indices of seriousness	Number of victims		
	Injured	Homeless	Dead
0	< 50	< 500	< 10
1	50 < 200	500 < 2 000	10 < 100
2	200 < 1 000	2 000 < 5 000	100 < 300
3	1 000 < 5 000	5 000 < 10 000	300 < 2 000
4	5 000 < 15 000	10 000 < 100 000	2 000 < 10 000
5	< 15 000	< 100 000	< 10 000

Compiled from Gillet[7]

Table 2: Scale of relief to be planned

Degree of seriousness	I	II	III	IV	V	VI
Number of victims	000 ↓ 025	030 ↓ 125	130 ↓ 225	230 ↓ 325	330 ↓ 425	430 ↓ 555
Scale of relief to be planned	Minimal	Moderate	Average	Large	Very large	Extremely large

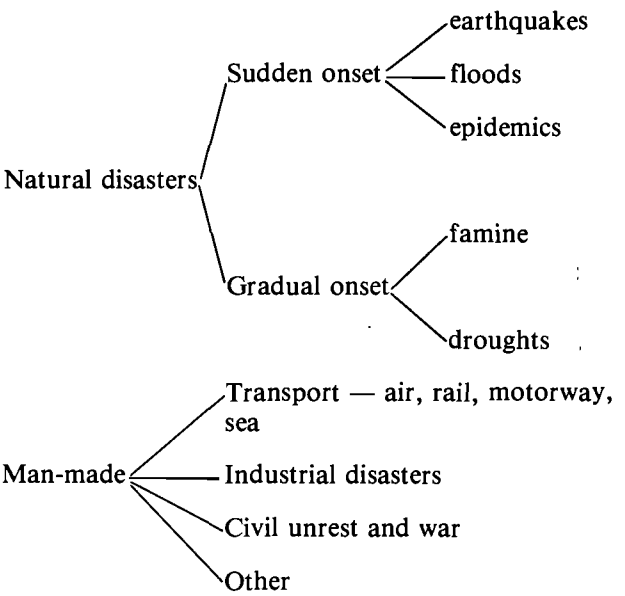
ed for all the other types of disasters. Casualties resulting from disasters can be divided into: deaths, casualties requiring "in-patient" hospital treatment and casualties not requiring "in-patient" treatment, i.e. minor injuries and uninjured persons affected by loss of property and a lack of food supplies[6 10 12]. These authors[6 10 12] suggest that minor disaster relief should be co-ordinated from the local or nearest hospital, a moderate disaster should be co-ordinated by the regional headquarters of emergency services; and a major disaster by the national disaster headquarters[6 10].

Minor and moderate disasters usually occur in limited areas that can be well delineated. This leads to a classification of disasters according to area and location. Smaller disasters can thus be subdivided into rural and urban disaster areas (usually falling within a radius of 12 km). Major disasters usually involve larger areas which may not be well defined[6 9 10].

Classification according to ease of evacuation

In minor and moderate disasters, where immediate evacuation is usually possible, the disaster can be classified according to the ease of evacuation. In a major disaster, immediate evacuation is seldom possible and evacuation usually takes place over a period of weeks. Two factors to be considered concerning the speed of an evacuation are that a rapid evacuation often results in an overloaded situation at the local hospital, while a slower evacuation would give the hospital more time to prepare for a more organised response. On the other, hand statistics have shown that victims, evacuated within the first two days following a disaster have a better chance of survival than those evacuated and rescued later[7].

This form of classification is essential for the preparation of relief action, since disasters of the same aetiology tend to require particular rescue and medical equipment while specific types of injuries are seen which are relatively common to specific types of disasters.



The above four classifications of disasters are interrelated. However, classifying a disaster according to size gives an immediate indication of the scale of rescue operations needed. Classification according to aetiology gives an immediate indication of the type of injuries that will occur, an indication of the rescue equipment required and an indication of the medical supplies that need to be available. In the light of this, it would pro-

bably be best to restrict classification to size and aetiology, e.g. a moderate man-made transport disaster.

The principles of planning for the advent of a disaster

Garb & Eng[6] refer to eight fundamental principles involved in planning for the advent of a disaster. These principals can be grouped into primary prevention which involves preventing the occurrence of the disaster wherever possible. (This includes the use of early warning systems.) Secondary prevention comprises minimising the number of casualties if the disaster cannot be prevented, preventing further casualties after the impact of the disaster, rescuing the victims, providing first aid to the injured, evacuating the injured to medical installations and providing definitive medical care. The last group, tertiary prevention, involves promoting the rehabilitation of the lives of the victims.

The chronology and geography of disasters

Disasters, although they may be of gradual or sudden onset, can usually be divided into chronological phases. These are the periods of threat, warning, impact, inventory, rescue, remedy and recovery. The time span of each chronological phase will vary in length according to the type of disaster and to the population numbers that are involved. A good example of chronological phases is the bombing of the Japanese city of Hiroshima during the Second World War. The predicted recovery phase (the period before people could move back into the area) was forty years. The community of Hiroshima has already recovered and at present the city of Hiroshima supports a population five times greater than that before the bomb blast[9 11 12].

In any disaster there are three concentric geographical zones[6]. In the centre is the impact area which is where the disaster actually occurs. Immediately adjacent to this is the filter area surrounded by the community aid area.

The residents of the filter area may see, feel or hear the actual disaster and they are usually the first people to arrive at the scene of the disaster. The community aid area is the outer zone of people who become aware of the disaster, via radio and news broadcasts, at a later stage. It is the community aid area that will provide the bulk of the aid to the impact area[6].

The epidemiological and public health aspects of a disaster[7 10]

Disaster epidemiologists perform two functions in the event of a disaster, viz: they make an input to the analysis of the disaster for co-ordinating relief strategy and conduct post disaster epidemiological studies for disaster-relief planning purposes.

The epidemiology of a disease process is determined by agent, host and environmental factors. The application of these factors to the epidemiology of a disaster is as follows[10]: The agent factors produce the actual injury, e.g. earthquake; the host factors in a disaster are the humans and animals, e.g. number of victims, population density; the environmental factors are the physical, chemical, biological and social climates in which the disaster occurs.

The epidemiological approach to a disaster is the same as the epidemiological approach to any disease epidemic and involves three steps. Firstly, verify that a disaster has occurred; secondly, determine whether large numbers of people are injured or dead; and finally, establish when and where the disaster occurred and the numbers of people that are dead, missing or injured. This step also involves determining what the immediate needs of the survivors are.

Agent factors[7 10]

There are primary, secondary and tertiary agent factors. The primary factor in an earthquake is the actual earthquake itself. Secondary agent factors in the period following the disaster are, among others, communicable diseases, malnutrition and exposure to the elements. However, most of the secondary and tertiary factors are better classed under host and environmental factors.

Host factors[7 10]

The host factor refers to the group of people who are the actual victims of the disaster. This group may include people who will require special care such as infants needing milk, pregnant women requiring provisions for childbirth, and chronically ill and debilitated people needing specialised medical aid and provisions. There will also be people with injuries of varying severity.

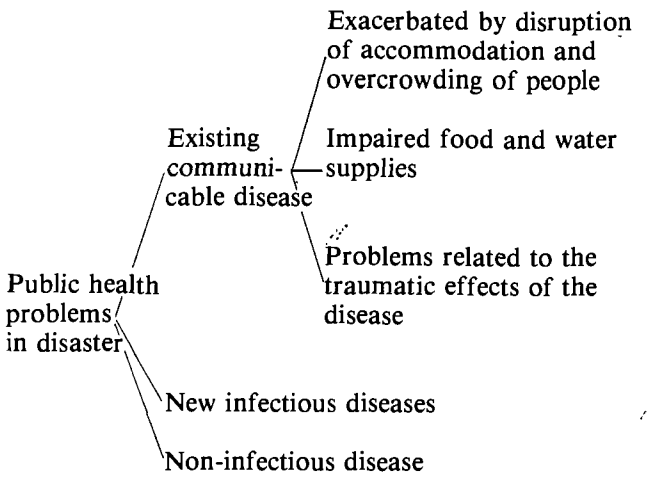
Environmental factors[7 10]

These factors will, for example in a war situation, include population density and the presence of high-rise buildings and factories with toxic chemicals. Weather is another major environmental factor, especially in cold regions and during winter months. The biological environment is the one situation where veterinarians and health officials can play an important role. This could involve the clearing of dead and decaying corpses (human and animal) and the provision of clean water supplies for the survivors[9]. Rodent control is very important since these scavengers invade a disaster area very quickly. Endemic diseases in the area need to be taken into account, e.g. in the Cape Province meningococcal meningitis, tuberculosis and plague are endemic diseases[9]. Epidemiological post-disaster studies of hospital records probably serve as a more important function for epidemiologists since these studies are an indispensable prerequisite for the planning and organisation of disaster relief. By identifying risk factors, epidemiological studies make it possible to mitigate their effects. The aforementioned Tables 1 & 2 are based on epidemiological studies of hospital admissions following earthquakes[7].

Public health problems in post-disaster situations

The public health objective is primarily to maintain the existing normal environment and to return to normal, in the shortest possible time, any abnormal situation in the environment (personal and non-personal) which may be deleterious to health[10].

The flow diagram in the following flow diagram illustrates how public health problems in a disaster situation may be subdivided.



By utilising data from the Department of Health & Welfare disease notifications, one could apply the classification outlined above, to a conjectured disaster in the city of Cape Town[10]. Existing communicable diseases which could be exacerbated by the disruption of accommodation and the consequent overcrowding of people are meningococcal meningitis, tuberculosis, measles, rheumatic fever, diphtheria, influenza, thrush and whooping cough. Existing communicable diseases exacerbated by impaired food and water supplies could lead to outbreaks of typhoid, cholera, infectious hepatitis and gastroenteritis. Existing communicable disease problems related to the traumatic effects of the disaster would include tetanus and tetanus serum hepatitis. New infectious diseases that could occur are cholera, typhus and plague.

Non-infectious disease problems which could arise are psychiatric depression, malnutrition and air pollution problems such as explosions and fires.

The most probable conditions that would occur in Cape Town in the event of a disaster would be gastroenteritis, food poisoning, typhoid and meningitis[10].

Regional disaster planning committees need to approach the public health problems related to their specific areas in a similar manner to that already stated for Cape Town.

Most major disasters result in chaos, casualties and deprivation. Rarely do they result in major infectious disease outbreaks[6 14]. Experience and published data show that post-disaster disease is usually more of a potential than a real threat to communities[6 7 10]. Nevertheless, it is necessary to be aware of these potential infectious disease problems. Another aspect which becomes very important to the public health official is the problem associated with the massing together of people in refugee camps[10]. These people, massed together, may combine all strata of social class. Grouping these people together could result in the rapid spread of infectious diseases. Tuberculosis and meningococcal meningitis are diseases more commonly encountered amongst the poorer social classes (Department of Health and Welfare, Civitas Building, Struben Street, Pretoria — personal communication). Planning for refugee camps entails paying careful attention to factors such as potable water supplies, food hygiene, education, personal hygiene supplies (soap etc.) and very thorough medical examinations of each person entering the camp. Medical staff constantly need to be on the alert for any new medical conditions which may occur[10].

Nuclear disaster and radioactive fallout

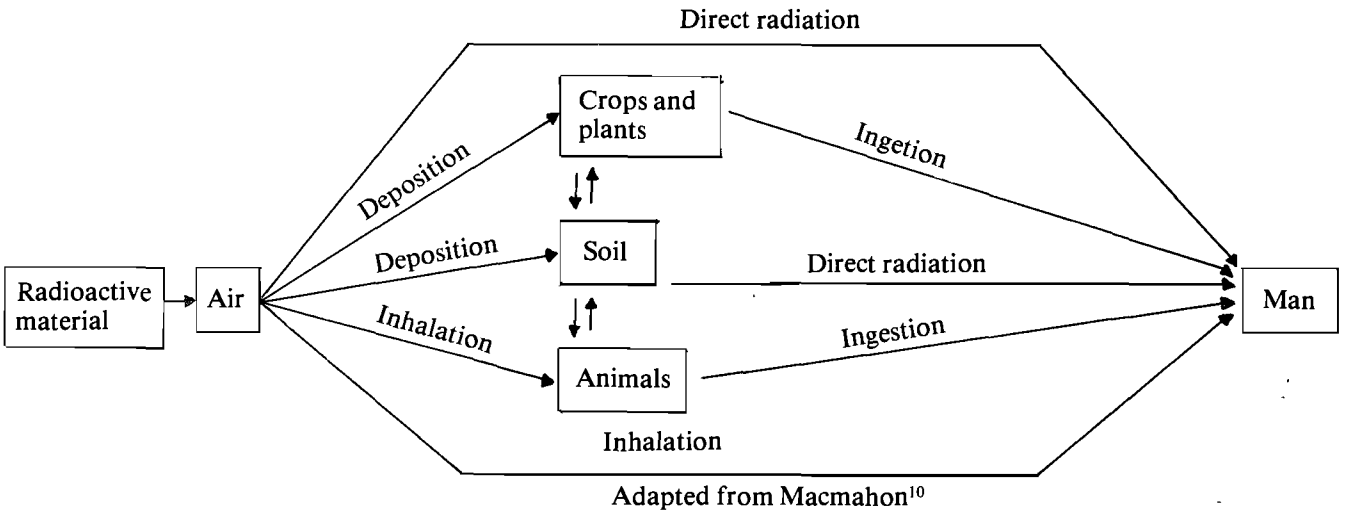
The possibilities of fall-out from nuclear weapon tests and the exploitation of nuclear energy have added new dimensions to the potentialities of radiation[4 15 13]. The biggest nuclear disaster was, without doubt, that which occurred in the Japanese city of Hiroshima during the Second World War[9 13]. Other incidents are the 1957 Windscale incident[15] and recently, 1986, the nuclear disaster at Chernobyl in the USSR. References in literature are limited with respect to contamination of food during a disaster. At present strontium-90 and iodine-131 are recognised hazards in milk supplies[9 15]. Strontium-90 has a half-life of twenty eight years and when ingested becomes incorporated in bone[15]. This is important in children, who consume the greatest quantity of milk[15]. Iodine-131 has a shorter half-life of about eight days, but it concentrates itself in the relatively small volume of tissue of the thyroid gland[15]. Iodine-131 was the radionuclide causing greatest concern in the 1957 Windscale incident in England[15].

Below is a simplified pathway for radioactive fall-out and leakage[10]:

LEGAL GUIDELINES FOR THE VETERINARIAN IN AN EMERGENCY SITUATION

The South African Veterinary Council (SAVC)

The SAVC has jurisdiction over veterinarians with specific reference to practising the veterinary profession



Adapted from Macmahon[10]

on animal patients[2] and has no jurisdiction over the ethical conduct of a veterinarian in an emergency, dealing with human patients (Jansen B C, personal communication, Chairman of the South African Veterinary Council, Veterinary Research Institute, Onderstepoort).

The South African Medical and Dental Council (SAMDC)

Act 56 of 1974[1] specifies that only registered medical doctors are legally entitled to practise any of the specific functions of a medical doctor for gain. The Act further defines the specific functions of a medical practitioner with regard to diagnosing and prescribing treatment[1].

