ANNUAL REPORT

OF THE

VETERINARY DEPARTMENT,

SUDAN GOVERNMENT.

1928.

ANNUAL REPORT

OF THE

VETERINARY DEPARTMENT,

SUDAN GOVERNMENT.

1928.

(McC. 10,022) Wt. 967/952 V. 150 6/29.

CONTENTS.

STAFF.

The following staff changes occurred during the year:—

Major F. J. Andrews, B.Sc., Royal Army Veterinary Corps, reverted to the British Army on 1st November on the expiration of the period of his secondment to the Sudan Government Service.

Mr. T. W. Emmerson, Head Clerk, who had 17 years service in the Department, retired on pension on 20th November, and this opportunity is taken to place on record an appreciation of the good work carried out by this painstaking and capable official during the whole of his service.

The staff of Veterinary Inspectors was augmented by the appointment of Mr. C. F. Magnier on 4th November and Messrs W. H. Glanville and A. B. MacIntyre on 18th November.

At the end of the year the distribution of the Veterinary Staff was as follows:—

Name.	Designation.	Province.
Mr. W. KENNEDY, D.S.O.	*Director*	Khartoum
El Kaim. R. S. AUDAS Bey, M.C. ...	*Assistant Director*	Darfur*
Mr. S. C. J. BENNETT, B.Sc.	*Vet. Research Officer*	Khartoum
Mr. A. B. MacINTYRE	*A/ Asst. Vet. Research Officer*	Khartoum*
El Kaim. J. GOING Bey, 4 N.	*Veterinary Inspector*	Kassala
,, C. P. FISHER Bey	,, ,,	Khartoum
,, J. R. ELLISON Bey	,, ,,	White Nile
,, T. MENZIES Bey	,, ,,	Darfur
,, H. B. WILLIAMS Bey, O.B.E.	,, ,,	Kordofan
El Bimb. L. E. PRICHARD, O.B.E. ...	,, ,,	Blue Nile
Mr. A. L. MULLEN	,, ,,	Blue Nile
Mr. C. W. PEMBREY	,, ,,	Khartoum*
Mr. C. F. MAGNIER	,, ,,	Halfa
Mr. W. H. GLANVILLE	,, ,,	Kassala

During the year the Director visited the Blue Nile, Upper Nile, Kassala and Kordofan Provinces and attended the Rizeigat Horse Show in Darfur Province.

The Assistant Director toured for three months in Darfur Province and also visited Kordofan Province in connection with the horse breeding scheme.

The Veterinary Research Officer spent four months in the Upper Nile Province in connection with the production of anti-rinderpest serum at a station which was established temporarily near Malakal.

---

* Temporarily.

Tours were made in Berber, Fung, Nuba Mountains and White Nile Provinces by Veterinary Inspectors in the course of the year and a Veterinary Inspector attended the tribal gathering at Salala in the Red Sea Province in February. A Veterinary Inspector was occupied at Gallabat for five months on mule purchasing duty.

SECTION I.

DISEASES OF ANIMALS.

I. DISEASES OF CATTLE.

Rinderpest and contagious bovine pleuro-pneumonia may be said to be widespread throughout most of the cattle-raising areas of the country and losses caused by these diseases appear, in some cases, to offset the normal annual increase of the herds. Much attention has in consequence, been devoted to the problem of reducing this mortality as far as possible and it is satisfactory to note that, in the case of contagious bovine pleuro-pneumonia, an effective and safe vaccine is now available in sufficient quantity to meet all demands and, in the case of rinderpest, it has been found possible to produce locally an anti-serum of high potency. When this serum is available in sufficient quantity it will be used, whenever Veterinary Staff is at hand, to reduce the losses in infected herds and to control the spread of the disease.

A considerable amount of research work is being carried out in Nigeria and in Kenya Colony with a view of obtaining a safe and effective vaccine against rinderpest. If such a vaccine could be produced easily and cheaply in the field the control of rinderpest would be considerably simplified and an intensive campaign, carried out simultaneously against both rinderpest and contagious bovine pleuropneumonia and aiming at the ultimate eradication of these diseases from the Sudan, would be amply justified.

Rinderpest.

The total losses recorded from rinderpest during the period under review, although less than in 1926 or 1927 were nevertheless considerable. In dealing with the numerous outbreaks which occurred the resources of the Department were often fully taxed and, in the case of a few extensive outbreaks, some time elapsed before effective control could be exercised. In previous reports reference has been made to the comparative ease with which outbreaks of rinderpest can be dealt with under favourable conditions in regard to grazing and water, and, conversely, the difficulties experienced in controlling the disease during the dry season of the year when large numbers of cattle are concentrated on the permanent water supplies. These difficulties are increased considerably if cattle belonging to a nomad tribe become infected when one of their seasonal migrations is in progress, particularly if the herd originally infected happens to be in advance of the others. An outbreak occurred under such conditions on the Rahad river near Mefaza

in November and, although staff and serum were despatched to the scene of the outbreak as soon as it came to notice, such large numbers of cattle in both Fung and Kassala Provinces have already become infected that it is feared the losses ultimately suffered will be very heavy.

In Kordofan Province in July rinderpest threatened to become widespread but by the adoption of energetic measures and by making free use of anti-rinderpest serum, the disease was ultimately got under control with remarkably few losses.

Several outbreaks occurred in the Blue Nile Province but with one exception these were reported to be of a mild character.

The total losses reported from rinderpest during the past three years are as follows:—

	Deaths.
1926	8,281
1927	8,629
1928	7,137

These figures do not represent by any means the total annual losses caused by rinderpest throughout the Sudan but, as pointed out in previous reports, they possess some value for purposes of comparison.

The number of cattle involved in the various outbreaks dealt with was 91,603 head.

The rinderpest control system at present employed depends for its success on prompt action being taken to segregate infected herds from healthy herds and on the early administration of anti-rinderpest serum to all susceptible cattle which have been exposed to infection. Owing to the vast distances to be covered it is not always possible to exercise the necessary control over an outbreak, with the desired promptitude, by members of the veterinary staff and it has long been recognised that the duty of taking immediate action in such cases must devolve on the tribal chiefs if any great degree of success is to be obtained. In some instances the native authorities have been extremely helpful in enforcing disease control measures but, generally speaking, much remains to be done in the way of educating these authorities to realize their responsibilities in this connection.

The early administration of anti-rinderpest serum to all susceptible cattle involved in outbreaks of the disease is only possible provided the necessary serum is available in sufficient quantity. During recent years the possibility of providing the country's serum requirements has been carefully explored and this year it was decided to attempt the production of serum on a fairly large scale in a temporary camp near Malakal in order to ascertain definitely the local difficulties, if any, which had to be overcome.

The Veterinary Research Officer, who was in charge of the serum station, found that the Nuer and Dinka cattle are very suitable as virus producers and that infection with trypanosomes or piroplasms did not interfere with the work. In the course of the operations seven hundred litres of serum of high potency were produced and, provided

sufficient suitable cattle are forthcoming, no great difficulty should be experienced in the future in producing all the serum the country is likely to require. Despite the fact that arrangements for collecting the neccessary cattle had not been satisfactorily concluded at the end of the year, the production of fifteen hundred litres of serum is aimed at next year and this quantity should suffice to meet present requirements. The quantities of serum used during the past three years were as follows:—

1926	...	1170	litres.
1927	...	525	litres.
1928	...	928	litres.

Rinderpest appeared on several occasions during the year among cattle intended for export to Egypt and was responsible for seventy-one deaths or destructions. With one exception these outbreaks originated in cattle which had been brought from the Upper Nile region. In all cases the disease was effectively controlled by the use of anti-rinderpest serum with little or no interference with trade.

Contagious Bovine Pleuro-Pneumonia.

The losses recorded from contagious bovine pleuro-pneumonia amounted to nine hundred and sixteen head and, for purposes of comparison, the losses reported during the past five years from this cause are given below:—

		Deaths.
1924	...	811
1925	...	829
1926	...	193
1927	...	542
1928	...	916

The heaviest losses in 1928 occurred in the Provinces of Kordofan (including Nuba Mountains) and White Nile and the death rate recorded in these areas was twice that of the previous year. The disease was, undoubtedly, widespread in Southern Kordofan during the year and the infection spread to portions of the Nuba Mountains but it is thought that the large increase in the reported deaths is to some extent due to the fact that cattle owners have reported losses from this cause more readily than in the past since they realize that a safe and effective vaccine against the disease is now available. In January the Veterinary Inspector, Kordofan Province, discovered cases of contagious bovine pleuro-pneumonia in herds totalling two thousand head belonging to the Homr tribe. The visibly affected animals were segregated and ultimately destroyed while the remainder of the cattle were vaccinated against the disease. No further cases occurred in these herds during the ensuing eleven months and the impression created was so good that, when an outbreak occurred in September in the cattle of another section of the tribe, the owners clamoured for vaccine and promptly and voluntarily slaughtered all infected animals.

In Kassala Province only six small outbreaks were recorded with a total mortality of thirty-two head. The Veterinary Inspector states that owners have not hesitated to report disease and have lent every assistance in carrying out disease control measures which shows that, in that Province also, the value of vaccination against the disease is fully appreciated by the natives.

The demand for vaccine was nearly double that of the previous year and seventeen thousand five hundred and ninety doses were issued from the Veterinary Laboratory. The output for 1926 was four thousand two hundred and fifty doses and for 1927 nine thousand four hundred and ten doses.