The legal perspective

The point at which a human being is declared as dead has been the topic of debate for many centuries[14]. Cerebral death, as defined by HAH van Till-d'Aulnis de Bourouill, is "the complete and irreparable cessation of brain function, including the function of the brain stem"[14]. Today it is generally accepted by medico-legal experts that cerebral deaths has occurred if no brain activity is recorded by electroencephalogram (EEG) for twenty minutes at normal body temperature (but not lower than 34°C)[14]. Death may be certified only by a medical practitioner. (Strauss S A, Department of Criminal and Procedural Law, University of South Africa — personal communication.*) This legal point is important as it has frequently happened at roadside accidents that observers have incorrectly proclaimed a victim as being dead (Strauss S A, Department of Criminal and Procedural Law, University of South Africa).

The subject of emergency treatment is essentially governed by "Common Law" in South Africa[14]. There are four major factors that arise when dealing with this subject, namely: The duty to rescue, the potential liability of the rescuer to the patient in respect of unskilful medical treatment administered in an emergency, the right of the rescuer to be compensated by the patient and the right of the rescuer to claim compensation from the author of the emergency, in respect of harm suffered by the rescuers as a result of measures undertaken to rescue the disaster victim. Usually, in legal cases arising from disasters, the injured tend to sue the parties responsible for the disaster, while there is usually an instinctive feeling of gratitude towards the rescuer[14]. The principles of South African law governing emergency treatment are such that the likelihood of successful action being brought in respect of emergency treatment administered in good faith, is minimal[14].

The duty to rescue: In principle there is no legal duty upon any person to rescue another. However, there may be an obligation in the case of persons who are under contract, such as firemen and ambulance drivers. A duty may arise by common law in certain situations in which the victim and would-be-rescuer may find themselves: "An omission is, in essence, unlawful where the circumstances are such that an omission would not only invoke moral indignation but also where the juristic convictions of society would require that the omission ought to be regarded as unlawful[11 14].

Another two factors that may be raised under rescue, emergency medical treatment and the law are "consent required" and "unauthorised administration". Consent required: "Even in an emergency situation, the will of the patient who is still capable of expressing it rationally, must therefore be respected"[14]. There are exceptions to this statement but these exceptions only apply to the medical fraternity such as in the case of vaccinating communities to prevent the outbreak of disease, or in the case of serious infectious diseases where a patient ought to be isolated[14]. In these situations, the benefit of the community is regarded as more important than the will of the individual. In the case of a juvenile patient, under eighteen years old, a prohibition imposed by a person lawfully entitled to give consent must be respected, provided that the prohibition is not against the best interests of the victim[14]. Unauthorised administration: The underlying principle in this concept is that a person is "entitled — not obliged — to take steps to protect the interests of another person". However, there are essential factors to this statement, namely: there must be a real state of emergency, the patient must be incapable of properly appreciating the situation, treatment must not be against the will of the patient, and the treatment must be intended to be in the best interests of the patient[14].

The duty of reasonable care: The action of a nurse, paramedic or doctor will be judged in the light of the degree of care and skill which can be expected from the "reasonable person"[14] in that field. In the case of extreme emergency, even unqualified laymen may render aid to the injured, provided that no expert medical aid is immediately available or within reasonable distance. It is also worth noting that "in a grave emergency situation, statutory duties or prohibitions will temporarily become suspended by virtue of the common law principles[14].

The potential liability of the rescuer to the patient in respect of unskilful medical treatment administered in an emergency: "In principle, laymen may, in an emergency situation, administer aid to an injured person or to a person suddenly manifesting signs of serious illness, provided that the circumstances are such that professional medical assistance is not immediately available and that it would be unreasonable to first endeavour to summon professional assistance"[14].

Legal guidelines for the purpose of a veterinarian administering emergency treatment to a person would thus include:

1. Veterinarians may not perform for gain any act prescribed in Act 56 of 1974[1] in any manner whatsoever.
2. Necessity knows no law (*"Nood breek wet"*[14]) — in a grave emergency situation statutory prohibitions will temporarily become suspended.
3. Veterinarians should view themselves, in a legal sense, as laymen who have access to drugs and knowledge that may be of benefit to a person in an emergency[11 13]. (Strauss S A S, Department of Criminal and Procedural Law, University of South Africa — personal communication.)
4. Veterinarians should, before treating a victim in an emergency, ensure that there is no one immediately available or within reasonable distance, who is better qualified to treat the victim than the veterinarian.
5. The victim should be treated to the best of the veterinarians's knowledge with the intention of preserving the best interests of the victim.

6. If possible, obtain the victim's consent to treatment.
7. Veterinarians will be judged on the basis of the "reasonable person".

THE ROLE OF THE VETERINARIAN DURING A DISASTER

There are two basic roles that the veterinarian could perform in the advent of a disaster:

1. During, or immediately after, the disaster the veterinarian could render emergency medical assistance to human victims in a paramedical role. The medical aid posts in the impact zone of a disaster are known as "Forward Medical Aid" posts (FMA)[4]. These FMA posts serve as sorting and first aid stations for the victims. It is at these posts that medical doctors examine each victim and sort the victims into those needing further hospitalisation and those victims merely needing first aid outpatient treatment. The medical doctors will diagnose and prescribe treatment for the patients. The treatment will then be administered by nurses, intern-year medical students, veterinarians, and dentists[4] [11]. Members of these "paramedical" professions would assist in setting up drips, bandaging and splinting, suturing and monitoring patients[4]. Veterinarians should also be capable of serving as surgical assistants. Veterinarians could make their clinics available as FMA posts in the impact zone. In the event of a veterinarian being the first to arrive in the impact zone, the veterinarian should administer first aid in accordance with the suggestions in the section "Legal guidelines".
2. During the rescue and remedy phases of the disaster, the veterinarian would serve in a veterinary public health role[9] [11]. According to Kay[9] the specific roles a veterinarian would perform, would involve the prompt recovery and disposal of animal remains. This is important since these carcases encourage the influx of rodents and flies which may act as carriers of diseases. Stray dogs and cats pose a major threat[9] [11]. The incidence of dog bites has been shown to increase in the impact zone after a disaster[10] [13]. Add to this, is the potential of conditions such as rabies and plague which could cause an extremely volatile situation to develop.

Following the disaster there would probably be an increase in animal casualties that would need attention.

Intensive vaccination campaigns would need to be organised

Veterinarians would perform a major role in the classical fields of veterinary public health such as zoonoses control where it is widely accepted that medical and veterinary officials combining their knowledge are more effective than either profession on its own[13]. The role of the veterinarian would be particularly important in primary preventative medicine on the farm thus indirectly influencing both the quality of food available and the transmission of diseases via food animals to the victims of a disaster.

In the event of a major disaster on a national scale, veterinarians, in the face of possible food shortage, might have to abandon condemning valuable food sources at abattoirs for reasons such as "aesthetically objectionable". In these situations the fully applied knowledge of a specialist such as the veterinarian would be needed to decide which food is potentially unsafe, which is safe and which is only objectional on aesthetic grounds.

The veterinarian involved in milk hygiene will be responsible for ensuring an adequate as well as safe, sound and wholesome supply of milk to the disaster area. This would entail maximizing milk production, controlling the potential of disease transmission via milk and ensuring that the milk being given to victims in the area is of a high biological value as well as being safe and sound. In the case of a nuclear disaster the milk may be contaminated with radioactive material[15]. Monitoring of the milk would be a major task. The pre-disaster planning of disaster relief strategies does not rely heavily on the presence of veterinarians, yet it would be foolish to ignore the beneficial resources and knowledge veterinarians, along with members of all other allied professions, could provide during this type of planning.

DISCUSSION AND CONCLUSIONS

The possible role of veterinarians in a disaster could be: initially to offer services to medical authorities at field posts. This would be during the "rescue" phase of the disaster. The services offered would presumably be in the capacity of paramedical assistants. During the "remedy" phase of the disaster veterinarians could be actively involved in the field of veterinary public health.

The maintenance of veterinary services in the field would be in demand as well. For the veterinarian to fulfil these two roles, some form of "disaster preparedness" course for veterinarians needs to be established. This course should include information on disasters, emergency medical training and veterinary public health priorities in a disaster environment. This course could be offered in a number of ways. Firstly as an undergraduate course. However, in our opinion undergraduates have more than enough information to cope with and the veterinary undergraduate course is already overloaded. Secondly as part of the military medicine course which is given to veterinarians doing their national service. In our opinion there is an advantage in doing such a course if circumstances require it, because persons trained in such a course are prepared for any disastrous event. Another advantage is that the South African Defence Force already offers courses in "emergency medical training" to the operational medical orderlies. The disadvantage of offering the course during the national service period is that it precludes that sector of veterinarians such as female veterinarians as well as all the other veterinarians who have already completed their national service. Thirdly it could be offerd as a post-graduate diploma course. This offers numerous advantage in that each veterinarian completing the "Disaster" course could possibly receive a diploma in "Disaster Emergency Medicine" which may possibly be registerable with the South African Medical and Dental Council. A second advantage would be that only those veterinarians interested would register for such a course. The disadvantages would be that there is no gauge of what interest would be shown in such a course and that the planning and compiling of a course such as this would be very difficult. The first disadvantage could easily be overcome by doing a survey.

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ARTICLE ARTIKEL

THE USE OF REDUCED-DOSE *BRUCELLA ABORTUS* STRAIN 19 VACCINE IN THE CONTROL OF BOVINE BRUCELLOSIS

J.A. ERASMUS* and M.C. ERASMUS**

ABSTRACT: Erasmus J.A.; Erasmus M.C. **The use of reduced-dose *Brucella abortus* strain 19 vaccine in the control of bovine brucellosis.** *Journal of the South African Veterinary Association* (1987) **58** No. 2 71-75 (En) Directorate of Veterinary Services, Veterinary Laboratory, P.O. Box 625, 9500 Kroonstad, Republic of South Africa.

Adult animals from a known negative and an infected herd were vaccinated with reduced-dose *Brucella abortus* strain 19 vaccine. Since some of these animals developed elevated post-vaccinal blood titres, it is suggested that, when adult vaccination is decided on, such herds should be bled and tested about 4 months after vaccination and thereafter at 2 month intervals. Reactions with complement fixation titres of 392 IU ml^{-1} or higher on the first test should be taken as positive. During the 2nd and 3rd tests, positive reactions should be taken as <98 IU ml^{-1} and 49 IU ml^{-1}, respectively. After vaccination, an overkill of up to 5%, due to vaccination reactions could be expected. Positive cases might occur up to 9 months after vaccinating an infected herd.

On farms selected for adult vaccination suitable calving facilities in isolation, largely facilitate eradication. Lochia samples for the early diagnosis of brucellosis should be collected. Adult vaccination with a reduced dose S 19 vaccine, should be practised on selected, problem herds only, where the owner is fully aware of the consequences of this procedure.

Key words: Bovine brucellosis, adult vaccination, reduced-dose *Brucella abortus* strain 19 vaccine.

INTRODUCTION

Vaccination of heifer calves with *Brucella abortus* strain 19 (S 19) vaccine must be regarded as the first step towards the eradication of bovine brucellosis. When dealing with a chronically infected, problem herd or with rapidly spreading disease, the same vaccine can be used in adult cattle. In this event a number of permanent vaccine reactors with persistantly high titres can be expected[14]. Observations in Australia and the USA led to the production of reduced-dose *B. abortus* strain 19 (diluted S 19) vaccines, containing $2{,}25 \times 10^8$ - 3×10^9 viable organisms per dose[1,5,7] as opposed to the $2{,}5 \times 10^{10}$ - $12{,}5 \times 10^{10}$ organisms per dose in the standard S 19 vaccine[1,3,14]. The former vaccine is supposed to generate a good immunity and should cause little interference in future serological tests[5,15]. When Becket & MacDiarmed[4] investigated the effect of diluted S 19 vaccine, containing approximately 3×10^8 organisms per dose in accredited herds in Britain, at least 15% of the females involved, developed complement fixation (CF) titres of $\geqq 1{:}8$ ($\geqq 49$ IU ml^{-1})[11] which persisted for about 12 months. Consequently they could not recommend the use of this vaccine in known uninfected herds at all.

The incidence of bovine brucellosis in the Highveld region is known to be exceptionally high. As this is thought to be partly due to improper calfhood vaccination, the use of diluted S 19 vaccine in adult cattle, was thought to be a possible method for controlling brucellosis in some of the infected herds in the area. In order to assess this hypothesis, 2 herds were selected. The first was a known negative beef herd and the second an infected dairy herd, which at the time of vaccination was plagued with *Brucella* abortions. These animals were injected with diluted S 19 vaccine, containing $3{,}8 \times 10^8$ - 1×10^9 organisms per dose (Veterinary Research Institute, 0110 Onderstepoort). Subsequent to vaccination, blood samples for serological testing were taken from each animal at regular intervals. In the case of the infected herd, lochia samples were also taken for bacteriological examination.

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MATERIALS AND METHODS

Experimental animals

A group of 50 Afrikaner and Simmentaler cows, aged 8 years and more, was selected (Group 1). They had all received their calfhood injection of S 19 vaccine between the ages of 3 - 10 months. After the first calf, they were removed from the general herd to the AI training centre at Potchefstroom where they were kept in strict isolation and not used for breeding purposes. All had reacted negative during annual brucellosis tests.

Immediately prior to injecting diluted S 19 vaccine, blood samples from each animal were taken in sterile, empty vacuum tubes. Subsequent samples were collected as indicated in Table 1.

In the infected herd (Group 2), consisting of Friesland cattle, brucellosis was diagnosed bacteriologically from samples taken from aborted foetuses. Regular vaccination with S 19 vaccine had not previously been practised and complete records regarding calf vaccination were not available. In order to limit the further spread of infection, the owner was advised to isolate cows in suitable calving facilities prior to calving.

About one month prior to vaccinating the herd, the positive cases, i.e. animals showing CF titres of $\geqq 30$ IU ml^{-1}, were identified and removed from the farm. After injecting the remaining females with the locally produced, diluted S 19 vaccine, blood samples were collected from each individual animal as shown in Tables 3 & 4.

Serological tests

Serum obtained from the respective blood samples, was screened by employing the rose bengal plate test

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(RBPT). All samples from Group 1 were also tested by complement fixation. Only those samples from Group 2 which reacted to the RBPT, were subjected to the complement fixation test (CFT). Both the tests were performed according to the method of Herr et al.[11].

Additional diagnostic tests

One animal from Group 1 (No 095) was slaughtered for experimental purposes after she developed a CF titre of $\geqq 784$ IU ml^{-1}. Samples taken from the 4 quarters of the mammary gland, the uterus and of the prescapular, supramammary, retropharyngeal and the inguinal lymph nodes, were subjected to bacteriological examination. When a 2nd case from this group developed a CF titre of 392 IU ml^{-1} (No. 744), she was inseminated. At calving, placenta smears were made for microscopic examination, lochia was collected for bacteriological examination and colostrum was sampled for a biological test.

In Group 2, where lochia samples were collected routinely within 12 - 24 h after calving or abortion, an animal was regarded as infected if its lochia sample revealed *B. abortus* organisms on culture. Significant post-vaccinal CF titres, however, developed in 8 cases (Table 4); lochia samples, however, proved to be negative for this infection. After the last set of blood samples was taken, milk samples[16] were collected from each of these animals for bacteriological examination.

Material collected for bacteriological examination, was incubated on Farrell's medium[9] at 37°C in air plus 10% CO_2. Suspect colonies were identified by applying standard bacteriological techniques[2].

Statistical analysis

Due to the obviously skew distribution of the data, median titre levels were determined[17] where indicated.

RESULTS

Data regarding sampling dates and the CF titres of the individual animals from Group 1, are given in Table 1 and are summarized in Table 2. Sampling dates, CF titres of reactors as well as the bacteriological results obtained for Group 2, are given in Tables 3 and 4.

The median CF titre for the negative herd reached a peak level of about 170 IU during the 2nd month after vaccination; thereafter a marked decline in titres followed (Table 2). By the 8th month, 90% of cases revealed titres of $\geqq 49$ IU ml^{-1}. During the course of the experiment, CF titres of $\geqq 784$ IU ml^{-1} were noted in blood samples of No. 095, 744, 769 & 778 (Table 1). As the lymph node and mammary gland samples of No. 095, collected during post mortem examination, and the placenta, lochia and colostrum of No. 744 did not reveal *B. abortus,* these titres were regarded as vaccination reactions.

Table 1: Complement fixation titres (IU ml^{-1}) for the individual animals from the known negative herd on different sampling dates. (Reduced dose *Brucella abortus* strain 19 vaccine injected on 11.04.1985).

Cow	CF titre on Day												Cow	CF titre on Day											
No.	0	7	36	69	92	123	168	197	252	281	330	384	No.	0	7	36	69	92	123	168	197	252	281	330	384
06	–	24	60	196	86	24	–	24	–	–	–	–	725	–	18	98	120	172	49	24	–	–	–	–	–
11	–	60	120	98	120	49	24	43	–	–	–	–	726	–	60	98	392	240	24	21	21	–	–	–	18
032	–	24	98	196	196	49	24	24	–	–	–	–	727	–	–	49	98	120	43	24	30	–	–	–	24
054	–	24	145	120	98	49	36	24	24	–	–	–	728	–	–	60	49	98	–	–	–	–	–	–	–
084	–	36	49	196	120	24	21	24	–	–	–	–	744	–	–	392	784	784	784	784	784	784	784	784*	392
095	–	49	784	S									745	–	–	30	49	36	–	–	–	–	–	–	–
097	–	24	86	196	120	24	–	36	–	–	–	–	747	–	–	120	196	784	172	196	C				
105	–	–	43	24	30	–	–	–	–	–	–	–	748	–	–	145	196	98	49	49	36	18	–	–	24
109	–	–	24	145	49	–	–	–	–	–	–	–	754	–	–	36	98	49	–	–	–	–	–	–	–
111	–	–	98	290	98	24	24	24	–	–	–	–	761	–	–	172	196	98	98	344	392	290	196	196	196
114	–	–	98	43	30	–	–	C					763	–	49	60	392	24	24	–	24	–	–	–	24
115	–	–	18	21	–	–	–	–	–	–	–	–	764	–	98	196	392	145	49	49	98	24	–	24	36
124	–	–	24	30	126	36	–	24	–	–	–	–	765	–	–	43	98	98	–	21	24	–	–	–	–
170	–	–	D										766	–	21	49	43	98	–	–	21	–	–	–	–
204	–	–	72	98	196	98	72	86	49	49	24	49	769	–	49	196	196	784	196	240	196	98	72	49	86
247	–	98	98	392	145	24	–	18	–	–	–	–	770	–	49	145	196	98	24	24	C				
303	–	24	21	60	49	–	–	–	–	–	–	–	771	–	49	196	196	196	49	49	72	43	49	–	36
313	–	–	98	392	196	36	–	18	–	–	–	–	774	–	24	72	196	196	49	24	36	–	–	–	24
316	–	–	24	120	60	24	–	–	–	–	–	–	776	–	49	98	98	196	49	36	24	18	24	–	24
364	–	–	86	196	196	49	24	24	–	–	–	–	778	–	–	49	784	98	24	21	18	–	–	–	–
365	–	–	72	43	24	–	–	–	–	–	–	–	782	–	49	120	196	172	43	49	60	24	49	36	72
373	–	21	49	49	86	24	18	21	–	–	–	–	784	–	24	72	196	196	72	72	98	49	49	43	36
473	–	49	98	98	49	–	21	21	–	–	–	–	785	–	60	120	392	240	43	60	60	43	24	30	30
708	–	49	30	98	98	43	24	36	–	–	–	24													
709	–	30	60	120	98	49	30	C	–	–	–	–	Me	–	21	86	170	98	30	22	24	–	–	–	–
714	–	21	30	98	98	24	21	21	–	–	–	–													
724	–	49	145	392	344	145	98	120	49	49	24	49													

– = CF titre < 15 IU/ml^{-1}
C = Culled
D = Died
Me = Median value
* = Calved (18.02.86), lochia and colostrum negative for brucellosis
Day 0 = Vaccination date

Table 2: A summary of the complement fixation titres (IU $m\ell^{-1}$) of the animals from the known negative herd on different sampling dates.

CF titre (IU $m\ell^{-1}$)	Percentage of animals										
Day **	7	36	69	92	123	168	197	252	281	330	384
≦24	66	12	4	6	50	73	64	82	82	86	77
30-49	24	22	15	15	35	13	14	11	11	9	14
60-98	10	39	21	31	6	8	14	2	2	–	4
120-196		22	40	35	6	–	4	–	2	2	2
240-392		–	17	6	–	4	2	2	–	–	–
≧480	0	4	4	6	2	2	2	2	2	2	2

** Day after vaccination

Table 3: Complement fixation titres (IU $m\ell^{-1}$) of reactors after vaccinating an infected herd with reduced-dose *Brucella abortus* strain 19 vaccine (Vaccinated on 4.6.1988)

	CF titres of positive cases on:								
Day(1.)	64	99	136	162	196	231	276	328	358
Cow No.									
028	392(4)	S							
3	49	30	–	–	–	784(4)	S		
47	784	784	S(4)						
58	196	784(4)	S						
73	–	172	784(5)	S					
74	98	784	784(5)	S					
76	30	18	–	24	–	–	784(4)	S	
123	196	196	784(5)	S					
141	–	784	784(4)	S					
162	784(5)	S							
203	36	120	784(5)	S					
206	784(4)	S							
211	–	–	–	–	–	784(4)	S		
234	–	784	784(4)	S					
427	392(4)	S							
Number(2.)	4	1	7	0	0	2	1	0	0
Total(3.)	126	124	112	106	99	96	93	88	88
% Positive	3,2	0,8	6,3	0	0	2,1	1,1	0	0

(1.) = Days after vaccination
(2.) = Number of cases diagnosed as positive
(3.) = Number of females in the herd
(4.) = Calved during this month; lochia bacteriologically positive
(5.) = Aborted during this month; foetus bacteriologically positive
S = Slaughtered

Table 4: Complement fixation titres (IU $m\ell^{-1}$) of vaccination reactors after vaccinating an infected herd with reduced-dose *Brucella abortus* strain 19 vaccine (vaccinated on 04.06.1985)

	C F Titres of vaccination reactors on:								
Day(1.)	64	99	136	162	196	231	276	328	358
Cow No.									
26	–	–	784	784	784(2)	784	D		
36	240(3)	196	145	120	98	98	36	196	145
39	–(3)	–	784	784	784	784	784	784	784
126	98	–	24	36	24	49	24	24(2)	–
137	24	24	18	24	21	24	24(2)	24	36
169	–	43	–	–	196	184(2)	172	98	D
205	–	86	98	98	49	98(2)	49	24	–
303	49	–	49	30	24	24(2)	36	49	49

(1.) = Days after vaccination
(2.) = Calved during this month; lochia bacteriologically negative
(3.) = Calved during this month; lochia bacteriologically negative; carcase samples subsequently bacteriologically negative
D = Died

Three months after vaccination, 3 cases from this group (No. 744, 747 & 769) still revealed CF titres of $\geq$392 IU ml^{-1}. In practice, these animals would have been diagnosed as reactors and eliminated (Director of Veterinary Services, Private Bag X138, 0001 Pretoria). This figure represents an incidence of 6,2% vaccination reactions.

Eight cows from Group 2 developed post-vaccinal CF titres of $\geq$30 IU ml^{-1} and revealed no *B. abortus* organisms in their lochia samples. Two of these (No. 26 & 169) died of other causes and no further samples could be taken from them. As the milk samples of the other six cases were negative for *B. abortus*, it appears that approximately 5% of false negative reactors developed after a known infected herd was vaccinated with diluted S 19 vaccine.

With regard to the actual positive animals in Group 2 (Table 3), 12 cases were detected from the time of vaccination up to the 4th month after vaccination, and were culled. Prior to or shortly after calving or abortion, their blood samples revealed CF titres of $\geq$392 IU ml^{-1}. Three positive cases (No. 3, 76 & 211) were identified 7 -9 months after vaccination. Their CF titres increased from $<$15 IU ml^{-1} to $\geq$784 IU ml^{-1} during the periparturient period. No further abortions due to brucellosis occurred after 4 months following adult vaccination.

DISCUSSION

It is generally agreed that adult vaccination will practically eliminate clinical disease, thus greatly reducing the degree of exposure of healthy cattle[12]. Since heifer calves born from infected dams may become latent carriers of infection[6] and a source of reinfection, brucellosis may be maintained in an adult vaccinated herd. This stresses the importance of culling both the positive case as well as her new-born calf.

The discontinuation of abortion after 4 months in the infected herd, could possibly be attributed to adult vaccination. The most obvious disadvantage of this procedure, however, appears to be the development of vaccinal reactions with CF titres of up to 784 IU ml^{-1}. In order to keep the unnecessary slaughter of vaccine reactors, as opposed to infected cases, to a minimum, blood samples should be collected at about 4 months after vaccination and thereafter at about 2 month intervals[13]. CF test results should then be interpreted as suggested in Table 5.

When an infected animal aborts or calves normally, enormous numbers of *Brucella* organisms may be shed via the foetal tissues and fluids to contaminate the environment[6 10 15]. In order to prevent further spreading of the organisms, early identification of positive cases becomes vitally important. This can be achieved by calving in isolation and sampling of lochia and blood within 24 h after calving, for bacteriological examination and serological testing, respectively[8]. About 9 months after vaccinating the known positive herd with diluted S 19 vaccine, *Brucella* (wild strain) organisms could be detected in the lochia of one post-paturient cow (Table 3), indicating the importance of examining all adult vaccinated animals in such a herd. This late positive diagnosis also indicates that adult vaccination with this vaccine does not necessarily assist in decreasing the time taken to eradicate the disease within an infected herd.

In herds where adult vaccination is decided on, blood samples should be collected about 4 months after vaccination and subsequently at intervals of 2 months. During these tests, a positive reaction should be taken as one where a CF titre of 392 IU ml^{-1} (or higher), 98 IU ml^{-1} (or higher) and 49 IU ml^{-1} (or higher), respectively, is found. Even under these circumstances an overkill of approximately 5% due to vaccination reactions, could be expected. Although this was not done in the trial reported here, subsequent blood tests at 2-6 month intervals, could be carried out and interpreted as in the case of blood samples collected about 10 months after vaccination. In the interim all cows should calve in isolation and the early diagnosis via lochia examinations and the elimination of infected animals and their immediate progeny, should be practiced. When selecting a herd for adult vaccination, the existence of proper calving facilities should be high on the list of priorities.

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Table 5: Suggested sampling dates and interpretation of complement fixation tests after vaccination with reduced-dose *Brucella abortus* strain 19 vaccine.

Blood samples taken at (months after vaccination)	Test no.	C F titres (IU ml^{-1} regarded as		
		Negative	Suspicious	Positive
4	1	344(1)		392(2)
8	2	43(1)	49-98	98(2)
$\geq$10	$\geq$3	24(1)	30-49	49(2)

(1) or less
(2) or more

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ARTICLE ARTIKEL

ANTIBIOTIC SERUM ACTIVITIES AGAINST BACTERIAL ISOLATIONS FROM CASES OF BOVINE PNEUMONIC PASTEURELLOSIS IN FEEDLOT CALVES

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ABSTRACT: Van Amstel S.R.; Witcomb M.A.; Fabian B.; Vervoort P. **Antibiotic serum activities against bacterial isolations from cases of pneumonic pasteurellosis in feedlot calves.** *Journal of the South African Veterinary Association* **58** No. 2, 77-80 (En) Faculty of Veterinary Science, University of Pretoria, Private Bag X04, 0110 Onderstepoort, Republic of South Africa.

The serum bactericidal activity test was carried out in two groups of 7 calves each suspected to be suffering from pneumonic pasteurellosis. The diagnosis was based on clinical signs, endoscopic examination and bacteriological investigations. The first group of seven calves received oxytetracycline at a dosage rate of 10 mg kg^{-1} once a day. A second similar group received penicillin at 30 000 IU kg^{-1} once a day. Results showed that the correlation between antibiograms, serum bactericidal activity and clinical response may be good for oxytetracyclines and poor for penicillin. The serum bactericidal activity test may be a good method to establish effective dosages for certain antibiotics in the treatment of pneumonic pasteurellosis.

Key words: Pneumonic pasteurellosis, serum bactericidal activity test.

INTRODUCTION

Pneumonic pasteurellosis is the most important disease of feedlot cattle[4,5]. From all observations and according to experimental evidence, *Pasteurella haemolytica* and *Pasteurella multocida* are the most important bacteria involved in the bovine respiratory disease complex[3]. Several other species of bacteria are sometimes isolated from pneumonic lungs as well as from the upper respiratory tract of normal cattle, but their involvement in the bovine respiratory disease complex has not been studied to any great extent[3]. Although *P. haemolytica* occurs in the tissues of the respiratory tract of normal calves, it has been shown that both the incidence as well as the mean colony counts increase in sick calves showing clinical signs of pneumonic pasteurellosis[3].

In a previous bacteriological survey in a feedlot in this country using newly introduced calves showing clinical signs of respiratory disease (anorexia, listlessness, pyrexia, nasal discharge, coughing and tracheitis on endoscopic examination), *P. haemolytica* was the most frequent isolate (45%) followed by *Pseudomonas aeruginosa* (25%) (S. van Amstel, unpublished data, Faculty of Veterinary Science, University of Pretoria, RSA).

Effective antibiotic treatment plays an important role in limiting the economic losses suffered from pneumonic pasteurellosis[4]. The serum bactericidal activity test is a long-established technique used to monitor antibiotic therapy in humans[6] and it was employed in an effort to measure antibiotic effectiveness in a feedlot in which the incidence of pneumonic pasteurellosis was as high as 80% of disease conditions diagnosed.

The test measures the greatest dilution of a serum sample wich is obtained while the patient is receiving antibiotic treatment, that will kill $\geq$ 99,9% of an inoculum of the infecting pathogen in vitro over 18-24 hours[6].

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Measurement of serum bactericidal activity may have a number of advantages for monitoring antibiotic therapy in feedlot calves suffering from pneumonic pasteurellosis. The test takes into account both the susceptibility of the causative organism to the antibiotic used for treatment, as well as its absorption and distribution within the animal. Both these pharmacokinetic factors are of great importance in feedlot cattle as stress, starvation and dehydration can have significant effects on the efficiency of these mechanisms[1]. The test may offer a close approximation of the contribution of the antibiotic employed in the therapy of pneumonic pasteurellosis cases, as such calves have been shown to be suffering from immunosuppression[1].

Although the role of several viral agents in the pathogenesis of pneumonic pasteurellosis is well established[3], no attempt was made at viral isolation as this had little relevance to the objectives of this trial.