The keeping qualities of this vaccine have not yet been definitely ascertained and, as it is necessary to know how long the vaccine remains effective after despatch from the Laboratory, experiments are in progress to clear this point up.

Forty-six cases of contagious bovine pleuro-pneumonia came under notice during the year among cattle awaiting export to Egypt.

Foot-and-Mouth Disease.

Outbreaks of foot-and-mouth disease occurred during the year in White Nile and Darfur Provinces but these were of a very mild character and the losses were trifling.

Anthrax.

No case of anthrax came under notice during the period under review.

Trypanosomiasis.

In the course of investigations in connection with the production of anti-rinderpest serum the Veterinary Research Officer had occasion to carry out repeated examinations of the blood of cattle in the Upper Nile Province. No cases of trypanosomiasis were found in one hundred and seventeen Nuer and Dinka cattle examined but seven out of thirty-one Arab cattle, brought from Nuba Mountains, were found to be infected with **Trypanosoma congolense**. He was later consulted by the District Commissioner, Shilluk area, about a disease which is known to the Shilluk by the name of "RUWAT" and which is not uncommon amongst their cattle. Blood examinations of typical cases showed **Trypanosoma congolense** to be present in every case. The Veterinary Research Officer considers it highly probable that the infection is introduced to the Shilluk area by Arab cattle purchased from cattle owners in Southern Nuba Mountains and that the disease is mechanically transmitted from them to the Shilluk cattle by blood-sucking flies other than tsetse since the Shilluk area is free from tsetse flies.

A few cases of infection with **Trypanosoma congolense** and **Trypanosoma vivax** came under notice during the year in Kordofan Province.

II. DISEASES OF CAMELS.

It is estimated that the average number of camels for which forage allowance was drawn during 1928 was one thousand nine hundred and, of this number, three hundred and twenty-six camels died from all causes or were cast as old and unfit for further service. These losses compare favourably with the losses suffered in previous years as is indicated by the following table:—

	Total losses.	Losses per cent per annum.
1924—25	491	27.7
1926	385	22.3
1927	379	20.7
1928	326	17.2

Heavy losses were reported to have occurred in the Red Sea Province — mainly confined to the young and very old camels — owing to the lack of rain but no other reports of abnormal losses were received from the camel-owning tribes.

Trypanosomiasis.

The steady progress that has been made during the past four years in reducing losses among Government camels is mainly due to the introduction of improved methods of diagnosis and to the use made of Naganol in the treatment of the common trypanosomiasis of the camel.

The losses recorded from this disease amongst police and other camels of the Civil Service were eighty-two in 1928 as compared with one hundred and eighty-eight in 1924-25, one hundred and two in 1926 and one hundred and four in 1927.

The losses from trypanosomiasis among Army camels amounted to 5.5 per cent of the total losses from all causes and the following table, compiled from figures kindly supplied by the Military Authorities, provides an interesting comparison with previous years:—

	Total losses from all causes.	Losses from Trypanosomiasis.
1924—25	377	133
1925—26*	201	58
1927	126	27
1928	127	7

Two hundred and thirty-two camels suffering from trypanosomiassis were treated with Naganol during the year. It is generally reported that when infected camels are in fair condition and the grazing is good the results of the treatment leave nothing to be desired.

A considerable amount of research work was carried out during the period under review at the Veterinary Research Laboratory with a view of improving methods of diagnosis, and an experiment was carried out to ascertain the duration of the immunity in camels which had been infected with **Trypanosoma soudanense** and cured with Naganol. The results obtained have a great practical value and full details of this and other research work will be found in the appended report of the Veterinary Research Officer.

---

* Covers the period from 1.10.1925 to 31.12.1926.

Mange. (Scabies)

This disease of camels calls for little comment this year. It has not been at all prevalent in Kassala Province and only a few cases came under notice in the Blue Nile Province. In Kordofan Province the disease has been successfully controlled in Government animals at Nahud and El Obeid by dipping at fortnightly intervals. In other districts by hand-dressing and constantly changing the lines the spread of this disease has been greatly checked.

III. DISEASES OF EQUINES.

During the period under report one hundred and forty-four horses, one hundred and thirty-eight mules and twenty-eight donkeys, the property of Government officials and employees, died or were destroyed. As the total number of horses, mules and donkeys for which forage allowance was drawn were approximately 1,075, 875 and 520 respectively the casualties represent losses of 13.4 per cent., 15.8 per cent. and 5.4 per cent. respectively. The mule losses were much less than were reported last year.

African Horse Sickness ("Nigma") accounted for twenty-four horses and sixteen mules as compared with forty-two horses and sixty-seven mules in 1927; fourteen horses and forty-two mules were destroyed on account of epizootic lymphangitis ("Sarraga") as compared with ten horses and thirty mules in the previous year.

The disease of horses, known to the Baggara of Southern Kordofan as "Um Luwei" and to which reference was made in last year's report as the cause of heavy losses in Dar Homr, appears to have died out and no opportunity presented itself of investigating the condition.

A few cases of "Biliary fever" (piroplasmosis) came under notice during the year, chiefly in Khartoum and Blue Nile Provinces.

African Horse Sickness.

African Horse-Sickness was not reported to have caused any serious losses in the horse-breeding areas with the exception of Dar Messeria. Only two deaths were reported from the Blue Nile Province where very heavy losses occurred last year.

It is interesting to note that three cases of African Horse-Sickness occurred in May in Wadi Halfa township, near the Egyptian border, and that the disease is reported to have appeared in Upper Egypt in July and to have caused very heavy losses during the ensuing five months. Altogether over seven hundred horses and mules are said to have died or to have been destroyed in Upper Egypt on account of this disease during the latter half of the year.

Epizootic Lymphangitis.

This disease was diagnosed at the Veterinary Research Laboratory in smears forwarded from eighteen horses, ninety mules and six donkeys. The total numbers of cases reported in 1926 and 1927 were sixty-three and fifty-one respectively so this year's total of one hundred and fourteen shows a somewhat alarming increase. Half of the total number of

cases reported occurred in the Fung Province and the majority of the remainder occurred in Khartoum, Kordofan and Blue Nile Provinces. As mentioned in previous reports, fresh infection is introduced every year from Abyssinia in mules purchased to meet military and police requirements, but the large increase in cases reported in Police animals in Fung Province can only be accounted for on the assumption that the mule lines in the principal Stations there have been allowed to become heavily infected with the disease. Arrangements have therefore been made to detail an experienced senior officer of the Department to visit that Province in the near future with a view of adopting measures aiming at the ultimate eradication of the disease there.

As far as the horse-owning tribes are concerned this disease has, so far, only caused serious losses in Dar Messeria and every effort is being made through the tribal authorities to persuade owners to destroy cases as soon as they are detected.

IV. DISEASES OF SHEEP AND GOATS.

With the exception of a few mild cases of sheep-pox no contagious or infectious diseases came under notice amongst 13,961 sheep kept under observation prior to being exported to Egypt. During the rains heavy losses occurred in certain flocks in the Blue Nile Province and the symptoms and post-mortem appearances were highly suspicious of the disease known in South Africa as "heart-water". Unfortunately, owing to the bad state of the roads at the time, it was not possible to carry out investigations with a view of arriving at a definite diagnosis but the transmitting agent of heart-water in South Africa—the bont tick (Amblyomma hebraeum) — is not known to occur in the Sudan.

Sarcoptic scabies and contagious pleuro-pneumonia of the goat are reported to cause losses from time to time but these diseases do not appear to be very prevalent in the principal goat breeding areas: nevertheless, when they appear among the flocks of small impoverished communities, which depend mainly on goats for their meat and milk supplies, the results must be very serious to the individuals concerned.

V. DISEASES OF DOGS.

Suspected cases of rabies were reported from all districts of Darfur Province and from Um Ruaba and Abu Zabad in Kordofan Province. The disease must, therefore, be considered to be widespread in the Western Sudan and a vigorous campaign against ownerless dogs in the various townships continues to be prosecuted. The tribal authorities in the Baggara District of Darfur Province have been requested to destroy all dogs surplus to the tribal requirements with a view of lessening the menace of the disease.

Several suspected cases of rabies were also reported in Kassala District from August onwards but the presence of the disease there was not definitely diagnosed until October. When the first suspicion arose the provisions of the Preventions of Rabies Ordinance were applied to the Kassala District and by the end of the year 1,287 dogs, 270 hyaenas and

234 jackals had been destroyed in the area. This is the first time, in recent years, that rabies has been definitely diagnosed east of the Nile and the infection is considered to have been introduced from Eritrea.

The Director of the Wellcome Tropical Research Laboratories, who examines all material forwarded from suspected cases of rabies, states that, during the period under review, positive diagnoses were made in the cases of dogs' brains forwarded from El Fasher (Darfur Province), Wau (Bahr El Ghazal Province), Kassala (Kassala Province) and Abu Zabad (Kordofan Province).

From reports received it is estimated that upwards of 3,000 ownerless or stray dogs were destroyed in the Provinces of Darfur, Kordofan, Khartoum and Kassala during the year.

VETERINARY HOSPITALS.