MATERIALS AND METHODS

Experimental animals

Two groups, each consisting of seven calves from a commercial feedlot were used. These calves showing clinical signs of acute pneumonic pasteurellosis (pyrexia, listlessness, nasal discharge, coughing and the presence of tracheitis on endoscopic examination) were selected from a group of 200 - 250 kg weaner calves which had been introduced into the feedlot during the previous three weeks. They did not necessarily originate from the same area as calves were bought from various parts of the country and then transported to this feedlot where they were grouped together. Upon arrival, all calves are vaccinated against infectious bovine rhinopneumonitis (IBR) and parainfluenza type 3 (PI3) viruses using an intra-nasal vaccine (TSV-2, Smith-Kline). Their previous vaccination history was not known.

Tracheal washes were obtained from each of the selected calves with the aid of a fibreoptic endoscope which was positioned in the trachea close to the origin of the bronchus supplying the apical lobe of the right lung. A sterile polyethylene catheter was fed through a channel in the endoscope and visibly brought into con-

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tact with some pus. With the aid of a syringe containing sterile normal saline connected to the catheter, a sample was collected and stored on ice for bacteriological examination.

The experimental animals were then given antibiotic treatment as follows: The seven animals in Group 1 were given an oxytetracycline (Oxytet, Medrix Laboratories, Randburg) intramuscularly at a dosage rate of 10 mg kg^{-1} once a day for four days. The seven animals in Group 2 received penicillin (Duplocillin, Wellcome/Coopers (S.A.), Kempton Park, Johannesburg) intramuscularly at a dosage rate of 30 000 IU kg^{-1} once a day for four days.

Blood samples were collected in sterile vacuum tubes (Terumo Corporation, Tokyo, Japan) from the experimental animals on four occasions: 4 and 10 hours after the first injection; 24 hours after the first injection and coinciding with the second injection; and 10 hours after the second injection. Serum was separated within two hours after the blood collections, frozen and stored for determination of bactercidal activity.

All the experimental animals were monitored daily for response to the antibiotic treatment using the following parameters: a favourable response to antibiotic treatment was associated with a drop in body temperature to below 39,6°C and/or an improved habitus and appetite. At the end of the clinical trial (Day 4) the endoscopic examination and tracheal washings were repeated. The disappearance of the tracheitis was also regarded as a sign of a favourable response to treatment.

Bacteriological procedures

Tracheal wash samples were centrifuged in a refrigerated centrifuge at 2 000 G at 4°C for 30 minutes. After removing the supernatant, the sediment was cultured on both MacConkey (code CM 7, Oxoid, Basingstoke, England) and Columbia Blood Agar Base plates containing 5% defibrinated horse blood (code CM 331, Oxoid, Basingstoke, England). The MacConkey plates were incubated in a normal atmosphere and the blood agar plates in 5% CO_2, both at 37°C. After a 24 hour incubation period, all cultures containing colonies suspected to be *Pasteurella* were subcultured onto both MacConkey and blood agar plates and incubated as described above. Plates showing no growth of *Pasteurella* type colonies were incubated for a further 24 hours and then re-examined.

Organisms from subcultures were Gram-stained and tested for the presence of oxidase. Gram-negative, oxidase-positive bacilli were then typed using the API 20 NE system. No serotyping was performed.

After being identified as *Pasteurella,* sensitivities to antibiotics were ascertained using the Kirby Bauer technique.

Serum bactericidal activity test

The method employed was a micro-technique based on the method of Fisher[2] and carried out as follows:

Micro-titre trays, each with eight rows of twelve u-shaped wells, were used. Using a twelve tip, multichannel pipette, 50 µl of Mueller-Hinton broth (code CM 405, Oxoid, Basingstoke, England) containing 5% lysed horse blood, was pipetted into each of these wells. Fifty µl of the animal sera to be tested, was pipeted into the first well of each row in each tray. Each well was then double-diluted through to well eleven. The final 50 µl was discarded, leaving the twelfth well as a growth control. The trays were then stored in a plastic bag at 4°C until the inocula were prepared.

Mueller-Hinton broth of the *Pasteurella* cultures incubated overnight at 37°C, were adjusted until the turbidities matched that of a 0,5% $BaSO_4$ standard giving approximately 10^8 cfu ml^{-1}. From these standardised suspensions, inocula of 10^6 cfu-ml^{-1} were prepared in Mueller-Hinton broth containing 5% lysed horse blood. Fifty µl of these prepared inocula were added to the appropriate rows of test animal sera. The final concentration of bacteria in each well was approcimately 5 x 10^5 cfu ml^{-1}. The trays were covered and incubated overnight at 37°C. Subinoculation was done on blood agar to check the purity of the final inocula.

After incubation, the trays were shaken to resuspend any deposit of organisms. The turbidity was observed using a concave magnifying mirror. The bacteriostatic activity was taken to be the greatest dilution of serum showing no visible turbidity. Twenty µl aliquots were dropped onto Columbia Blood Agar from each of the serum dilutions showing no turbidity. These were incubated overnight at 37°C to determine the bactericidal activity. A 99,9% kill was represented by two or less colonies per subculture.

Four *P. haemolytica* isolates (71, 72, 386 & 426) representing two from each group, were incubated against four serum samples obtained at different times to represent peak and trough serum antibiotic concentrations from all the calves in both groups.

Following the serum bactericidal activity test, the four *P. haemolytica* isolates were tested for the presence of β-lactamase using Intralactam strips (Mast Laboratories Ltd., Bootle, Werseyside, UK) according to the manufacturer's directions.

RESULTS

Bacterial isolations

On the first day of the clinical trial, five isolates of *P. haemolytica* were obtained (Tables 4 & 5) from both groups of calves. No other bacteria were isolated. On the fourth day of the trial six isolates of *P. haemolytica* were obtained (Tables 4 & 5) from both groups. On this occasion several other organisms were also isolated including *Pseudomonas aeruginosa* (2 isolates), *Pseudomonas testosteroni* (1 isolate) and *Pseudomonas fluorescens* (1 isolate). In one case only was there a mixed infection present (*P. haemolytica* and *P. testosteroni*).

Serum bactericidal activity test

The results of the antibiotic sensitivities of the four isolates of *P. haemolytica* used in the test are shown in Table 1.

Table 1: Results of the antibiotic sensitivities of four *Pasteurella* isolates

Isolate number	Antibiotic	
	Oxytetracycline	Penicillin*
71	Resistant	Sensitive
72	Resistant	Sensitive
386	Sensitive	Sensitive
426	Resistant	Sensitive

* All four isolates produced β-lactamase

The results of the serum bactericidal activity test for Groups 1 & 2 calves can be summarised as follows:

The sera from all fourteen calves in Groups 1 & 2 showed no bacteriostatic or bactericidal activity in any of the dilutions when incubated with Isolates 71, 72 & 426. The sera from three calves in Group 1 showed limited bacteriostatic activity against isolate 386. (Table 2). The sera from all seven calves (Group 2) showed good bacteriostatic activity (1:16-1:64 dilutions) and limited bactericidal activity against Isolate 386. (Table 3).

Table 2: Results of the serum bacteriocidal activity test in three calves in Group 1 receiving oxytetracycline against isolate 386

	Animal number					
	1		4		723	
	Serum dilution giving bacteriostatic/cidal concentrations					
Serum collections	Static	cidal	static	cidal	static	cidal
0	1 in 4	<1 in 2	1 in 4	<1 in 2	1 in 16	<1 in 2
1/10	1 in 2	<1 in 2	<1 in 2	<1 in 2	1 in 4	<1 in 2
2/0	1 in 2	<1 in 2	<1 in 2	<1 in 2	1 in 8	<1 in 2
2/10	1 in 2	<1 in 2	<1 in 2	<1 in 2	<1 in 2	<1 in 2

0 = 4 hours after first injection
1/10 = 10 hours after first injection
2/0 = 24 hours after first injection and coinciding with second injection
2/10 = 10 hours after second injection
1 in 2 = No visible bacteriocidal activity in the 1 in 2 dilution

Table 3: Results of the serum bacteriocidal activity test in calves in Group 2 receiving penicillin against Isolate 386

	Animal number													
	21		26		29		31		32		33		34	
Serum	Serum dilutions giving bacteriostatic/cidal concentrations													
collection	static	cidal	static	cidal	static	cidal	static	cidal	static	cidal	static	cidal	static	cidal
0	1 in 64	1 in 16	1 in 128	1 in 16	1 in 64	<1 in 2	1 in 64	1 in 2	1 in 128	1 in 2	1 in 64	<1 in 2	1 in 128	1 in 2
1/10	1 in 32	<1 in 2	1 in 128	1 in 8	1 in 32	<1 in 2	1 in 16	<1 in 2	1 in 16	<1 in 2	1 in 8	<1 in 2	1 in 32	1 in 2
2/0	1 in 8	<1 in 2	1 in 16	1 in 2	1 in 4	<1 in 2	1 in 8	<1 in 2	1 in 8	1 in 4	1 in 4	<1 in 2	1 in 4	<1 in 4
2/10	1 in 32	<1 in 2	1 in 256	1 in 4	1 in 8	<1 in 2	1 in 64	<1 in 2	1 in 64	1 in 16	1 in 16	<1 in 2	1 in 8	<1 in 2

0 = 4 hours after the first injection
1/10 = 10 hours after first injection
2/0 = 24 hours after first injection and coinciding with second injection
2/10 = 10 hours after second injection
<1 in 2 = No visible bacteriocidal activity in the 1:2 dilution

Clinical observations

The clinical response of the calves in Groups 1 & 2 is shown in Tables 4 & 5, respectively.

Table 4: The clinical response of the calves in Group 1 receiving oxytetracycline

	Day of treatment					
	Day 1			Day 4		
Animal number	Tracheitis + pus	*Pasteurella* isolation	Habitus + appetite	Tracheitis + pus	*Pasteurella* isolation	Habitus + appetite
1	Present	Negative	Poor	Present	Positive	Unchanged
2	Present	Negative	Poor	Present	Positive	Unchanged
3	Present	Positive	Poor	Present	Negative	Unchanged
4	Present	Negative	Poor	Present	Negative	Unchanged
70	Present	Positive	Poor	Present	Positive	Unchanged
71	Present	Positive	Poor	Present	Negative	Unchanged
72	Present	Positive	Poor	Present	Positive	Unchanged

Table 5: The clinical response of the calves in Group 2 receiving penicillin

	Day of treatment					
	Day 1			Day 4		
Animal number	Temperature (°C)	Tracheitis + pus	*Pasteurella* isolation	Temperature (°C)	Tracheitis + pus	*Pasteurella* isolation
21	40,3	Present	Negative	39,4	Present	Positive
26	39,0	Present	Positive	39,7	Present	Positive
29	39,7	Mild	Negative	39,8	Mild	Negative
31	40,2	Present	Negative	39,4	Present	Negative
32	39,5	Present	Negative	38,4	Absent	–
33	39,1	Mild	Negative	39,7	Absent	–
34	39,3	Present	Negative	41,1	Present	Negative

DISCUSSION

Although a cause-effect relationship between the *Pasteurella* organisms isolated and the clinical syndrome described is only assumed, both the frequency of isolation of *Pasteurella* in this trial and evidence given in the literature[3], indicate that *P. haemolytica* may be the most important bacterial agent involved in the bovine respiratory disease complex. Based on the foregoing, the use of *P. haemolytica* isolates in the bactericidal activity test as an indicator of the effectiveness of antibiotic treatment employed, seemed justified. Although it is customary for the bacterial agent used in the test to be obtained from the patient involved, this was not done in this case for the following reason: *P. haemolytica* could not be isolated from every calf involved at the onset of the clinical trial and as the minimum inhibitory concentrations (MIC) of different *Pasteurella* isolates for a specific antibiotic can vary considerably[4], it was thought that a more overall picture of antibiotic efficacy would be obtained if each *Pasteurella* isolate was tested against the sera of each calf in the trial.

The sera from calves in Group 1 receiving oxytetracycline showed no or very limited (Table 2) bacteriostatic activity against the *Pasteurella* isolates used. This correlated with the clinical response and with respect to bacterial isolations carried out. All seven calves showed virtually no clinical response to the oxytetracycline treatment based on their habitus, appetite and the presence of tracheitis and pus on endoscopic examination (Table 4). Positive *Pasteurella* cultures were found in 4 out of 7 calves at the end of the trial (Table 4).

From the calves in Group 1, one *Pasteurella* was isolated (386), which, despite being sensitivity to oxytetracycline (on antibiogram), was not noticeably inhibited by the sera of animals in Group 1. This could have been caused by several factors including insufficient dosage and factors influencing absorption.

The results for the serum bactericidal activity test carried out on the calves in Group 2 essentially correlated with the clinical course of the condition but not with the sensitivity tests. The clinical condition, based on the parameters shown in Table 5 of five calves (21, 26, 29, 31 & 34), remained unchanged or deteriorated during the period of the trial whereas the remaining 2 (32 & 33) improved.

All four *Pasteurella* isolates were sensitive to penicillin on sensitivity testing using the Kirby Bauer technique, yet the sera of the calves in Group 2 were only inhibitory against one isolate (386) as is shown in Table 3. Isolate 386 was cultured from the tracheal wash of Calf 26. Despite bacteriostatic activity at high dilutions of the serum of this calf against its own isolate (Table 3), the clinical response was poor and the treatment was ineffective in eliminating the causative organism (Table 5). This raises the question as to what the desired titer for serum bacteriocidal or bacteriostatic activity should be to effect a clinical recovery. The most common recommendation in human medicine[6] is to adjust the antibiotic dosage to achieve a peak serum bactericidal activity titer of $\geqq$ 1:8. In the case in hand, a bactericidal activity titer of $\geqq$ 1:8 was present in the serum collected four and ten hours after the first injection (Table 3). This may imply that the dose of penicillin (30 000 IU kg^{-1} bodyweight) was insufficient.

The remaining three *Pasteurella* isolates (71, 72 & 426), despite being sensitive to penicillin on antibiogram (Table 1), were not inhibited by any of the serum dilutions from the calves in Group 2. This finding could have been related to the β-lactamase production by the isolates.

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ARTICLE ARTIKEL

BOVINE BRUCELLOSIS IN THE HIGHVELD REGION
1. EFFECT OF DELAY IN TRANSIT ON ROSE BENGAL TEST RESULTS

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ABSTRACT: Erasmus J.A.; Davey Sewellyn C. **Bovine brucellosis in the Highveld Region 1. Effect of delay in transit on rose bengal test results.** *Journal of the South African Veterinary Association* (1987) **58** No. 2 81-84 (En). Directorate of Veterinary Services, Veterinary Laboratory, P.O. Box 625, 9500 Kroonstad, Republic of South Africa.

Although the incidence of false negative rose bengal plate test (RBPT) results on sera which were delayed in transit for one to 17 days was > 0,65%, up to 7,2% of such reactions occurred in one infected herd. Since no correlation between the incidence of false negative RBPT results and delay in sera in transit could be found, it was postulated that this type of reaction should be attributed to animals in the early incubation stage of the disease or to individual variation in the rate of response to the RBPT; a problem which should resolve itself during consecutive tests. Blood samples taken from herds to be sold at sales or public auctions, however, should all be tested by the complement fixation test.

No correlation between the serum agglutination test and complement fixation test results were noted except where serum agglutination test titres exceeded 134 IU ml^{-1}.

Key words: Bovine brucellosis, delay in transit.

INTRODUCTION

The serum agglutination test (SAT) has for many years been the primary test for brucellosis in individual animals. This test has certain known limitations, especially in the early incubation stage, in the late chronic stage as well as in its ability to differentiate between antibodies resulting from infection and those due to vaccination[5]. When examining the value of the rose bengal plate test (RBPT) in the diagnosis of bovine brucellosis, Morgan, MacKinnon & Cullen[7] found a closer relationship between results obtained with the RBPT and the complement fixation test (CFT) than between results obtained with the RBPT and the SAT. Most countries subsequently introduced the RBPT as a screening test and the CFT as the definitive test for brucellosis.

False negative RBPT reactions, which should be of rare occurrence[4 7 8], may arise during the incubation stage or as a variation in the serological response by individual animals[6]. Serum from some animals, when delayed in transit, may also result in false negative RBPT reactions[1]. This phenomenon, which was noted in some batches of serum which were delayed in transit for >48 h, appeared to be unevenly distributed between batches and occurred mainly during the warmer months[1]. As delays in transit appeared not to affect SAT results[3], Herr[1] postulated that a combination of factors such as temperatures of about 40°C, together with the effect of agitation during transit and the action of enzymes produced by contaminants present in sera, resulted in amino acid denaturation thus affecting some or all of the antibody molecules. The degree of denaturation might be such that at pH 3,8 (RBPT) antigen-antibody binding is delayed or effectively blocked, but has no effect at pH 7,0 (SAT).

The authors knew that many batches of serum received at this laboratory are delayed in transit for c 48 h. A marked number of false negative RBPT reactions might thus be expected. In order to evaluate the occurrence of this reaction on sera delayed in transit, 2 sets of observations were made.

Firstly, selected batches of sera were screened by employing the standard RBPT and the microtitre SAT technique. All reactors to any or both of these tests were also subjected to the CFT. Secondly, selected batches of serum were screened by applying the RBPT, but all samples within these batches were also subjected to the CFT. By completing this study during the early winter to early spring of 1986, the effect of high temperatures during transit, was reduced.

MATERIALS AND METHODS

Double screening of sera

During the period April 1986 to June 1986, 46071 serum samples from 649 herds were received for routine brucellosis testing. The delay in transit, *i.e.* the time elapsing between collection of blood samples and performance of the RBPT, was recorded for each batch. On batches from farms where calfhood vaccination with strain 19 (S19) vaccine was practised or vaccine was not in use at all (known calfhood vaccination history), the RBPT was performed on each sample. When >10% of samples in a batch reacted to this test, the entire batch was subjected to the SAT as well. Sera reacting to either or both of these tests were finally subjected to the CFT. On batches from herds where adult vaccination was applied, all samples were subjected to the 3 tests mentioned. Test procedures employed were described by Herr, Bishop, Bolton & Van der Merwe[2] and by Herr et al.[3].

Entire batches subjected to RBPT and CF testing

Twenty six batches of serum, from which at least 5% of samples per batch reacted to the RBPT, were selected for CF testing on all samples.

According to the policy of the Directorate of Veterinary Services, an animal with known calfhood vaccination history should be regarded as a positive

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reactor if its CFT titre is ≧30 IU ml^{-1}. After adult vaccination a CFT titre of ≧60 IU ml^{-1} should be regarded as positive.

For the purposes of this study, a reaction was designated false negative if serum from an animal with a known calfhood vaccination history revealed a negative RBPT and a CFT titre of ≧30 IU ml^{-1}, or when serum from an adult vaccinated animal tested RBPT negative but had a CFT titre of ≧60 IU ml^{-1}.

RESULTS

Batches of serum received from 649 farms were delayed in transit for up to 17 days (Fig. 1). Only 32% of these could be tested within 48 h of sampling. The upper 50% and upper 90% of these batches could be tested within 4 and 7 days, respectively. Despite these delays, only 3 samples (0,12%), taken from cases with a known calfhood vaccination history, revealed false negative RBPT reactions (Table 1). Where adult vaccination was applied, no cases with false negative RBPT results were recorded.

The relationship between SAT and CFT results are summarised in Fig. 2. Of the 156 RBPT positive samples having SAT titres of ≧27 IU ml^{-1}, 92% had CFT titres of ≧24 IU ml^{-1}. Where the SAT titres were 34 -106 IU ml^{-1}, the number of CFT negative diagnoses slightly decreased (P>0,05) to 87%. Where the SAT titres were ≧ 134 IU ml^{-1}, 82% of these samples had CFT titres of ≧30 IU ml^{-1}. The overall incidence of false negative RBPT reactions in 26 infected herds was 0,64% (Table 2). This figure varied from 0 - 7,2% between batches. Delays in transit for up to 10 days (Table 2), obviously did not influence the occurrence of false negative RBPT reactions.

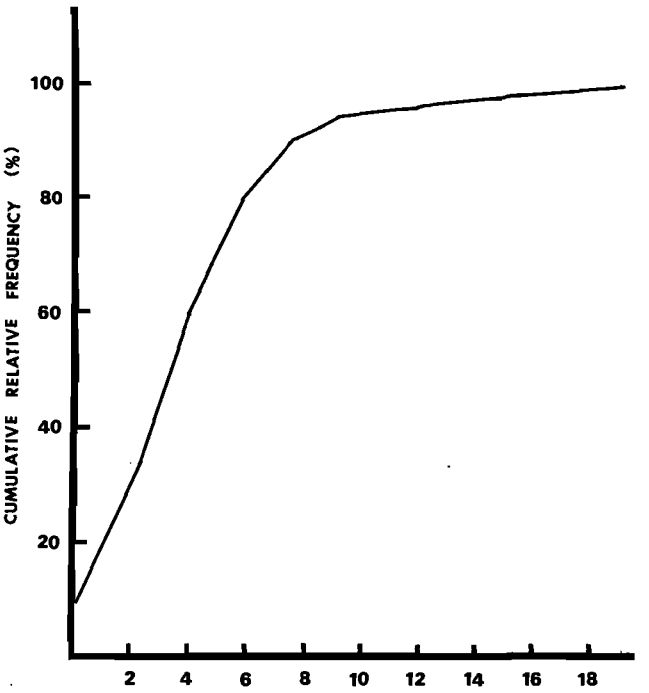

Fig. 1: Cumulative relative frequency curve for the number of days in which 649 batches of sera were in transit

DISCUSSION

About 70% of the 649 batches of serum tested during April 1986 to June 1986 were delayed in transit for >48 h. In fact, 3 of these batches could only be tested 17 days after collection of the blood samples. Nevertheless, the incidence of false negative RBPT reactions from herds with known calfhood vaccination histories was only 0,12%. As these results were obtained with the

Table 1: Serological results from herds with various vaccination histories

Vaccination history	RBPT	SAT	Number of sera with CFT titre of 0 - 24 IU ml^{-1}	30 - 49 IU ml^{-1}	≧60 IU ml^{-1}	Total
Known calfhood vaccination	+	<17	90	5	4	
		17-27	58	1	1	
		34-67	151	9	5	
		≧80	87	9	183	603
	−	<17	1620	1	0	
		17-27	97	1	1	
		30-67	179	2	0	
		≧80	22	0	1	1924
Total				(0,08%)	(0,04%)	2527
Vaccinated as adults	+	<17	5	2	0	
		17-27	45	0	1	
		34-67	163	9	1	
		≧80	108	25	29	388
	−	<17	80	0	0	
		17-27	18	0	0	
		34-67	26	0	0	
		≧80	0	0	0	124
Total						512

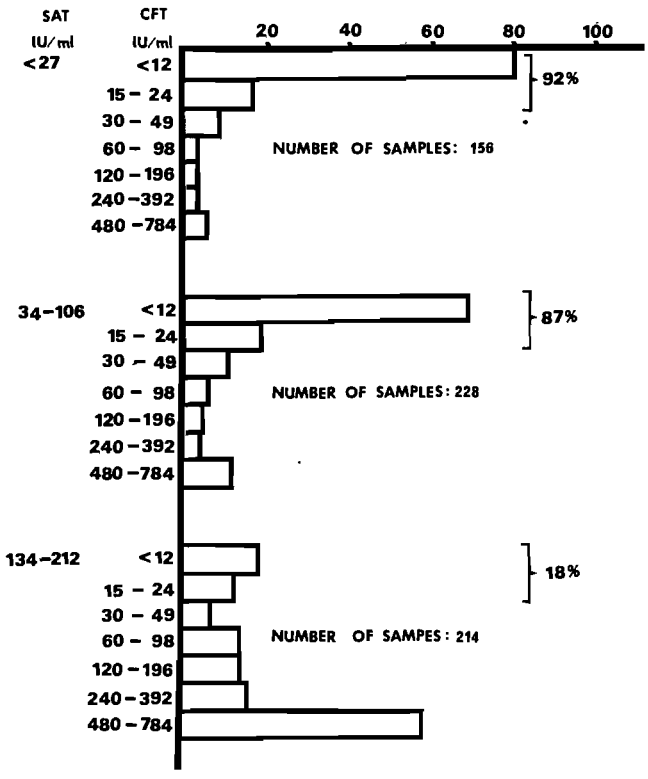

Fig. 2: Distribution of CFT titres at various SAT antibody levels

microtitre SAT, which has been shown to be more sensitive than the standard tube test[3], the double screening technique at a routine diagnostic laboratory appears to be a superfluous exercise when applied to control false negative RBPT reactions during the cooler months of the year.

Where the RBPT and the CFT was performed on all samples within a batch, important differences in the results were apparent. Although the overall incidence of false negative RBPT reactions was 0,64%, such reactions occurred at a rate of up to 7,2% in one of the selected 26 herds (Table 2). No correlation could be found between delay of serum in transit and the occurrence of false negative RBPT reactions (Table 2). From available information with regard to false negative RBPT reactions[6], one could at this stage, postulate that false negative reactions obtained in this study could be attributed to factors such as animals being in the early incubation stage of the disease or to individual variation in the rate at which some cases respond to the RBPT.

Overall false negative RBPT reactions of up to 0,64% seem to correspond well with figures obtained internationally. Increased false negative reactions within some herds, clearly, is not a phenomenon confined to high ambient temperatures and is not influenced by delays in transit during cooler weather either. Based on current information, such reactions should be expected in recently infected animals or in late responders to the RBPT. An incidence of 7,2% of false negative RBPT

Table 2. The incidence of false negative RBPT reactions on sera from 26 herds

Days in transit	Farm number	Samples in each batch	False negative reactions	% of false negative reactions
1	7	76	1	1,3
	9	79	0	0
	12	69	5	7,2
	22	91	0	0
2	1	44	2	4,5
	4	77	0	0
	8	81	0	0
	11	163	0	0
3	14	51	0	0
	15	74	0	0
	16	49	1	2,0
	19	79	0	0
	23	88	0	0
	24	29	0	0
4	2	11	0	0
	5	170	0	0
	17	44	0	0
	18	70	0	0
	20	76	0	0
	21	76	1	1,5
5	3	84	0	0
	10	281	0	0
	13	117	2	1,7
7	6	87	2	2,3
	26	52	0	0
10	25	73	0	0
Total		2191	14	0,64

results, is alarming, but in view of the possible causes, this problem should resolve itself during consecutive tests in the same herd. From this data it is evident that, when sera are tested to clear herds to be sold at a sale or a public auction, the CFT should be performed on all samples.

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ARTICLE ARTIKEL

THOROUGHBRED BLOOD SERUM INORGANIC PHOSPHATE CONCENTRATIONS IN RELATION TO FEEDING REGIME AND RACING PERFORMANCE

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ABSTRACT: Denny J E F M **Thoroughbred bloodserum inorganic phosphate concentrations in relation to feeding regime and racing performance.** *Journal of the South African Veterinary Association* (1987) **58** No. 2, 85-87 (En). Department of Animal Health and Production, Faculty of Veterinary Science, Medical University of Southern Africa, 0204 P O Medunsa, Republic of South Africa.

Horses receiving a pelleted or cubed dietary supplementation with roughage, have serum inorganic phosphate (SIP) concentrations consistently below an accepted mean of 1,032 mmol ℓ^{-1} or 3,1 mg dl^{-1}. Further, it has been reported that the best eight, two-year-old Irish Thoroughbred track performers of 51 horses tested over a 10 month period, had significantly lower SIP concentrations than the worst eight track performers. In an endeavour to assess any nutritive effect on SIP concentrations and also to assess any effect of SIP concentrations on track performance, metabolic blood profiles from 303 horses in training at the Summerveld Training centre in Natal, were evaluated for various blood parameters over a two year period. Of these 303 profiles, 264 were analysed for SIP concentrations. These horses were on three known feeding regimes viz. Feed 1 — cube feeding plus hay; Feed 2 — oats, wheaten bran and greens plus hay; Feed 3 — Mixed feeding regime of feeds 1 and 2; Feed 4 — unknown regime. Dry matter intake varied between 2 and 2,5% of estimated bodymass and in the Feed 1 regime, the proportion of cubed supplement in the diet was increased from 30 to 70% as the training programme progressed. Statistical analysis of SIP concentrations showed that horses on the Feed 1 regime had significantly lower SIP concentrations than horses on the other feed regimes. Of the 303 profiles, 224 could be identified with actual races. Performances of horses on the various feeding regimes were, for Feed 1 - 101 races, 52,5% placed and 47,5% unplaced; Feed 2 - 66 races, 36,6% placed and 63,4% unplaced; Feed 3 - 26 races, 25,92% placed and 74,07% unplaced; Feed 4 - 30 races, 60% placed and 40% unplaced. It is suggested that the lower SIP values of the horses on Feed 1 may be due to inadequate phosphorus absorption caused by rapid ingesta passage rate or because of increased carbohydrate metabolism coupled with increased training. The latter may also be associated with better track performance.

Keywords: Thoroughbred, serum inorganic phosphate, feeding regime, racing performance.

INTRODUCTION

The practice of using blood profile parameters as a guide to the fitness of racehorses has long been used and, in fact, blood sampling and haematology are routine procedures for most training establishments.

Two main areas of extensive study of the Thoroughbred's haemogram have been the changes occurring because of training, and the relationship between the parameters of the haemogram and racing performance. The controversy surrounding the relationship between the haemogram of the Thoroughbred and subsequent racing performance, however, appears to remain unresolved[9].

Little work has been carried out on the relationship of various blood parameters to nutritional status and performance, respectively. The objective of blood sampling could well be expanded to include monitoring to detect nutritional deviations which could lead to suboptimal performance of racehorses. A blood parameter which could be worthwhile investigating, is serum inorganic phosphate concentration.

It has been stated by Van der Walt[10], that horses, receiving a cubed or pelleted dietary supplement, have serum inorganic phosphate concentrations consistently below an accepted mean of 1,032 mmol $\ell.^{-1}$ This worker further suggested that commercially manufactured cube supplements should have a higher phosphorus content. Other workers[5] have, interestingly, reported that the best eight, two-year-old Irish Thoroughbred track performers from 51 horses measured on seven occasions over a 10 month period, had significantly lower serum inorganic concentrations than the worst eight; the mean and standard deviation of the best eight being 0,98± 0,12 mmol ℓ^{-1} and the worst eight 1,08± 0,21 mmolℓ^{-1}.

It was therefore decided to evaluate serum inorganic phosphate (SIP) as a parameter in relation to feeding regime and track performance.