Six hundred and ninety-seven animals were admitted to the Khartoum Veterinary Hospital for treatment during the year and, of these, fifty-five died or were destroyed as incurable. In addition to the above, fifty-seven animals were admitted for destruction. The returns from the shoeing forge attached to the Hospital show that 5,160 horses and mules were shod there during the period under review.

The provision of hospital accommodation for animals at Wad Medani has filled a long-felt want and four hundred and forty-six animals were admitted for treatment of which number thirty-one died or were destroyed. The number of out-patients treated at Wad Medani alone amounted to three thousand two hundred and twenty-one.

SECTION II.

TRADE IN LIVESTOCK AND LIVESTOCK PRODUCTS.

1. EXPORT AND IMPORT TRADE.

Cattle and Sheep.

The total numbers of cattle and sheep exported during the period under review were 11,114 cattle and 13,961 sheep, a decrease of 2,346 and 197 respectively on the figures for last year. The exports for the last five years were as follows:—

	Cattle.	Sheep.
1924	12,122	25,122
1925	19,041	30,870
1926	15,884	19,073
1927	13,460	14,158
1928	11,114	13,961

During the past four years the importations of cattle from French Equatorial Africa, Eritrea and Abyssinia, through frontier stations, were as follows:—

	French Equatorial Africa.	Eritrea.	Abyssinia	TOTAL.
1925	4,138	1,229	5,117	10,484
1926	3,331	756	3,971	8,058
1927	1,844	805	573	3,222
1928	1,029	127*	1,511†	2,667

The export figures, contrary to what was anticipated, show a further decline in the cattle and sheep trade and this is apparently due to a falling off in the demand for imported meat in Egypt. The local supplies of cattle and sheep were well maintained during the year and there was no interference with trade due to outbreaks of disease.

The system introduced last year of regulating the number of cattle from the Western Sudan awaiting export at El Obeid and of segregating such cattle until exported, again worked most satisfactorily and an extension of the system, to embrace Abu Zabad as well as Nahud, is under consideration. The amount of work involved in this connection is evidenced by the fact that, during the past twelve months, 6,954 cattle for export and 7,335 cattle for local slaughter were despatched by rail from El Obeid and, at one time, there were no fewer than 6,700 head of cattle on hand there.

---

* Of this number 126 were cows.
† Of this number 822 were cows.

The cattle exported during the year were drawn from the following Provinces in the numbers shown:—

	Number of cattle.
Darfur and Kordofan	7,656*
White Nile	1,129
Upper Nile	684
Bahr-el-Ghazal	74
Blue Nile	60
Khartoum	436
Berber	1,050
Red Sea	25
TOTAL	11,114

The average market price at El Obeid for cattle intended for export, and the numbers sold, during the past three years, were as follows:—

	Number of cattle sold.	Average Price. £E.m/ms.
1926	7,268	3.536
1927	6,855	2.981
1928	7,034	3.338

The increase in price in 1928 as compared with 1927 is considered to be due to the high prices obtaining for hides.

CAMELS.

The number of camels exported to Egypt during the year is not accurately known but from figures supplied by the Provincial authorities it may be estimated at about 9,000 head.

The Veterinary Inspector, Kassala Province, reports on the subject as follows:—

"The camel trade continues to flourish and prices appear to be "satisfactory. At the commencement of the trading season in Octo- "ber prices were lower than those realised at the beginning of the "year but during November and December there has been an im- "provement. 6,935 permits were issued to exporters. This number "falls very short of that issued in 1927 but it may be taken as "certain that large numbers of animals have gone North without any "permit. The Rashaida have been purchasing all the fat female and "young male camels in good condition that they can find. Female "camels in the best condition are fetching up to £E. 17 in Egypt; "these are being purchased by the exporters for about £E. 10 or "£E. 11. The demand for male camels in moderate condition for "either work or slaughter is not so good as last year; the Zebeidia "are paying roughly £E. 6 or £E. 7 for them, and it is said that "the profit realised is small".

*Includes a certain number of cattle from French Equatorial Africa.

In addition to the trade with Egypt one thousand eight hundred and one camels were exported from Kordofan and Darfur Provinces during the year and the destination of the majority is said to have been Northern Nigeria. Most of these camels were females. This trade has increased considerably as only three hundred and seventy-four camels were exported to the West last year: prices, however, fell to such an extent during the trading season that it is feared it is not one capable of much development.

MULES.

Three hundred and eighty-five mules were imported from Abyssinia via Gallabat during the year as compared with four hundred and forty last year.

HIDES AND SKINS.

The following figures, showing the export of hides and skins, and their value, for the last five years, have been extracted from the Customs returns:—

Year.	Hides. Tons.	Skins. Tons.	Total value. £E.
1924	358	426	62,052
1925	462	601	98,714
1926	428	821	126,431
1927	1,067	932	155,285
1928	2,309	880	298,623

The numbers of hides, sheepskins and goatskins exported in 1928 were 328,161; 412,530 and 257,959 respectively so that the average weights per piece were as follows:— Hides 7.03 kilogrammes; sheepskins 1.78 kilogrammes; goatskins 0.56 kilogramme.

A very large increase in the export trade in hides has been registered during the past two years and is attributable to an increased demand from abroad with a corresponding increase in values. When the Market value of hides is low exports are limited mainly to those which are produced in areas tapped by railway or steamer, but, when prices rise above a certain level, the cost of animal and even motor transport can be borne by the trade and hides are attracted from the more remote districts of the country.

The average prices offered for "Fashoda" hides in Omdurman market in the years 1924 to 1928 inclusive were £E. 41.2, £E. 49.6, £E. 42.9, £E. 60.5 and £E. 82.7 per ton respectively.

Towards the end of the year there were indications that the high prices which have been obtaining on the European markets during the past eighteen months had attracted such large quantities of hides as to threaten to over-supply the demand. It is to be hoped that any reaction which may occur in this connection will prove to be of a very temporary nature. This trade has suffered at least one notable set-back in the past when merchants holding large stocks suffered heavy losses owing to a sudden cessation of demand with a consequent slump in

prices. Recovery from such a set-back is a slow process and it is considered that the trade can only be developed on really sound lines provided that the demand is steady and prices are reasonably stable.

While many hides of good quality are exported annually the quality of the majority leaves much to be desired. The defects commonly noticed are due to careless flaying, to drying in the sun instead of in the shade and to failure to fold properly or to guard against damage in transit by beetle larvae. Efforts continue to be made to encourage the exercise of greater care in preparing hides for market but progress in this direction will not be marked until traders in the outlying districts will arrange to offer better prices for hides of superior quality than they are prepared to pay for those of medium quality. As a rule the procedure adopted by such traders is to class hides offered to them for sale as either exportable or unexportable and no further effort at grading is attempted.

Generally speaking the quality of the local sheep-skins and goat-skins is good, probably owing to the greater ease with which flaying and drying can be carried out than in the case of hides but here again shade-drying is not carried out as extensively as it might be.

The following information in regard to the classification of 1,743 tons of hides exported during the year has been kindly supplied by the merchants who handled the consignments:—

	Number of hides.	Total weight Tons.	Percentage by weight.
Fasher flint-dried	145,427	831	47.5
Dry salted	45,575	505	29.0
Fashoda	51,088	255	14.5
Sun-dried or shade-dried other than Fasher or Fashoda ...	22,432	152	9.0
		1,743	

The only importations of hides or skins of any consequence were some 7,000 skins from Arabia and 813 camel loads of hides from French Equatorial Africa.

II. INTERNAL TRADE.

Meat Supplies.

The following statement shows the numbers of animals slaughtered for food in ten of the larger towns during the past three years:—

	1926	1927	1928
Cattle	21,035	21,627	27,601
Sheep	180,509	167,923	142,444
Goats	8,489	9,152	8,650
Camels	1,911	2,284	2,712

It will be noted that there has been a considerable increase in the amount of beef consumed this year with a corresponding decrease in the consumption of mutton. This is probably due to the high prices prevailing for hides.

A return of the animals slaughtered by licensed butchers in Kassala Province is as follows:— 5,760 cattle; 15,198 sheep; 439 camels and 292 goats. These figures do not include the meat supplies of the large gangs of workmen who were employed on the new railway extension nor do they include animals slaughtered for food in the smaller villages.

The following returns from the Blue Nile Province give an interesting indication of the amount of meat consumed, particularly in the Gezira area:—

Market.	Cattle.	Camels.	Sheep.	Goats.
Wad Medani	4,087	1,104	18,885	276
Makwar	944	93	3,077	405
Hag Abdulla	142	70	892	—
El Hosh	1,883	150	2,023	—
Kamlin	80	20	1,400	—
Hassaheissa	275	28	3,081	13
Nayel	89	54	291	3
Gedeidim	693	197	952	177
Rufaa	169	—	3,016	—
Mesellemia	2,200	1,340	7,024	—
Halawin	736	220	2,413	—
TOTAL ...	11,298	3,276	43,054	874

The figures given for the four last-mentioned markets are estimates only, as records were not kept at those centres.

RIDING ANIMALS.

The number of animals purchased locally for Government use during the year are estimated to amount to 150 horses and 400 camels.

SECTION III.

IMPROVEMENT OF LIVESTOCK.

CATTLE.