MATERIALS AND METHODS

Metabolic blood profiles, from 303 horses over a two year period, at the Summerveld training centre in Natal, were evaluated for various blood parameters. Of these profiles, 264 were analysed for SIP concentrations and were statistically analysed to determine any relationship with feed regime. In addition, 224 of the total 303 profiles could be equated with actual races and feed regime. They were also analysed to establish any relationship between feeding and performance. Three known feeding regimes and one unknown were used which were as follows:

Feed 1: Horses which were fed a balanced commercial cube supplement with hay (generally teff hay). The cubed supplement generally contained 16% crude protein and had an energy content of 12 MJ kg^{-1}.

Feed 2: Horses which were fed a conventional diet consisting mainly of oats, wheaten bran, greens such as carrot tops, freshly cut grass and teff hay.

Feed 3: Horses which were fed a mixture of cubed supplement in variable quantities with oats, bran, greens and hay.

Feed 4: Unknown.

In all cases the hay was mainly teff with variations occurring only when supply was short. Dry matter intake

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Table 1: Variation of cube supplement/hay ratio fed at different training stages

Work load	Percentage cube supplement	Percentage hay
Light work or training	30	70
Medium work or training	50	50
Heavy work or training	70	30

figures were based on 2-2,5% of the livemass, which was the amount of feed recommended to the trainers as a daily intake for each horse. Further, the cubed supplement and hay ratio of Feed 1 varied depending on stage of training as shown in Table 1.

Venous blood from horses at rest was extracted from the jugular vein, two to three days prior to a race, with an evacuated tube (Venoject, Terumo Corporation, Tokyo, Japan) using an 18 gauge needle. SIP concentration was determined by means of Harleco kits and read on a Guildford spectrophotometer and in this trial measured in mg dl^{-1}. Statistical analysis of results was carried out using the X^2 method described by Rayner[8] and analysis of variance SPSS method[9].

RESULTS

The SIP concentrations of horses receiving Feed 1 were significantly lower ($P<0,01$) than for both other known feeds. Mean SIP concentrations with Standard Errors are illustrated in Figure 1 and given in Table 2. The mean SIP concentration for horses receiving the unknown feed, although not given in Table 2, was 3,37± 0,07 or 1,087 mmol ℓ^{-1} which was also significantly higher than Feed 1 but lower than Feed 2 & 3. In an endeavour to assess the effect of feed regime on track performance, 224 profiles, from which performance on the racetrack could be equated, were analysed to establish any relationship between feed type and performance.

Table 2: Mean serum SIP concentrations from horses on three known feeds

Feed	n	Mean mg dl^{-1}	Standard error	Mean mmolℓ^{-1}*$^{-1}$
1	111	3,013	0,0575	0,971
2	116	3,383	0,0575	1,091
3	37	3,519	0,1057	1,135
	264			

* Converted from mg dl^{-1} by division of a factor 3,1.

The effect of feeding regime on placings in 224 races is given in Table 3.

The horses on the cube feeding regime (Feed 1) had better performances than those on the other two known feeding regimes particularly when the first three placings are considered.

The horses on the unknown feeding regime (Feed 4) also performed well. In order to statistically assess the results presented in Table 3 a X^2 test for independence

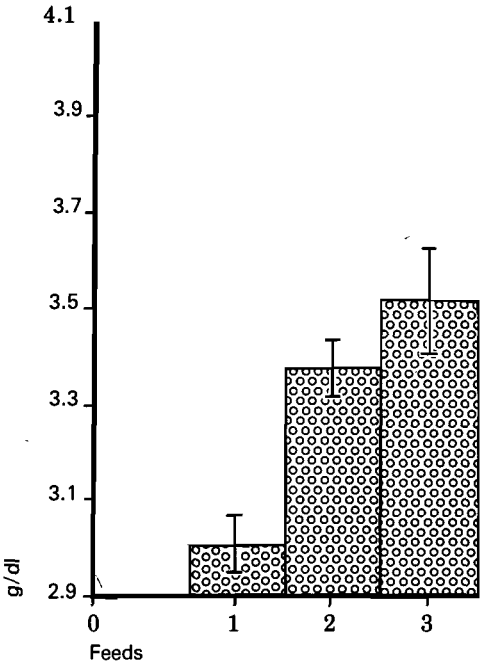

Fig. 1: Serum inorganic phosphate distribution with standard errors indicated

using a 5 x 4 contingency table, was carried out. It was found that the placing proportions do vary ($P<0,05$), the discrepancy from homogeneity being more marked for the unplaced horses.

Figures from the contingency table were extracted to illustrate the performance of horses receiving Feeds 1 & 4 which as observed from Table 3, were the best performance groups. (Fig 2).

It will be observed from Fig. 2 that the group receiving cubes (Feed 1) produced more first and second race placings than expected while the group receiving Feed 4 (unknown feed) produced a more than expected number of fourth placings. Should fourth placings have been removed from Table 3, it is apparent that the group receiving Feed 1 had superior performance.

DISCUSSION

Literature norms for serum inorganic phosphorus concentrations vary considerably. For example Berrier[1] gives a range of 1,29-2,58 mmol ℓ^{-1} and Blood, Henderson & Radostits[2], 1,0-1,8 mmol ℓ^{-1}. Coffmann[3] reported that horses receiving a diet with a calcium to phosphorus ratio of 2/1, had SIP levels ranging between 1,03-1,267 mmol ℓ^{-1} and he further adds that horses receiving pelleted or cubed feeds as a full concentrate supplement, have SIP concentrations consistently lower than this.

Table 3: The effect of feeding regime on placings in 224 races.

	Placings												
	1		2		3		4		Unplaced		Total	Percentage	
Feed	n	%	n	%	n	%	n	%	n	%		P	U
1	15	14,85	20	19,80	10	9,90	8	7,92	48	47,52	101	52,47	47,52
2	10	15,15	4	6,06	5	7,57	5	7,57	42	63,63	66	36,36	63,63
3	2	7,40	2	7,40	1	3,70	2	7,40	20	74,07	27	25,92	74,07
4	4	13,33	4	13,33	5	16,66	5	16,66	12	40,00	30	60,00	40,00

P = placed U = unplaced n = number

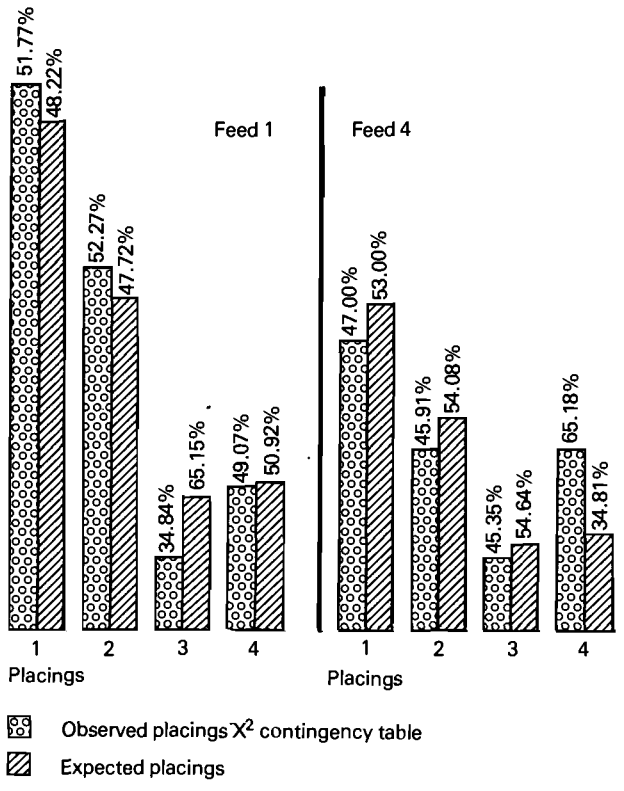

Fig. 2: Observed and expected race placings of horses on Feed 1 and Feed 4 from X^2 contingency table

This latter statement has been confirmed in this survey where horses on Feed 1 (cube supplement) had a mean SIP concentration of 0,971 mmol ℓ^{-1} which was not only below accepted norms but was also significantly lower than the means of horses on other feeds.

Earlier work[5] suggested that low SIP concentrations of 0,98 mmol ℓ^{-1} may be related to good performance. Results from this survey support this view as horses receiving a balanced cubed supplement and hay produced superior performance to horses on other feeds with the exception of horses on unknown feeding regimes. However, analysis of placings of horses on the cube supplement feeding regime were greater than expected while this occurred only in respect of fourth placings for horses on the unknown feeding regime. Thus if fourth placings were removed from the X^2 analysis, the performance of horses on the cube feeding regime was superior. In addition, as horses on the cube feeding regime predominated throughout the survey, it is suggested that a fair proportion of horses on the unknown feeding regimes were in fact receiving a cube supplement with hay.

From a nutritional point of view the poorer performance of horses on Feeds 2 & 3 could probably be ascribed to an imbalance of the total daily ration. The horses receiving the mixed feed, which contained variable proportions of cubed supplement, had the highest SIP concentrations. It could be expected that the diet was imbalanced particularly with regard to vitamin and mineral concentrations since the cubed supplement was not the only concentrate source.

The lower SIP serum concentrations found in balanced cube fed horses may have been a result of the rapid rate of passage of ingesta leaving insufficient time for phosphorus absorption in the dorsal and small colon. Hintz[6] has observed that cubing or grinding feed increases the rate of passage of feed through the tract but that cubed or pelleted feed has a faster passage than grain and hay feeds. Denny[4] has further shown faecal calcium and phosphorus content is higher when horses receive cubed or pelleted feed has a faster passage than grain and hay feeds. Denny[4] has further shown that faecal calcium and phosphorus content is higher when horses receive cubed feed. Other possibilities of low SIP concentrations are firstly increased carbohydrate metabolism. Irish workers[5] have suggested that when exercising maximally, best performers catabolise creatine phosphate at a greater rate and after exercise have a greater net requirement for and a greater efficiency in regenerating creatine phosphate from creatine and inorganic phosphate. Thus, should the rate of passage of cubed feeds affect performance, raising the phosphorus level in balanced cubed supplements could be worthwhile investigating although low SIP concentrations in this study appeared to be advantageous.

Secondly, increased exercise also has an effect on the rate of passage of the ingesta which could be synergistic with cubing of the supplement and the possible consequent decreased intestinal content could reduce stress on the horse.

Thirdly there could be a training-feeding interaction implying better educated trainers, better fitness-to-race evaluation and better management practices.

This suggests that disciplined feeding and training could be coupled in producing better performance.

It is concluded that, apart from genetic or pathological blood parameter values, serum inorganic phosphate concentrations could be used to evaluate racing performance potential of the Thoroughbred and that this in turn could be related to feed regime and stage of training.

Suggested SIP concentrations which could be used to predict good racing performance potential are in the region of 3,013 g $d\ell^{-1}$ or 0,972 mmol ℓ^{-1}.

ACKNOWLEDGEMENT

The assistance of Dr Brian Baker in providing laboratory facilities and blood profile data is acknowledged with thanks.

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CASE REPORT **GEVALVERSLAG**

THE PATHOLOGY OF A CASE OF BILIARY ATRESIA IN A FOAL

STELLA S. BASTIANELLO*, and J.W. NESBIT*

ABSTRACT: Bastianello Stella S.; Nesbit J.W. **The pathology of a case of biliary atresia in a foal.** *Journal of the South African Veterinary Association* (1986) **57**, 89-92 (En) Department of Pathology, Faculty of Veterinary Science, University of Pretoria, P/Bag X04, 0110 Onderstepoort, Republic of South Africa.

The pathological features of biliary atresia in a foal are described. A 4-week-old American Saddler foal was presented for autopsy following an illness characterised by clinical features indicative of hepatic failure. The significant macroscopical lesions occurred in the liver which was extremely enlarged, mottled in appearance and indurated. Bile stasis was evident. Lobular distinction was absent and on sectioning, large bile ducts were absent. A moderate ascites, hydrothorax and hydropericardium and a mild anasarca and intermuscular oedema accompanied the hepatic lesion. The diagnosis of biliary atresia was determined by the histo-pathological features of bile duct proliferation and extensive replacement fibrosis. The condition is compared to extrahepatic and intrahepatic biliary atresia of man and evidence is presented for regarding this case to be one of extrahepatic origin.

Key words: Pathology, biliary atresia, equine.

INTRODUCTION

Congenital biliary atresia is a well documented although rare entity of human infants, in which it may be either intrahepatic or extrahepatic in origin[3]. In animals, biliary atresia is extremely rare but has been reported in rhesus monkeys, mice, pigs and a foal[2,7].

The aetiology of biliary atresia in equines is completely unknown and there is only one record of the condition in foals[7]. This report describes the pathology of a case of biliary atresia in a foal.

HISTORY AND CLINICAL SIGNS

The foal presented for post-mortem examination was the fourth foal of an American Saddler mare. Although the foal was born 2 weeks prematurely, the gestation and birth of the foal had been uneventful. As far as could be ascertained, the 3 previous foals are still in good health. This particular foal progressed well until 3 weeks of age when it became listless, anorectic and icteric. A few days later, it developed a recurring high fever, polydipsia, polyuria and resultant dehydration. The animal was treated intensively with antibiotics, multivitamin preparations, liver stimulants and fluid therapy. The foal did not show any improvement and died within a week of the onset of illness when it was presented for autopsy.

PATHOLOGY

A complete post-mortem examination was performed. Specimens of the liver and a series of other tissues were collected in formalin for routine histopathological examination. Routine sections were prepared from paraffin-embedded tissue blocks and stained with haematoxylin and eosin (HE). Selected sections of the liver were stained with the Hall's stain for biliverdin, Berlin blue for haemosiderin, Masson's trichrome for collagen, the Gomori reticulin impregnation (GRI) method for reticulin fibres, periodic-acid-Schiff (PAS) for mucopolysaccharides, and PAS, Schmorl's and the long Ziehl-Nielson (ZN) methods for lipofuscin[4].

Macroscopic Pathology

The carcass was in a fairly poor condition. A moderate icterus was present. Oedema was evident as a mild anasarca and intermuscular oedema involving the large muscles of the back and limbs together with a moderate ascites, hydrothorax and hydropericardium.

The liver was extremely enlarged and firmer than normal. The capsular vessels were distended and tortuous and numerous subcapsular petechiae and ecchymoses were evident (Fig. 1). The colour varied from pale pink to yellowish-white interspersed with blotchy purple areas. The lobular architecture was no longer discernible. When sectioned, no large bile ducts were evident. There was no obvious abnormality of the extrahepatic bile duct, but the patency thereof was unfortunately not determined. There was an irregular deposition of fibrous tissue which occurred as strands, a few mm to several cm in width, both on the surface and within the substance of the liver (Fig. 2). The fibrous tissue occasioned the variation in colour described above. After formalin fixation, the hepatic tissue appeared as islands of dull green tissue interspersed amongst the fibrous strands.

Other findings included moderate congestion and oedema with multifocal petechiae and ecchymoses of the lungs; moderate lymphoid atrophy of the spleen and lymph nodes; moderate congestion of the entire gastrointestinal tract; absence of gastric contents; the presence of pasty, grey colonic contents and a mild serous atrophy of the mesenteric fat depots.