Reference was made in last year's report to a proposal that was on foot to hold cattle shows in the cattle-raising areas of the Western Sudan. It was hoped that it would be found possible to hold such shows at the same times and places as the horse shows when the annual tribal gatherings take place. Unfortunately this hope was not realized, for, at that season of the year, the cattle are too widely scattered over the Northern grazing grounds to permit of a representative show being held. The effort to persuade the cattle owners to adopt a system of exchanging herd bulls with one another was, however, persisted in as the following extract from a report furnished by the Assistant Director shows:—

"In the past the Baggara tribes of Kordofan and Darfur have "practised an intensive form of in-breeding; the owners being under "the impression that the mating of brother and sister was sound "but that the mating of a bull with its female offspring or a bull "with its dam was contra-indicated. After exhaustive explanations "and several meetings with the Sheikhs and head men of the Darfur "Baggara they were convinced that the scheme was a sound one. "A start was then made with the Fellata and 130 camps exchanged "herd bulls. The Habbania and Rizeigat followed suit and within "the next few weeks the majority of the camps in Southern Darfur "will have exchanged bulls. The tribes further West and North, "being sedentary people, will be dealt with later on.

"It will only be a matter of another year or two when the scheme "will be definitely established and the exchange of herd bulls will "be inter-tribal. At present only bulls within the tribe or "Omadia" "are being exchanged.

"In conjunction with this scheme castration on a large scale is "recommended and all young male stock, with the exception of a "few selected calves from the best milking strains — the future "herd bulls — will be castrated. The use of the bloodless cast- "rator was demonstrated and a few selected tribesmen instructed "in its use. In the near future it is anticipated that we shall be "able to supply a number of these instruments on loan to the natives.

"The scheme did not meet with the same reception amongst "the Kordofan Baggara but it is hoped that with a little more expla- "nation they will shortly follow the example of their neighbours.

"As it was not found practicable to hold cattle shows as originally "proposed the necessary exchanges of bulls were effected at the "various camps or watering places."

The reports received about the five young half-bred bulls which were despatched at the end of last year to the Upper Nile Province are not very satisfactory. A half-bred Friesian which was sent to Abwong gradually lost condition and died in August. The half-bred dairy Shorthorn sent to Nasser shared a similar fate after surviving twelve months. The three remaining half-bred Friesians, stationed at Renk, Bor and Kodok respectively, are still alive but only the one at Renk appears to be thriving under local conditions. The experiment is still in progress and arrangements are being made to replace the bull that died at Abwong with another half-bred Friesian from the Khartoum North Dairy herd. The results so far obtained indicate that cattle of the type used in the experiment are not particularly suited to the areas referred to and, to keep such cattle in condition there, it is necessary that they be given a daily grain ration in addition to being allowed to graze freely.

Six young half-bred bulls from the Khartoum North Dairy herd — five half-bred Friesians and one half-bred Shorthorn — were issued to Inspectors of the Sudan Plantations Syndicate in August in the hope that, to some extent and in the course of time, they may effect an improvement on the local breed of cattle, particularly from a milking point of view.

Steady progress continues to be made in the improvement of the breed of cattle in the Government dairy herd at Khartoum North. The half-bred stock now consists of six young cows, six two-year-old heifers, sixteen yearling heifers, four yearling bulls, nineteen heifer calves and ten bull calves. The Shorthorn bull which was imported by the Government in 1925 has not proved satisfactory from a breeding point of view and most of the calves dropped during the year were bred from a Friesian bull kindly loaned by the American Mission at Gereif. The results of crossing native cows with the Friesian and dairy Shorthorn have proved to be very satisfactory from the point of view of milk-production but it is considered that better all-round results would be obtained with the Ayrshire cross and arrangements are accordingly being made to import a young Ayrshire bull for use with the dairy herd next year.

HORSES.

The Government scheme to improve the breed of horses in the Western Sudan has now been in operation for about three years and, although the resultant improved stock is still immature, there is every indication that the improvement aimed at can be achieved if the effort to do so is sustained. All the horse-owning tribes are now anxious to participate and the demand for Government sires far exceeds the supply available. It is evident, therefore, that there is an urgent need for more good stallions if the scheme is to be developed, from both the Civil and Military point of view, to the limits of its usefulness.

The following extract from a report by the Assistant Director gives some details of the year's work:—

> **Darfur**. "The percentage of successful matings, although not "so high as was originally estimated, compares favourably with the "results obtained in some of our renowned throughbred studs in "England and Ireland. The number of foals and improved young "stock seen and tattooed at the various shows held during the year "was ample proof of this. After a careful review of the conditions

"and experience of the past three years on the working of the "scheme, it was considered that a few slight modifications were "necessary and these have been introduced this year. Instead of "looking up the Service Book and enquiring about a particular "foal, the foal was produced and his origin was proved by the "service certificate, he was then tattooed on the upper gum and "the service certificate was completed, stitched into a leather wallet "("Hegab") and hung round his neck. Tattooed fillies will auto- "matically be registered when old enough to breed.

"Mares of exceptional quality are now being mated with the best "imported horses only.

"The prize money was distributed in small amounts amongst "the owners who had produced the best results and whose stock "had been well looked after. Cash prizes were also given to the "tribal farriers."

Kordofan. "The Homr are showing great keenness and are "very anxious to line up with their Darfur neighbours, but the chief "object of supplying sires to this tribe must be administrative. They "have not got the material and the district lacks much for successful "horse improvement.

"The Messeria are improving, but it will be some considerable "time before they regain the ground lost during the past few years."

Khartoum and Shendi. "All native mares produced received "attention, but it is impossible to obtain and keep exact records of "results. From time to time the improved stock appears on the "race-course, but owing to adverse local conditions, cost of forage "and the unsuitability of the district together with faulty conform- "ation due to the Dongolawi origin of the Northern horses — it is "seldom that anything outstanding from the point of view of a util- "ity riding horse is seen.

"The Sudan Government Railways and Steamers have kindly "agreed to mares being consigned at quarter fare to and from "Khartoum for stud purposes.

"During the year eight stables were erected at El Fasher and "two at Nyala. The stables at Abu Zabad were repaired and rend- "ered mosquito proof.

"The following list shows the distribution of Government Stal- "lions:—

"**Darfur Province**:— Allahom, Talisman, Atbara, Kiolan, Bac- "carat, Monarch, Talab, Asad-el-Karim, Diamond Jubilee and No "Joke.

"**Kordofan Province**:— Lulu, Nahud, Dori, Abu Warda, Farad "and Hunting Harry.

"**Khartoum and Shendi**:— Tom Bowling, Oberto, Melik and "Sapper.

"Two stallions died and two were destroyed in the course of "the year.

"Lord Woolavington generously presented the Government in "September with the thoroughbred horse "**Tom Bowling**", by "Hurry

"On" out of "Windyridge" by "Swynford". This horse landed fit "and well. He is rather big for our purpose but with careful "mating should prove of considerable value.

"Lord Astor presented the Government with the thoroughbred "Oberto", by "Lemberg". "Oberto" is a horse of the right size and "should prove eminently suited to the indigenous mare. He arrived "in rather poor condition and suffered from Biliary fever for the first "few weeks but is now making rapid strides to recovery".

CAMELS.

A camel show was held at Salala in the Red Sea Province in February during the Bisharin Sheikhs' Meeting. The Veterinary Inspector who attended this show reported that, on the whole, the entries were poor both in number and quality and fell below the standard of last year. This is not to be wondered at when it is remembered that the Bisharin country was suffering from lack of rain and that a large number of good camels were purchased there last year for the Egyptian Government.

During the year the Military Authorities kindly agreed to hand over to this Department all cast Army camels which were suitable for breeding purposes and, in this way, several Bisharin camels were obtained and distributed among the camel-owning tribes in Northern Kordofan. It is hoped that, in time, this will result in the production of sufficient half-bred camels to supply police and other requirements in that Province.

DONKEYS.

Arrangements are being made to purchase five good donkey stallions of the riding type for use in the Gezira area, Blue Nile Province, with a view of improving the breed of donkey in that area.

SHEEP.

A fair crop of lambs has been obtained at the Gezira Agricultural Research Farm out of native and crossed native-Marais ewes by the two Merino rams imported from South Africa last year.

POULTRY.

With a view to encouraging Government Officials and others to take an interest in poultry improvement a pamphlet, written by Mr. H. A. McLoghry of this Department, on the care and management of improved breeds of fowls in the Sudan was printed and distributed. The results are most gratifying and ten White Wyandotte/Leghorn cross cockerels, six dozen eggs of the same strain and five dozen pedigree White Leghorn eggs were ordered and despatched to Darfur, Kordofan, Blue Nile and Kassala Provinces during the year. From reports received from these Provinces and the Upper Nile Province the results have been most satisfactory and it is hoped that, in a few years' time, a marked improvement in the breed of fowl kept in the neighbourhood of all the principal Government stations will be effected.

SECTION IV.

MISCELLANEOUS.

GRAZING AND WATER.

The rains in 1928 may be described as good generally throughout the cattle-raising areas of Darfur and Kordofan. In El Obeid District, however, a heavy fall in June was followed by a long dry spell which resulted in a disappointing crop of grass. Water was plentiful around El Obeid and Nahud and cattle awaiting export were able to water from ponds ("fulas") right up to the end of December.

In Berber Province the rains were described as sporadic and poor in quality and, in general, were insufficient to ensure adequate grazing. In the Northern District no rain fell compelling the nomads to scatter to other more fortunate districts and Provinces in search of grazing.

In the Red Sea Province conditions in regard to grazing and water, in the whole of the Bisharin country, in the North, West and South-west of the Province, were definitely bad and the same applies to the Amarar. Fair rains fell patchily in the Northern Hadendoa country and reports from the Gash were good. The winter rains broke at the end of October and the prospects for the winter grazing on the maritime plains were reported to be good.

Steady progress continues to be made in various Provinces in the provision of additional dams ("hafirs") for the collection and storage of surface water.

LIVESTOCK IN THE GEZIRA AREA.

The Veterinary Inspector in charge of the Gezira Area states, in the course of his report, that no serious mortality occurred amongst cattle and deaths were mainly confined to animals recently purchased and rushed into work. He emphasises the necessity of providing shade for work-oxen as many cases of exhaustion, due to hard work and constant exposure to the sun in the middle of the day, came under notice.

In the course of the year measures were adopted with a view to exercising more effective control over the movement of cattle into the irrigated area and the various market centres were placed under closer supervision. By these means it is hoped that the risk of disease being introduced to the area has been reduced to a minimum.

All work-oxen in the area were again vaccinated against contagious bovine pleuro-pneumonia with culture vaccine. A few isolated cases of this disease occurred during the year amongst newly-purchased animals

awaiting vaccination. In order to facilitate the operation of vaccination the Sudan Plantations Syndicate has kindly agreed to erect cattle "crushes" at three centres in the area.

On the recommendation of the Veterinary Inspector the use of nose-rings on work-oxen is being tried and, if successful, will be a great improvement, from a humane point of view, on the native ear-rope.

In one district a heavy mortality occurred during the rains amongst sheep and goats. The cause of this mortality was not definitely ascertained but the symptoms and post-mortem appearance suggested the possibility of the disease being South African Heartwater.

A very succesful live-stock show was held at Wad Medani in January.

KHARTOUM AND OMDURMAN MILK SUPPLY.

Enquiries were instituted during the year with a view to ascertaining the approximate quantities of milk consumed in the towns of Khartoum and Omdurman. As a result it is estimated that the daily consumption of milk in Khartoum, including the villages of Deims, Burri and Moghren, is about seven hundred and fifty gallons and in Omdurman is about four hundred and twenty gallons. It is further estimated that the quantities of goats' milk consumed represents seventy-five per cent. of the Khartoum supply and ninety-five per cent. of the Omdurman supply.

The Government Dairy at Khartoum North supplied 12,481 gallons of cows' milk, 223 gallons of cream and 4,675½ lbs. of butter during the year.

BUILDINGS.

Various structural improvements were carried out at the Veterinary Hospitals at Wad Medani and Kassala during the year.

GENERAL.

In concluding this review of the activities of the Veterinary Department during the past year the writer wishes to place on record his grateful appreciation of the helpful way in which Provincial staffs and all other Departments and Services have, when occasion arose, closely co-operated with and assisted this Department in carrying out its duties.

In particular thanks are due to the Director of the Wellcome Tropical Research Laboratories and his staff for the promptness and thoroughness with which any assistance sought has been rendered.

W. KENNEDY,
Director,
Veterinary Department,
Sudan Government.

APPENDIX.

REPORT

of the

Veterinary Research Officer.

ANNUAL REPORT

OF THE

VETERINARY RESEARCH OFFICER,

SUDAN GOVERNMENT.

1928.

STAFF.

Veterinary Research Officer.

Held by myself throughout the year.

Assistant Veterinary Research Officer.

Vacant throughout the year. On November 20th Mr. A. B. MacIntyre, Veterinary Inspector, was attached and remained until the end of the year.

Laboratory Assistant.

Mr. P. A. C. Kenny held the post throughout the year.

For seven months of the year I was absent from the laboratory; from February to May inclusive in the Upper Nile Province making cattle plague antiserum and from the middle of July to the middle of October on leave. During these periods the whole of the work of the Khartoum laboratory devolved on Mr. Kenny.

A. ROUTINE WORK.

The main sections of routine work have been, the examination of specimens submitted for diagnosis, the manufacture and issue of contagious bovine pleuro-pneumonia vaccine, the issue of testing apparatus and Naganol and the collection of records in connection with the control of camel trypanosomiasis, and the manufacture of cattle plague antiserum.

1. Examination of Specimens.

A total of 712 specimens has been examined; this number is exclusive of any examination made in connection with laboratory work. Entomological and helminthological specimens are not included since the former are passed immediately to the Government Entomologist and the latter are sent in parcels, as material accumulates, to England. The following is a detailed list arranged under headings of animal species.

CAMELS:			
	Trypanosoma soudanense	40	
	Pyogenic infections	1	
	Negative	84	
			125
HORSES:			
	Piroplasma caballi	21	
	Trypanosoma brucei	7	
	Trypanosoma congolense	1	
	Filariasis	6	
	Epizootic lymphangitis	18	
	Pyogenic infections	27	
	Cutaneous habronemiasis	1	
	Ringworm	2	
	Negative	104	
			187
MULES:			
	Piroplasma caballi	1	
	Trypanosoma brucei	2	
	Filariasis	1	
	Epizootic lymphangitis	90	
	Pyogenic infections	58	
	Sarcoma	2	
	Negative	70	
			224
DONKEYS:			
	Piroplasma caballi	4	
	Epizootic lymphangitis	6	
	Pyogenic infections	4	
	Negative	13	
			27
CATTLE:			
	Trypanosoma congolense	4	
	Theileria (?mutans)	4	
	Trypanosoma vivax	2	
	T. vivax and T. congolense	1	
	Globidium infection	1	
	Rabies	1	
	Pyogenic infections	2	
	Negative	24	
			39
DOGS:			
	Piroplasma canis	1	
	Trypanosoma congolense	1	
	Negative	38	
			40
FOWLS:			
	Spirochaeta gallinarum	12	
	Negative	42	
			54
Miscellaneous negative specimens			16
		Total	712

II. Notes on Specimens Examined.

(i) Trypanosomiasis.

As in earlier years camels have provided the bulk of the positive diagnoses, undoubtedly because more specimens have been submitted than in the case of other species. Less camels specimens are, however, being received than in the past owing to the general use of the formol-gel test in the field.

All specimens except one of horse and mule trypanosomiasis were received either from the Nuba Mountains or from El Obeid, an observation that coincides with those of previous years. The remaining interesting diagnosis was of **Tryp. brucei** in a horse at Malakal. Malakal itself is nowhere near a tse-tse area although animals from such areas come to Malakal. The horse under notice had previously been in Wadi Halfa for two years, was transferred direct to Malakal without going anywhere near a fly zone, and since arriving in Malakal some weeks earlier it had never been outside.

The single specimen of canine trypanosomiasis of **Tryp. congolense** was in a dog imported into Khartoum from Mongalla Province.

Regarding **Tryp. congolense** infection in cattle a little more notice than usual may be given, in spite of the small number of specimens submitted. It is of course known that this trypanosome exists in the tse-tse areas of the Southern Sudan as well as in the Nuba Mountains but almost no information is available as to its occurrence in the non tse-tse areas. This year, however, during my four months' tour in the Upper Nile Province I was able to make some observations. Altogether 735 blood examinations, including repeat examinations, were made from 148 cattle employed in making cattle plague antiserum; of these 31 were "Baggara" cattle obtained from near Ta.odi while the remaining 117 were chiefly Nuer—with a few Dinka—cattle collected from places as far apart as Abwong, Nasser, Jenglei and Shambe. Seven of the "Baggara" cattle were found to be infected with **Tryp. congolense,** while no Nuer or Dinka beast was found to be so infected. It thus appears that the Nuer and Dinka cattle have at present little to fear from trypanosomiasis in the non tse-tse areas.

Regarding Shilluk cattle the case is different. I was fortunate in being consulted by Capt. Cann (District Commissioner, Shilluk Area) about a cattle disease known to the Shilluks as "Ruwat". I made blood examinations from typical cases and found **Tryp. congolense** in every case. The observation is significant in that the Shilluks, although never themselves ranging into a tse-tse area, do occasionally purchase cattle from Arab cattle owners further west; these cattle presumably import **Tryp. congolense** from the Nuba Mountains and the parasite must be further distributed mechanically. Notice is directed to these observations as Arab cattle owners are now crossing the Nile with the object of selling cattle to natives along the Sobat river. It is possible that losses from **Tryp. congolense** among Shilluk cattle are not very heavy; mechanical transmission may not be a great danger, but it is certain that "Ruwat" is widespread and well known to the Shilluks, and on this account it seems that introduction of Arab cattle into the Dinka and Nuer areas may not be entirely without danger.

(ii) Epizootic Lymphangitis.

As in earlier years the greatest number of positive specimens has come from the Fung and Blue Nile Provinces but this observation has to be considered alongside the fact that these provinces submit most smears for diagnosis. The following small table should therefore be consulted when considering the distribution of the disease.

TABLE I.

Pus smears received and positive diagnoses of Epizootic Lymphangitis from individual Provinces of the Sudan.

Province.	Number of smears.	Positive diagnoses.
Fung	109	56
Khartoum	69	22
Blue Nile...	29	11
Nuba Mountains...	13	10
Darfur	7	5
White Nile	5	4
Upper Nile	8	3
Kordofan...	7	2
Kassala	4	1
Berber	3	0
Other Provinces...	0	0
TOTAL	254	114

From the evidence set out in this table one is led to conclude that Epizootic Lymphangitis is very widespread, and in the absence of any information as to either the number of susceptible animals exposed or the number that are examined without pus smears being submitted it is difficult to know whether the disease is more to be feared in some districts than in others.