Histopathology

The predominant finding was a pronounced proliferation of bile ducts which were surrounded by a variable amount of fibrous tissue (Fig. 4). The hepatic tissue was distinguishable as islands of hepatocytes interspersed amongst this mass of ductular and fibrous tissue. In the less severely affected areas the hepatic tissue exhibited a

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degree of confluence so as to form the predominant component of the tissue (Fig. 3).

The newly formed or actively proliferating bile ducts encompassed lumens of varying size and shape. The lining cells were cuboidal with an amphophilic cytoplasm and round to oval, vesicular nuclei. Occasional duplication of the lining epithelium was evident (Fig. 5) as well as a relatively high mitotic index averaging 2 mitoses per 40 X magnification field. In many instances the lining cells had separated from the underlying basal lamina (Fig. 5). Several of these cells exhibited vacuolar degeneration, many of the vacuoles containing homogenous acidophilic inclusions of varying size (Fig. 6). Focal flattening of the lining epithelium was evident in many of the more mature bile ducts. The lumens of these ducts were mostly empty although some contained cytoplasmic debris or the occasional, isolated desquamated and necrotic epithelial cell (Fig. 5). A noteworthy feature was the complete absence of bile within the lumens of the proliferating bile ducts.

The fibrous tissue component consisted mostly of fibroblastic or mature collagenous tissue (Fig. 3-15). The fibroblastic tissue consisted mostly of mature, elongated, fibroblasts, fewer plump, immature fibroblasts, moderate amounts of reticulin fibres and some collagen fibres. Many of the mature fibroblasts exhibited pyknosis or karyorrhexis whilst some of the immature fibroblasts were in the process of mitosis. The collagenous tissue was composed of collagen fibres which varied from strands a few fibres thick to wide bands, the latter occurring especially in the vicinity of blood vessels. There was moderate oedema of the fibrous tissue and mineralisation of some of the reticulin fibres.

The islands of hepatic tissue exhibited loss of architectural structure. In the less severely affected portions, portal triads or central veins were occasionally discernible. The portal triads were noteworthy because of 2 characteristics: firstly, a total absence of normal bile ducts and, secondly, vascular hypertrophy or hyalinisation. Another significant feature was parenchymal cholestasis characterised by distension of the canaliculi with bile. The hepatocytes revealed prominent nuclear and cytoplasmic changes. These included cytoplasmic degeneration (Fig. 7 & 8) and pigmentation, anisonucleosis and a moderate degree of binucleation (Fig. 7) and multinucleation (Fig. 8). The hepatocytes in the smaller islands of hepatic tissue, almost without exception, showed varying degrees of degeneration from cloudy swelling through hydropic changes to hyaline droplet degeneration (Fig. 7 & 8). On the other hand, only a small proportion of the hepatocytes within the larger islands exhibited these degenerative changes. Many of the degenerated hepatocytes contained varying amounts of lipofuscin and bile pigments. Similar pigments were also present within the Kupffer cells which appeared prominent and hyperplastic.

Focal scattered round cell aggregates were present at the edges of the remaining hepatic tissue. These aggregates were composed predominantly of small and large lymphocytes, some macrophages and isolated neutrophils and plasma cells. Many of these cells exhibited pyknosis or karyorrhexis.

DISCUSSION

Van der Luer & Kroneman[7] reported on the passage of soft, grey clay-like faeces and clinical pathological tests indicative of total obstruction of bile flow in a foal with extrahepatic biliary atresia. Pasty grey contents were present in the colon of this foal but no clinical pathological tests were performed. The jejunal intussusception was regarded as a terminal and incidental event not connected to the hepatic pathology.

The diagnosis of biliary atresia in this foal was based on the histopathological features of the liver. These comprised a diffuse and extensive bile duct proliferation and hepatocellular depletion with fibrous replacement resulting in eventual effacement of the lobular architecture. An important diagnostic feature was the complete absence of any pre-existing bile ducts in the remaining portal triads. The bile duct proliferation was regarded as an abortive attempt to engender continuity of the biliary excretory pathway in the affected neonatal animal. The failure to form a functional biliary tree led to an ongoing, progressive proliferation of bile ducts in a disorganised fashion resulting in parenchymal degeneration and atrophy, replacement fibrosis and consequent loss of architectural structure. The hyalinisation of the portal vessels together with the presence of tortuous subcapsular vessels probably represent an attempt to compensate for the portal hypertension which arose consequent upon the severe hepatic fibrosis[5].

In man, 2 types of biliary atresia (extrahepatic and intrahepatic) are recognised. Extrahepatic biliary atresia is progressive in nature and is associated with periportal and perilobular fibrosis, bile duct proliferation, cholestasis, pseudoxanthomatous transformation (lipofuscinosis), giant cell formation (in about 15% of cases), hepatocellular copper accumulation and ultimately cirrhosis[3]. Intrahepatic biliary atresia, on the other hand is seldom progressive in nature, being characterised by a paucity of intrahepatic bile ducts in the portal triads, occasional non-progressive periportal fibrosis and patchy pseudoxanthomatosis[3]. The histological lesions in this case conform to those of extrahepatic biliary atresia in man and is in agreement with the reported findings of a similar case in a foal[7].

The aetiology and pathogenesis of biliary atresia in animals is unknown. Whilst conjectura, 2 pathogenetic mechanisms are recognised in man, firstly, a congenital absence of bile ducts and secondly, postnatal destruction of bile ducts following chronic cholangiohepatitis.

Fig. 1: Grossly enlarged pale liver with subcapsular haemorrhages.
Fig. 2: Cross-section of the liver in a less severely affected area. The white areas represent the fibrous tissue traversing the dark-coloured hepatic tissue.
Fig. 3: Severe perilobular fibrosis and bile duct proliferation. Note absence of portal triads within the hepatic tissue. HE X 40.
Fig. 4: Marked bile duct proliferation. Note the extensive fibrosis and parenchymatous remnants (P). HE X 100.
Fig. 5: Proliferating bile ducts embedded within fibrous connective tissue. Note the duplication of the epithelium (arrowheads), cytoplasmic debris within the lumen and separation of the epithelium from the underlying basal lamina. HE X 200.
Fig. 6: Note the cytoplasmic inclusion within a bile duct epithelial cell (arrowhead). HE X 1000.
Fig. 7: Degenerative changes within the hepatocytes. A binucleated cell is arrowed. HE X 400.
Fig. 8: Hepatocytes in various stages of degeneration. A multinucleated cell is arrowed. HE X 400.


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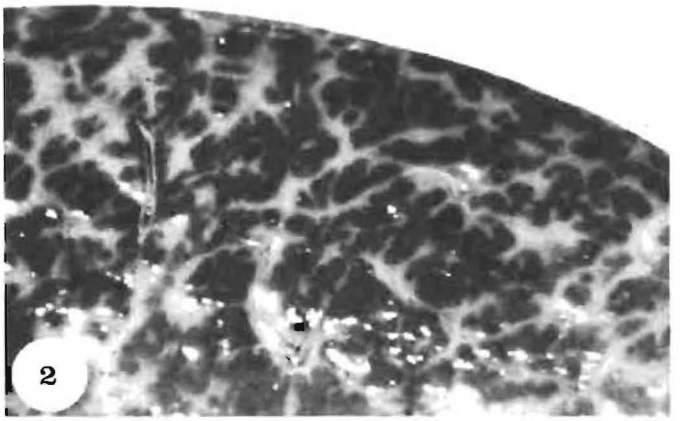
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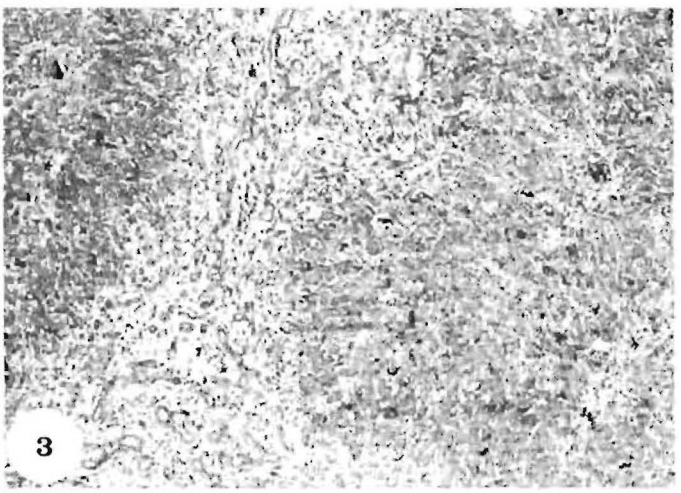
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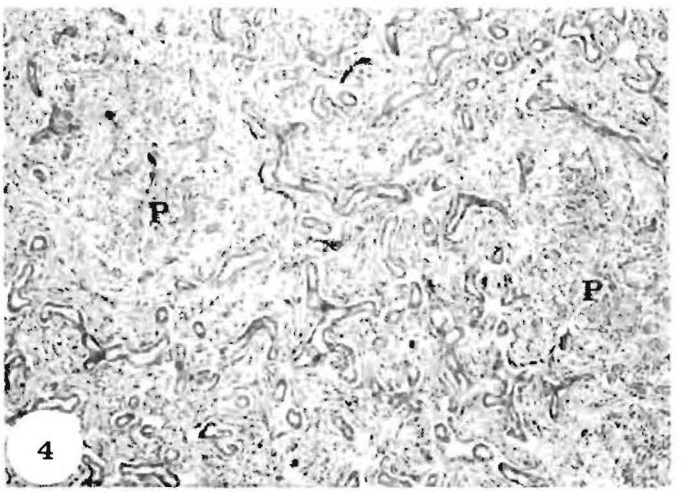

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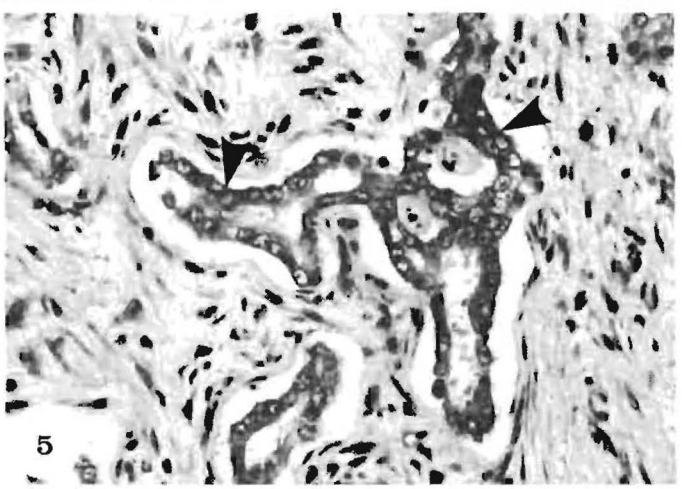
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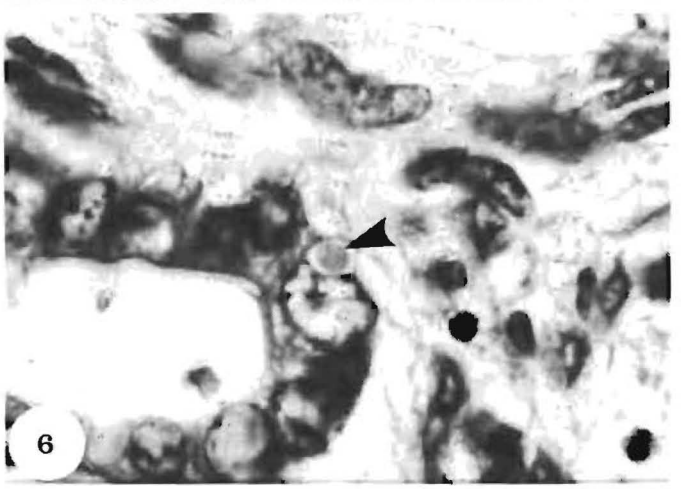
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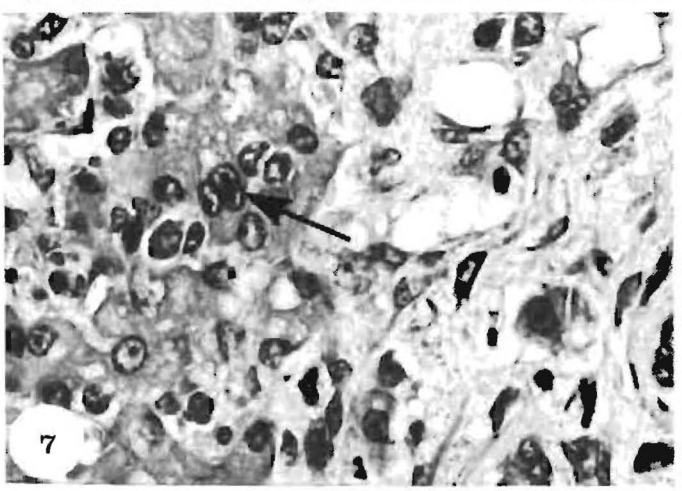
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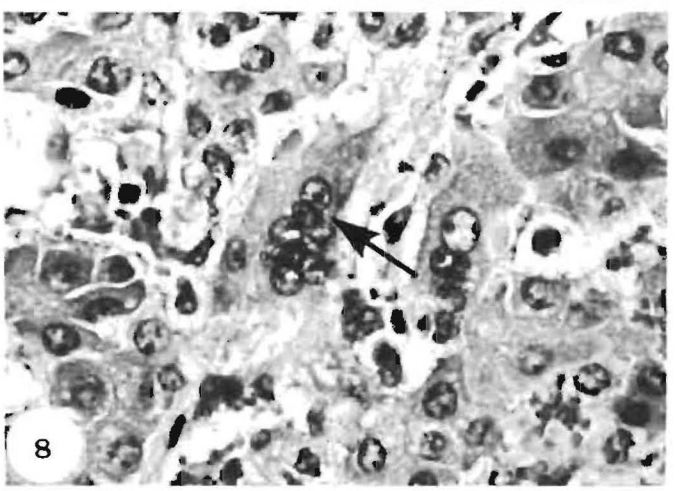
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In so far as the latter is concerned, certain viral infections, namely rubella, varicella, reovirus and cytomegalovirus have been implicated[3]. Although a cholangiohepatitic pathogenesis cannot be excluded, it is our opinion that in this case, the biliary atresia was congenital in nature. A similar conclusion was arrived at by Van der Luer & Kroneman in their recently reported study of biliary atresia in a foal[7].

A hepatopathy of foals with similar but not identical features to that of extrahepatic biliary atresia has recently been described[1,6]. This condition, however, involved foals 2-6 days of age and was associated with the feeding of a nutritional paste containing fermentation agents which presumably produced mycotoxins[1,6]. No such product was administered to this foal.

Extrahepatic biliary atresia should be considered as a pathological entity in foals 4-6 weeks of age showing signs of hepatic failure. Histopathological examination of the liver will confirm the diagnosis.

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HAEMONCHUS CONTORTUS RESISTANCE TO IVERMECTIN

We have investigated the use of ivermectin in sheep at three locations in the western Cape Province, South Africa. At all three locations, grazing on spray-irrigated kikuyu pastures was intensive and without the benefit of rotation with cattle or to other pastures. These factors along with unseasonably warm weather may have favoured both an increase in the number of generations of *Haemonchus contortus* and its survival on pasture. Ivermectin was administered at intervals of approximately 3 to 5 weeks over periods of 18 to 24 months. This intensive use of ivermectin under the described conditions resulted in the emergence of resistant strains. Our laboratory investigations of two of the field isolates have shown that they are sensitive to trichlorfon, oxfendazole and levamisole. Studies with these strains are continuing.