(iii). Globidium infection.

No previous note has been made of **Globidium** infections in the Sudan but in the Report for 1926 a case of "sarcosporidiosis" in a horse was reported. This case was subsequently fully described in a scientific publication. Material was sent to Dr. C. N. Wenyon who informed me that the parasite was a **Globidium**. The case diagnosed this year was from a Nuer bull in the Upper Nile Province, in poor condition and suspected of trypanosomiasis. **Globidium** spores were seen in blood smears, but smears made from blood drawn from the jugular vein did not show these bodies. The bull was slaughtered and material taken for further examination but beyond establishing intense skin infection there has been no time to examine it. The case is interesting in that it is the third case encountered recently, the first being in a horse in which the extent of the infection was fully studied, the second in a donkey which was also suspected of trypanosomiasis owing to its poor condition and the third in the above mentioned bull. It is possible therefore that **Globidium** infection is not very rare in the Sudan and it may account for appreciable losses. The fact that more cases are not diagnosed is possibly due to skin infection not always being so intense that a cyst is liable to be cut when obtaining blood for microscopic examination.

* BENNETT, S.C.J. A peculiar equine Sarcosporidium in the Anglo-Egyptian Sudan. *Veterinary Journal*, Vol. 83, p. 297, June 1927.

(iv). Fowl spirochaetosis.

The 54 specimens examined do not represent all the work done in connection with this disease. The twelve positive cases observed (including one turkey) were all in living birds which were treated with Atoxyl, and with the increasing numbers of imported fowls and turkeys it is becoming more general for owners to have their whole flock injected with this drug as soon as the first positive case is diagnosed.

III. Control of camel trypanosomiasis (Tr. soudanense).

With the exception of supplying materials and keeping records this is now completely delegated to Veterinary Inspectors in the field, the method consisting of diagnosis by means of the formol-gel test and treatment of positive reactors only with a single dose of 10 grammes of Naganol intravenously. Records of each individual camel treated are being collected for study in the laboratory but the number of cases for analysis is as yet too small to warrant detailed discussion. It may, however, be said that although the formol-gel test has not been found nearly so reliable as had been anticipated the method of control has amply justified itself in the sense that many camels that would not have received treatment owing to non-diagnosis have been cured. The questions of relapse and reinfection cannot be profitably discussed at this stage because the second season in which the method has been employed is not yet ended and relatively few treated camels have been submitted to re-examination. Experiments both concerning these questions and improved methods of diagnosis have been carried out in the laboratory and will be described under the section of this report dealing with research proper.

IV. Control of Contagious Bovine Pleuro-Pneumonia.

As during last year the issue of a single dose living culture vaccine has been continued. Requisitions for it have approximately doubled as compared with 1927, the issues for the last three years being:—

October 1st 1925 to December 31st	1926	4,250 doses
	1927	9,410 doses
	1928	17,590 doses

Owing to a laboratory accident issues had to be suspended during December but were resumed by the end of the month.

There has been no change in the technique of production except that no culture is now being issued that has been in artificial medium for more than 26 generations — i.e. six months with weekly transplants. This rule is a natural sequel to the discovery that cultures of a few generations in artificial medium produce immunity more rapidly than older ones.

V. Cattle Plague.

This year for the first time an attempt has been made to produce cattle plague antiserum on a large scale in the Sudan but for a number of reasons no attempt was made to prepare the whole of the country's requirements. In the first place, seeing that the process was entirely new

to the country the whole of the work had necessarily to be done by myself for some time. Further, there was no definite knowledge as to the extent to which collateral diseases such as trypanosomiasis and piroplasmosis would interfere, and, finally, one was not certain of a supply of suitable cattle for maintaining the virus. The season's work was therefore in the nature of a large scale trial of local conditions and only aimed at producing sufficient serum to pay for the experiment; ultimately 700 litres of serum were produced and tests showed it to protect against any symptoms except mild fever or slight catarrh in doses of from 5 c.c. to 10 c.c. per 100 lb. body weight. The serum itself was thus at least up to the required standard of cattle plague antiserum.

Regarding the more special local features, it was found that Nuer and Dinka cattle are very suitable as virus producers, being almost universally susceptible to cattle plague, a finding that is doubtless referable to a method of herding where the owners live in small villages and each beast is known individually by name. A most important observation was that infections with trypanosomes or piroplasms did not interfere with the work. As has already been mentioned in connection with trypanosomiasis, no Nuer or Dinka beast was found to harbour trypanosomes, while only two individuals were found with **Piroplasma bigeminum** and three with **Theileria ? mutans**. No precautions were taken to prevent the spread of piroplasms by blood inoculations (all cases were in virus producers) but no secondary cases occurred. It seems probable that the cattle are in a state of tolerance towards piroplasms because ticks of many species are plentiful; in the course of the season, and without making any special search the following were collected:— **Boophilus decoloratus, Hyalomma aegyptium, Rhipicephalus evertsi, Amblyomma lepidum** and **A. variegatum.**

Regarding trypanosomiasis it was found that the addition of Tartar Emetic in a final concentration of 1-10,000 in the virus blood prevented transmission. This finding was also confirmed by the inoculation of white rats with blood so treated.

A point of little scientific interest but of great practical importance is that the cattle are very easy to handle, thus differing from the Arab cattle which are very troublesome. The local natives are further, almost ideal for handling them, but for branches of the work requiring a little intelligence it is probable that Arabs from the Northern Sudan will be required for some considerable time.

In fact the only point that caused anxiety was the supply of cattle. It is not sufficient merely that the cattle should be suitable, one must also be certain of obtaining them. An attempt is to be made in 1929 to produce the whole of the country's serum requirements and, in order to accomplish this in the four months during which it is possible to work in the Upper Nile Province, about 300 cattle will be needed; at the end of the 1929 working season one should therefore be able to come to a definite conclusion as to the possibility of permanently fulfilling all our requirements of cattle plague antiserum.

B. RESEARCH.

Mention has already been made of my absence from the laboratory for seven months of the year during which, owing to the non-appointment of an Assistant Veterinary Research Officer, the Khartoum staff consisted of one Laboratory Assistant. In consequence the research programme had to be cut down to a minimum; no new work was undertaken and the only work carried out was that which could not possibly be allowed to stop.

The following is an account of work that has reached a stage on which a report is profitable.

I. DIAGNOSIS OF TRYPANOSOMIASIS IN CAMELS (T. soudanense).

Attention was drawn in my report for 1927 to certain shortcomings of the formol-gel test as a diagnostic agent; the particular point mentioned on this occasion was the uncertainty that existed as to the length of time that elapsed between infection and the appearance of a positive reaction to the test. One of the objects of the work now to be described has been to improve on the formol-gel test and seeing that this test has never yet been very closely studied in spite of its general adoption in the Sudan it will be convenient to discuss it fairly fully before giving an account of a test that will probably supersede it.

1. The formol-gel test.

It will be advisable to consider the various points for criticism separately as far as possible.

(a) **Technique**. When the test was first introduced in India for the diagnosis of human Kala-azar it was insisted that the essential positive phenomenon was the development of opacity in the formolised serum rather than the gelation. Later, when the test was adapted to the diagnosis of camel trypanosomiasis in the Sudan the same feature was stressed (KNOWLES. **Jl. Comp. Path. & Therap**. 1924. Vol. 37, p. 37—ff). Still later it was found that the development of opacity was unreliable and it was better to rely on gelation alone (KNOWLES. **Jl. Comp. Path & Therap**. 1927, Vol. 40, p. 59 ff) and more recent experience in this country has confirmed the latter view. Having determined this point, however, a still more difficult problem presented itself: Fresh serum itself is a slightly viscous liquid and the addition of formalin to almost any sample appears to increase the viscosity slightly; what significance, therefore, is to be attached to partial gelation recorded in a formol-gel test, particularly when the gelation is fairly advanced? This problem has hitherto received no attention. It has been assumed that partial gelation indicates a kind of "incubation stage" during which the ability to gelate in the presence of formalin is developing. Knowles (l.c. 1927) records that in the only three camels observed a positive reaction — i.e. **complete** gelation — developed in 37, 44 and 50 days respectively after infection; no mention is made of any transition period where partial gelation was observed. In any case, whether observed or not, it has not hitherto been questioned that partial gelation later develops into complete gelation, although officers in the field are instructed that the only "positive" reaction is complete gelation (within 24 hours with two drops of formalin added to one cubic centimetre of serum).

It is not necessary at this point to discuss partial gelation more fully as it is intimately related to other phenomena of an equally problematical nature.

(b). **Incubation period**. Mention has already been made of Knowles' record in which the "incubation periods" were 37, 44 and 50 days in three camels, but these three cases may not be generally representative. *A priori* it is possible that some camels may require more than 50 days to develop a positive reaction while some individuals may die in less than 37 days after infection, and regarding the latter point in particular it seems that acute camel trypanosomiasis has received very little attention either from this or from any other aspect. Before discussing the matter further it is necessary to consult Table II. which constitutes a list of **all*** normal camels experimentally infected with **Tryp. soudanense** in the course of various experiments in this laboratory during the past eighteen months. All were infected with 1 c.c. of blood from an infected camel and tests were performed twice weekly for the first two months and weekly thereafter.

TABLE II.

Development of formol-gel reaction in camels infected with **Tryp. soudanense**.

Date of infection.	Camel No.	Day reaction appeared.	REMARKS.
31.5.27	L. 4	Not in four months.	Camel died of trypanosomiasis after four months.
17.11.27	S.S. 62	Not in 23 days.	Camel died of acute trypanosomiasis after 23 days.
6.12.27	S.S. 146	Not in 21 days.	An acute case. Naganol given on 21st. day (Positive reaction appeared on 28th. day and remained for two weeks.)
6.12.27	S.S. 88	Not in 148 days.	A chronic case in which tryps. first appeared in the blood on the 140th. day, although subinoculation was positive on the 29th day. Treated on 148th day with Naganol.
10.12.27	S.S. 173	17th.	A chronic case. Test remained positive until 103rd day.
10.4.28	S.S. 60	Not in 12 days.	Camel died of acute trypanosomiasis in 12 days.
10.4.28	S.S. 218	48th.	Reaction became negative again by 111th day and remained negative for 21 days (until camel was treated.)
22.8.28	L. 14	Not in 22 days.	Camel died of acute trypanosomiasis in 22 days.
28.10.28	L. 15	36th.	Remained positive for two weeks only, gave a partial reaction for two weeks more, and from 64th day constantly negative. Camel still infected and still under observation.

* Except some so recently infected that observations are of no value.

The number of animals included in Table II. and the variety of the observations make it difficult to analyse the results. Four out of the nine infections ran an acute course and in the field would have been missed altogether if the blood had not been examined on one of the occasions when trypanosomes were present, while of the five remaining cases that would be classed as subacute or chronic two camels never developed a positive reaction at all, two developed a reaction that later disappeared and only one developed a persistant positive reaction. Where a positive reaction did develop the "incubation period" varied from 16 to 48 days.

To sum up the observations on the "incubation period", therefore, one can conclude little but that a positive formol-gel reaction may present itself a short or a long time after infection, or it may never appear at all. Thus most acute cases and many chronic cases will be missed if reliance be placed on the test, the danger of missing chronic cases being aggravated by the possibility of an established reaction subsequently disappearing.

(c). **General reliability.** The foregoing conclusion is so greatly at variance with those of Knowles that the principle on which the earlier work was based must be examined. Reference to the publications shows that the usefulness of the test was based almost entirely on observations of chronic cases in the field. Moreover the cases were themselves selected because they were reactors to the test. For example there was no programme that included the examination of possible infected camels that neither showed trypanosomes in the blood nor gave a positive reaction to the formol-gel test. A few non-reactors were subsequently found to be infected on repeated microscopic examination of the blood, but microscopic blood examination is recognised to be the least certain method of detecting chronic trypanosome infections. It seems therefore probable, and in view of the cases detailed in Table II. certain, that there were infected camels with a negative reaction and that these were left out of consideration. This argument is supported by the evidence (as yet incomplete) of Veterinary Inspectors in the field who record that they often give Naganol to camels that on clinical grounds appear to have chronic trypanosomiasis while the formol-gel reaction is negative; improvement in the condition of the camels satisfies them that trypanosomiasis is at issue.

Conversely to this objection stands the one of non-infected camels reacting to the test. In one batch of camels observed by Knowles (l. c. 1927) nine out of 160 healthy remounts gave positive reactions but on retest a few weeks later they were negative. None of the remaining 151 were, however, examined to see how many would develop a positive reaction, still without infection. With the reacting non-infected camels, as with the infected non-reacting camels one has therefore, no information as to the proportionate numbers.

(d). **General.** In addition to the above it is recognised that a few other chronic infections may be responsible for the presence of a positive formol-gel reaction; further cases have been observed in the laboratory this year. These cases are probably not numerous and may for convenience be classed with the "healthy" camels that give positive reactions, whether temporary or otherwise, especially as the condition responsible for the reaction is usually only determined on post-mortem examination.

(e). **Summary.** The foregoing paragraphs have been limited to criticism of the formol-gel test, but when considering practical means of diagnosing trypanosomiasis in the field one has nothing to compare with it except microscopic examination of the blood. In spite of its shortcomings, therefore, there is no doubt that its use must continue until something better is found. One may therefore conclude in regard to this test:—

1. Generally speaking it is a very valuable test.

2. It is unreliable in that:

   (a). It is difficult to read the test and interpret the significance of opacity and gelation, particularly partial gelation.

   (b). The "incubation period" is uncertain and in acute cases death is likely to ensue before a reaction can be expected.

   (c). Some infected camels (chronic) fail to react and some non infected camels react - proportion of both not determined.

2. The Mercuric Chloride Test.

The foregoing short criticism of the formol-gel test shows that to improve on it one must either go over the whole of the ground again in order to assess accurately its shortcomings, or one must devise some new test that will avoid the chief objections to it.

Recent work in India has proved that the diagnostic phenomenon in this test actually is opacity and not gelation and that the opacity is referable to the precipitation of an excess of globulins, particularly euglobulin, in the serum. The relative instability of globulins in solution made it appear probable that a wide range of substances should be able to produce a precipitate of the excess without introducing the complicating and possibly even masking factor of gelation. There also seemed to be no reason why some substances should not be more delicate than formalin, in the sense that they would detect a smaller excess and would probably produce a precipitate earlier in the course of the disease.

Experiments on these lines have been in progress for over three years and it is now certain that in mercuric chloride we have a far better diagnostic agent than formalin. A first communication on this subject has already been published, * but the following is a short account of the test, and in part is a comparison of it and the formol-gel test.

(a) **Technique.** Without entering into details of the preliminary work of titrating sera and chemical compounds it may be said that of the many tried, most of which were somewhat useful, mercuric chloride was ultimately chosen. In actually performing the test one cubic centimetre lots of mercuric chloride solution are put into small test tubes and one drop of serum added to each. The preliminary observations were that:—

(i) In any concentration of mercuric chloride up to 1-10,000 a prepitate occurs in the case of all camels.

---

* BENNETT S.C.J. and KENNY P.A.C. Mercuric chloride as a diagnostic agent for trypanosomiasis in camels. *Journal Comp. Path. and Therap.* 1928, Vol. 41, pp. 341—353.

(ii) Very few normal camels give a precipitate with a 1-15,000 solution.

(iii) No normal camel has yet been found to give a precipitate with a 1-20,000 solution.

(iv) Infected camels give precipitates in solution of much higher dilution (in advanced cases with distilled water alone).

(v) The precipitate is in no case very heavy, but when compared with the water-clear negative tubes there should never be any doubt about reading the result.

(vi) A most important practical feature is that the result of the test can be read off in a few minutes, thus eliminating the twenty-four hours' delay in obtaining the result that occurs with the formol-gel test. At present a practice is made of reading results after a quarter of an hour, but there is no noticeable difference in the opacity if one waits somewhat longer.

(b). **Incubation period.** Fortunately a sufficient quantity of records have been compiled to enable a fairly definite decision to be given on this point. Limiting one's consideration in the first place to records of experimentally infected camels in which the date of infection is definitely known, Table III. gives the particulars of fourteen camels, showing the number of weeks required for reaction to develop to dilutions of 1-20,000 and 1-25,000 mercuric chloride.

TABLE III.

Number of camels that developed reactions to two dilutions of mercuric chloride over a period of four weeks

Mercuric Chloride.	Reaction developed in			
	1 week.	2 weeks	3 weeks	4 weeks
1–20;000	4	10	—	—
1–25,000	1	6	6	1

Thus, if a precipitate in contact with a 1-20,000 solution is taken as a positive reaction all fourteen camels became positive within a fortnight, while if a 1-25,000 be considered necessary (in order to have a wide gap between positive and negative) thirteen out of the fourteen were positive in three weeks and all within four weeks. Very few acute cases would be missed in this period.

Nine of the above fourteen camels died or received early treatment either because they did not belong to the laboratory or because they were being used in special experiments. In the case of the remaining five, however, it is interesting to compare the length of time required for a reaction to develop to this test (1-20,000 dilution) and the formol-gel test (Table IV.)

TABLE IV.

Length of time for reaction to develop to mercuric chloride and formol-gel tests.

Camel No.	Mercuric Chloride.	Formol-gel.	REMARKS.
S.S. 88	14 days	Never	*See* Table II.
S.S. 173	7 ,,	17 days	Reaction persisted.
S.S. 218	14 ,,	48 ,,	F-G reaction later became negative. (*See* Table II.)
L. 15	14 ,,	36 ,,	F-G reaction later became negative. (*See* Table II.)
L. 16	14 ,,	38 ,,	Still under observation.

The camels that died or received early treatment are omitted from the table because the period required for a formol-gel reaction to develop is generally longer than the period that elapsed up to the time of death or treatment. In all of them a mercuric chloride reaction actually developed as shown in Table III. but owing to early treatment one is unable to effect a comparison, since a formol-gel reaction was inhibited.