These findings underscore the danger of exclusive reliance upon repeated use of a single anthelmintic product without consideration of treatment programs integrated with other management practices in the control of helminthiases of sheep. Particular care should be exercised to utilize the full recommended dose based on actual body weights.

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BOOK REVIEW — BOEKRESENSIE

PRACTICES IN VETERINARY PUBLIC HEALTH AND PREVENTIVE MEDICINE IN THE UNITED STATES

GEORGE T. WOODS (Editor)

The Iowa State University Press, Ames, Iowa 50010, 1986 pp xviii + 347, tabs 16, figs 33, Price £32,50 (ISBN 0-8138-1441-3)

This publication consists of 24 individual papers, by 15 individual contributors, divided into three parts i.e.

1. Practices in Veterinary Medical Public Health and Preventive Medicine Administration
2. Practices in Prevention, Control and Eradication of Selected Infectious Diseases and
3. Environmental Health Practices in Veterinary Public Health and Preventive Medicine. The purpose of the book is to focus on specific examples of practices in the USA related to herd health and community medicines topics.

It is a comprehensive work providing details of a great variety of activities in the USA which fall under the scope of the title of the book. These include matters such as the Administration of County Health Departments. Veterinary Public Health Programmes, Teaching Public Health in Veterinary Curricula, the Control and Eradication of Brucellosis, Bovine Mastits, Mycobacterial Infections in Swine, Bovine Cysticercosis, Bovine Tuberculosis, Hydatid Disease, Surveillance of Trichinosis, Canine Rabies Control, Disease Prevention in Laboratory Primates, Residues, and Public Health Implications of waste-water sludge distribution on land, Animal Models and Epidemiology. Each contributor has supplied a full list of references and papers contain a mint of valuable and specific information. The provision of an index adds considerably to the value of the book and it is highly recommended to all those with an interest in this field of veterinary activity.

L W VAN DEN HEEVER

FOOD QUALITY CONTROL: FOODS OF ANIMAL ORIGIN

HARRY V. HAGSTAD and WILLIAM T. HUBBERT

1st Edn. The Iowa State University Press, Ames, Iowa, 50010. 1986 pp VIII and 148, numerous illustrations and tables, Price $12,95 (ISBN 0-8138-0702-6)

The book describes the identification of potential hazards and critical control points in the food production chain. As far as this aspect is concerned, the book is clear and concise, giving the reader a broad outline of the production process and the identification of potential hazards. From this point of view, it could be a useful book for both students and veterinarians.

However, the essential elements of a control system are the identification of potentially critical points in the production process, the analysis of the associated hazards and the establishment of acceptance/rejection criteria, and finally, the establishment of systems to ensure that effective control is maintained.

The title of the book implies that it is also concerned with quality control. There is no attempt to analyse the potential hazard, establish acceptance criteria or give any guidance as to control systems. From this point of view, the title is misleading.

Consequently for readers interested in functional quality control this book cannot be recommended.

J P DU PLESSIS

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CURRENT THERAPY IN EQUINE MEDICINE

N. EDWARD ROBINSON

2nd Edn. W.B. Saunders Company, West Washington Square, Philadelphia PA19105. 734 pages with a few illustrations and two excellent appendices on: 1) Normal Clinical Pathology Data and 2) Table of Gommon Drugs and Dosages (ISBN.....)

The book is divided into 18 sections including the appendices.

The consulting editors and contributors are drawn from the best and most outgoing of current equine practitioners, researchers and lecturers from around the world. Some of these are personally known to me such as Jill Beech, Harold Hintz, Ruben Rose, Sid Ricketts, Gary Carlson, James Coffman, Robert Cook, Leo Jeffcott, Al Mermitt, Malcolm Roberts, Peter Rossdale, David Snow and M Vandeplassche. There are also certain contributors from Onderstepoort, Frank Bristol, Chris Button, Michael Shires and Sandy Littlejohn.

I found the book to be very up to date, very practical and in parts fascinating reading. The 18 sections are as follows: 1) Alimentary Tract Diseases; 2) Behavioural Problems; 3) Cardiovascular Diseases; 4) Endocrine Diseases; 5) Foal Diseases; 6) Foot Diseases; 7) Hematopoietic Diseases; 8) Internal Parasites; 9) Neurologic Diseases; 10) Nutrition; 11) Ocular Diseases; 12) Problems of the Performance and Endurance Horse; 13) Reproduction; 14) Respiratory Diseases; 15) Skin Diseases; 16) Toxicology; 17) Urinary Tract Diseases; 18) Appendices. While I had intended to skip through them, I soon realised that there is such a host of new information in virtually all the sections and it is so simply and practically presented, I found myself reading each and every detail.

I would strongly recommend this excellent book to anyone with an interest in the equine — be he a student, a new or old practitioner or one of the professional staff at a teaching institute.

In particular I personally found the section on colic and abdominal disorders to be very comprehensive.

The section on cardiovascular diseases tended to be a bit complicated especially when dealing with echocardiography, but the section on cardiac arrhythmias was very comprehensive and practical.

The following topics are dealt with individually:

Section 4 on Endocrine diseases — reaffirms their presence and the lack of practical treatment.

Section 5 on Foal diseases is both detailed and practical. Leo Jeffcott's section on passive transfer of immunity to foals is excellent as is the table on the D.D's of diarrhoea in foals. Gastroduodenal ulcers is well covered.

Section 6 Foot diseases — the old saying "no foot no horse" is very accurate and this section is both practical and thorough.

Section 7 Hematopoietic Diseases is adequate.

Section 8 Internal Parasites — re-emphasises the severity of this problem to the equine practitioner and gives some practical advice on when to treat, how to clean up pastures and what drugs to use.

Section 9 Neurological Diseases — an area which has been neglected — a valuable update and useful reference for all.

Section 10 Nutrition — very practical with good reference tables and useful ideas for the care and feeding of the sick horse.

Section 11 Ocular Diseases — Has some very practical and sensible tables that cover most aspects of eye problems and treatment thereof. A really good update for the teacher, older vets and the students.

Section 12 Problems of the Performance and Endurance Horse — a useful summation of the exercise physiology of the performance horse, with an indepth discussion of the poor performance, the fatigued horse and the normal and abnormal electrolyte levels.

Section 13 Reproduction — a very complete and updated section. Ranging from control of oestrus through treatment of mares, foetal conditions (including twinning), problems at parturition, dystocias, stallion genital abnormalities and embryo transfers.

Section 14 Respiratory diseases — this section covers viral, bacterial, lymphatic and neurological pathology of the respiratory tract. Innervative and practical therapy is discussed.

Section 15 (Skin diseases) and Section 16 (Toxicology) — both useful updates on both old and new ideas including a useful chapter on sample collection for diagnosis of drug abuse.

Section 17 Urinary Tract diseases — a good general section on treatment and diagnosis of kidney diseases and a few specific updates — practical and useful.

Having read through it, I doubt I could do without it.

B BAKER

NUCLEAR AND RELATED TECHNIQUES IN ANIMAL PRODUCTION AND HEALTH

Proceedings of Symposium, Vienna, 17 - 21 March 1986

Jointly organized by IAEA and FAO

International Atomic Energy Agency, Wagramerstr. 5, P O Box 100, A- 1400 Vienna 1986. pp XI and 695, numerous tables and figures. Price unknown (ISBN 92-0-010286-7), obtainable through Van Schaik's.

The FAO/IAEA International Symposium on the Use of Nuclear Techniques in Studies of Animal Production and Health in Different Environments was organized jointly by the IAEA and FAO and held in Vienna from 17 - 21 March 1986. The Symposium was attended by 130 participants from 45 countries and including 41 major papers and 42 posters. Many of the participants were from developing countries and the majority of presentations described work conducted within these countries.

The primary function of the FAO/IAEA Programme on Animal Production and Health is to assist in the establishment and strengthening of the capability of veterinary and animals science institutes in developing countries to conduct research into the causes of, and solutions to low animal productivity. Research within these countries concentrates on animal feeding, breeding and disease-control and ont he interaction between these. Within and across these disciplines nuclear and related techniques, employed in association with standard methods, help veterinary and animal scientists to assess such parameters as the nutritional value of feeds and the reproductive and disease status of livestock. The approach is thus the identification of constraints followed by efforts of minimize their impact.

In the Proceedings of the Symposium the papers published are subdivided in four principal and interrelated topics: adaptation of animals to the environment, animal reproduction, animal health and animal nutrition. Within each topic, consideration is given to those nuclear and related techniques currently employed in investigative research and their usefulness in studying animal production systems.

Progress towards new areas of application and new techniques are covered, particularly the development and practicability of radio- and enzyme-immunoassays and other biotechnological methods for the diagnosis of livestock diseases. The main focus is thus on problems of developing countries but it is for the first time that the most advanced tools and techniques are emphasized in the improvement of livestock productivity in these countries. The book can be recommended to Veterinary and Animal Scientists using modern nuclear techniques in studies of animal production and health in different environments.

D R OSTERHOFF

TICK-BORNE ENCEPHALITIS AND HAEMORRHAGIC FEVER WITH RENAL SYNDROME IN EUROPE
EURO REPORTS AND STUDIES 104
REPORT ON A WHO MEETING

World Health Organization, Regional Office for Europe, Copenhagen, 1986. pp 79. (Summaries in French, German and Russian). Price Sw.fr. 8.- (ISBN 92 890 1270 6). Available in RSA through Van Schaik's Bookstore (Pty) Ltd., P.O. Box 724, 0001 Pretoria.

Most veterinarians in South Africa would probably be able to recall making passing acquaintance during their training with the colourful names of at least two members of the tick-borne encephalitis (TBE) complex of flaviviruses: louping ill, a zoonotic disease of sheep and cattle in Britain, and Russian spring-summer encephalitis, a more severe disease of man which occurs mainly in Siberia and is now called Far Eastern TBE (FETBE). The 8 known members of the TBE complex are closely related antigenically, but vary considerably in their pathogenicity for man. They occur in a belt across the northern hemisphere from Britain, through continental Europe and Asia to North America.

One of the two subjects dealt with in the booklet under review is "Western" or central European TBE (CETBE) virus, which falls between louping ill and FETBE with regard to both geographic distribution and the severity of the disease which it causes in man. The booklet collates the findings of a World Health Organization working group on the epidemiology of CETBE in 8 selected countries, ranging from Switzerland in the west to Yugoslavia in the east. There are reports on the distribution and occurrence of the disease in each country and descriptions of the ecological features of endemic foci, together with details of the tick vectors and rodent reservoir hosts involved in perpetuating the virus in cryptic transmission cycles.

The second part of the booklet deals with a group of virus diseases known collectively as haemorrhagic fever with renal syndrome (HFRS). Hantaan virus, the causative agent of Korean haemorrhagic fever is the prototype for the group and lends its name to the newly established *Hantavirus* genus of bunyaviruses. Related viruses have been isolated from rodents in North America and antibodies have been found in many parts of the world. However, human infections have been recognized only in Europe and Asia, with the severity of disease again tending to increase from west to east. The booklet summarises the available information on the occurrence, diagnosis and control of HFRS in 9 countries in Europe, from Belgium in the west to the Soviet Union in the east.

The booklet is unlikely to appeal to the average veterinary practitioner in Africa, even for the purpose of establishing the risks associated with a holiday in the forests or on the ski-slopes of Europe! On the other hand, it provides the sort of information which should be assimilated by public health officials, pathologists and those involved in veterinary and medical teaching, so that an awareness of these two groups of diseases can filter through to the veterinary and medical professions at large. After all, the experiences of the northern hemisphere suggest that lack of evidence of the occurrence of these viruses in the southern hemisphere may stem purely from lack of appropriate investigations. It is believed, for instance, that hantaviruses may have become distributed worldwide with ship-borne rodents, while it is known that tick-borne viruses can be translocated over vast distances by migratory birds.

R SWANEPOEL

GERTRUD THEILER

11 September 1897 — 2 May 1986

The passing of Dr Gertrud Theiler on 2 May 1986 brought to an end an era in the history of both the Theiler family and scientific endeavour in South Africa, which spanned some 90 years. As is well known, it was her father, Sir Arnold Theiler, who founded and was the first Director of the Veterinary Research Institute, Onderstepoort. It was only after his death, though, that his younger daughter Gertrud joined the Institute's staff and brought further fame to it by her valuable studies on African ticks.

Gertrud Theiler was born on 11 September 1897 in Les Marais, Pretoria. After matriculating at Pretoria Girls' High School she studied at Rhodes University for a year, then went on to the South African College, Cape Town, where she obtained her B.Sc. in 1918. She followed this with several years of post-graduate study overseas on various aspects of helminthology, first with Professor Fuhrmann at the University of Neuchâtel, where she obtained her D.Sc. in 1922. Subsequently she studied with professor Warrington York at the Liverpool School of Tropical Medicine and under Professor R.I. Leiper at the London School of Tropical Medicine. Her research during this period was documented in several scientific publications. Even today that on the strongylids and other nematode parasites of South African equines is regarded as one of the standard works on the subject.

Following her return to South Africa at the end of 1924 Dr Theiler spent 15 years teaching biology, initially at Jeppe High School for Girls, Johannesburg, where she stayed for 2 years. She left Jeppe to become Senior Lecturer in Zoology and Physiology at Huguenot University College, Wellington, and was promoted to the Professorship of the Department in 1935, a singular achievement, especially for a young woman at that time. She left Wellington after 3 years and, for a brief period only, lectured in Zoology at Rhodes University. In 1940 she was appointed in the Entomology Section at Onderstepoort and embarked on the full-time research career that was to occupy her for over 25 years and for which she became world renowned. Her detailed descriptions of numerous African tick species have in many cases still not been superceded. She also laid the foundations for our knowledge of the zoogeography of these parasites, especially those occurring in southern Africa. She always maintained close contact with other tick workers, not only in other African countries but all over the world. Over the years many of them visited her at Onderstepoort for training or discussions. She could always be relied on to provide help and advice, as well as to supply pertinent extracts from the literature, illustrations and reference specimens of ticks. These were a great boon, especially as relatively few people working in Africa at that time had access to such comprehensive library facilities as were available at Onderstepoort. She

officially retired in 1967, but returned to her original subject, helminthology, and remained at the laboratory as an honoured guest worker until 1983 — a most remarkable record of service. Throughout this period she was a member, sometimes in an honorary capacity, of a galaxy of scientific and cultural societies in South Africa as well as overseas. Her contributions to parasitology were recognized by the awards to her of the Senior Captain Scott Medal of the Biological Society in 1960 and the Elsdon Dew Medal of the Parasitological Society of Southern Africa in 1975.

But merely to list, however briefly, Gertrud Theiler's scientific achievements would be to lose sight of her as a person. She was, understandably, extremely proud of her family heritage. Essentially she herself was kindly and generous, with simple tastes as far as day-to-day living was concerned. The interests that occupied her leisure hours almost all involved some form of outdoor activity. At weekends, for example, she could often be found, dressed in an open-necked shirt and slacks, or khaki shorts in the summer, and usually bare-foot, up the kopje at the back of her house inspecting her treasured aloes or simply pottering in the garden with her dogs. For several years she was actively interested in dog training, and was an Executive Member of the Pretoria Dog School.

In her youth she was a keen sportswoman, and while at school played for the 1st teams in hockey, tennis and netball. From 1927 - 38 she played in, and coached,

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