(c). **General reliability**. The general reliability of the test can only be estimated by knowing whether all infected camels react to it and all non-infected camels do not. An analysis of the 120 camels tested in this laboratory shows:—

Total tested		120
Not followed up		51
Followed up ...	Positive	42
	Negative	27

Of the above all the positive reactors have been proved to be infected either by seeing trypanosomes in the blood or by animal inoculation; many of them, moreover, were used in infection experiments. Of the negative reactors it cannot be said that all have been **proved** free from infection; most of them have been, however, and the remainder belong to camel units in Khartoum working in close contact with the Veterinary Department and are in no way suspected of being infected. It can at any rate be claimed that hitherto no camel not known to have, or suspected and subsequently proved to have, trypanosomiasis has reacted to the test.

A further most important observation has been recorded in the case of two camels with strong positive formol-gel reactions. Repeated microscopic examination of their blood and repeated animal inoculations have failed to establish the presence of trypanosomes, while the formol-gel reaction still remains strongly positive and the mercuric chloride reaction negative.

(d) **Mechanism of the test.** It was assumed at the outset that the precipitate produced in positive reactions consisted of globulins, and preliminary analyses carried out by Dr. E. S. Horgan of the Medical Research Laboratories on a few infected camels tended to show that there was a decrease in albumin and an increase in globulins, particularly euglobulin. Further work in collaboration with Dr. Horgan is now in progress with the object of following through the changes that occur in the serum, starting with clean camels, infecting them and allowing them to become affected to the most advanced degree, and later curing them with Naganol and observing further changes. Final results are not yet available but observations up to date show conclusively that positive reactions to the test are referable to an increase in globulins chiefly euglobulin.

(e) **Summary.** It is not advisable to draw final general conclusions at this stage in the study of the test but the work carried out up to that end of 1928 indicates that:—

(i) A camel should be considered infected with trypanosomes (**T. Soudanense)** if one drop of its serum added to one cubic centimetre of 1-20,000 aqueous mercuric chloride solution produces opacity within a few minutes.

(ii) There is fairly definite evidence that this test will detect trypanosomiasis within two or three weeks of infection.

(iii) All infected camels so far tested have given positive reactions but no non-infected camels — including some with positive formol-gel reactions — have done so.

(iv) The test is easier to carry out than the formol-gel test, there is not so long a delay in being able to read off the results and the readings are easier to interpret.

II. DURATION OF IMMUNITY IN CAMELS INFECTED WITH *Tryp. soudanense* AND CURED WITH NAGANOL.

In my report for 1927 I criticised the evidence that had been adduced to show that camels cured of trypanosomiasis possessed an immunity to reinfection of relatively long duration (pp. 20 - 22). It was pointed out that in the first place the case was not proved, and further, that some of the evidence inclined one to the opinion that the immunity, if any, was of short duration.

At the end of 1927 an experiment was formulated with the object of obtaining definite evidence on this point, and by the courtesy of the Medical Officer of Health for Khartoum I was allowed to use working camels of the Khartoum Sanitary Section, arrangements being made that the experimental camels should be worked and fed throughout in exactly the same way as the remainder of the unit.

Details of Experiment. Twelve camels were infected on 6.12.27 with *Tryp. soudanense* from another camel, infection was confirmed, and a single dose of ten grammes of Naganol given intravenously when clinical symptoms indicated it in the case of each individual. The experiment was thus carried out in circumstances exactly parallel to those that

would exist under field conditions. Cure was proved in every case and in camels that were retested a complete cure was confirmed by the inoculation of white rats and the recording of a negative reaction to the mercuric chloride test.

The programme consisted in selecting at random two out of the twelve cured camels after an interval of 4, 8, 12 .....etc. months and testing their immunity, with control camels, by the inoculation of infected blood. Full particulars of each camel re-tested are given below.

(a). Re-test four months after cure, 10-4-28.

Camel No. 90. Cured on 15-12-27 during very acute infection. On retest developed no symptoms, trypanosomes were never seen in the blood, and reaction to mercuric chloride test remained negative. On 10-6-28 (eight weeks after test inoculation) two white rats were inoculated, one of which developed trypanosomiasis. On 6-8-28 two more rats inoculated both of which remained negative. Camel still working and healthy.

Camel No. 124. Cured on 28-12-26 during subacute infection.

On retest no symptoms developed, mercuric chloride reaction remained negative, rats inoculated on 10-6-28 and 6-8-28 all remained healthy.

Camel No. 218. (Control). Trypanosomes appeared on 24th day. Mercuric chloride test positive in 14 days.

(b). Re-test eight months after cure 6-8-28.

Camel No. 87. Cured 16-12-27 during fairly acute infection.

On retest mercuric chloride reaction became positive on the 28th day and trypanosomes appeared in the blood on the 40th day. Camel lost condition and had to be treated.

Camel No. 134. Cured on 20-12-27 during subacute infection.

On retest mercuric chloride reaction became positive on the 14th day, trypanosomes appeared in the blood on the 33rd day. Lost condition and had to be treated.

Camel No. 14. (Control). Trypanosomes appeared on the 13th day, mercuric chloride reaction on the 14th day.

(Experiment discontinued).

The results obtained in this experiment were sufficiently definite. Even four months after cure, one of the two camels tested had only a partial immunity against re-infection, while eight months after cure neither of the two camels tested appeared to have any immunity at all. One is therefore compelled to conclude that after curing a camel of trypanomiasis with Naganol it may, in a period not greatly exceeding four months and almost certainly not exceeding eight months, be as susceptible to re-infection as a "clean" camel.

This finding has an important bearing on the control of camel trypanosomiasis in the field. Immunity to re-infection appears to be so definitely of much less than one year's duration that there can be no hope of cured camels remaining immune from one fly season to the next; all camel units in bad fly (Tabanid) zones will therefore have to be closely inspected for trypanosomiasis every year.

III. CONTROL OF CAMEL TRYPANOSOMIASIS, GENERAL CONSIDERATIONS.

Having evolved a test which seems with certainty to detect **Tryp. soudanense** infestation within two or three weeks of infection there will, if the test is generally adopted, be no necessity for waiting until two or three months after the seroot (Tabanid) season before testing camels. The assumption that a reaction to the formol-gel test takes probably two months to develop has been shown to be of very doubtful accuracy — it may not develop at all, or it may develop and subsequently disappear spontaneously, or when present it may not be due to trypanosome infection. Even though it detects the majority of cases — as it probably does — the delay of two months or more is sufficient to allow some of the acute cases to die, and subacute cases to lose condition. The mercuric chloride test still requires much study, but even at the present stage it seems to be so superior to the formol-gel test that until some strong objection be found to it one does not hesitate to recommend its general adoption, with the additional suggestion that routine testing of camel units be carried out as soon as possible after the fly season.

IV. Trypanosome vivax INFECTION IN CAMELS.

Following the programme mentioned in last year's report (pp. 24-25) of studying the behaviour of camels towards infection with trypanosomes of all species, opportunity has been taken to infect a camel with a strain of **Tryp. vivax**.

The trypanosome was taken direct from a naturally infected bull and injected into a camel coming from a trypanosome free area, and giving a negative reaction to both the mercuric chloride and formol-gel tests. The intention was to study the symptoms, including the possible development of positive reactions to the tests and later, when clinically indicated, to ascertain the value of Naganol as a remedy. After infection the blood was examined daily with the microscope and weekly as to serum reactions.

In regard to blood stream infection, trypanosomes first appeared in the blood on the 17th day and were present in moderate numbers daily until the 25th day, during which period the camel had an elevation of temperature ranging from two to four degrees Fahrenheit above normal. From the 26th day onwards no trypanosomes were seen and there were no exacerbations of fever, but the reaction to the mercuric chloride

test continued to intensify and the formol-gel reaction became positive. When the latter occurred — seven weeks after infection — ten grammes of Naganol were given and the mercuric chloride and formol-gel reactions gradually disappeared. Table V. is a condensed summary of the course of the infection.

TABLE V.

Course of *Tryp. vivax* infection in Camel No. L. 10
(Infected on 13.1.28).

DATE	Micro-exam.	Formol-Gel	MERCURIC CHLORIDE. 1–15,000	1–20,000	1–25,000	1–50,000
23.1.28	—	—	±	—	—	—
1.2.28	—	—	+	±	—	—
8.2.28	—	—	++	++	+	±
15.2.28	+	—	++	+	±	±
22.2.28	+	—	++	++	+	±
14.3.28. Given Naganol ..	—	+	++	++	+	+
28.3.28	—	+	++	++	+	+
11.4.28	—	+	++	++	+	±
18.4.28	—	+	++	+	±	±
2.5.28	—	+	+	±	—	—
28.5.28	—	+	±	±	—	—
6.6.28	—	—	±	—	—	—
17.8.28	All tests consistently negative to this date. Experiment discontinued.					

It is not intended to discuss this case at length. It has been seen, however, that camels are susceptible to **Tryp. vivax,** a finding to which I cannot find earlier reference in any literature available locally. In this one case the course of the infection was not different from that of probably the bulk of infections with **Tryp. soudanense,** and as with the latter the disease was as easily cured with one dose of ten grammes of Naganol. Complete proof of cure — i.e. by sub-inoculation would be difficult to obtain because **Tryp. vivax** is not normally transmissible to the small animals usually employed in such tests. The complete disappearance of reaction to the two diagnostic tests, however, may be taken as proof that the camel was actually cured.

Another observation in connection with this trypanosome was its transmissibility to a white rat and a monkey. If, therefore, there is any distinction between **Tryp. cazalboui** and **Tryp. vivax** it seems that the trypanosome observed in this laboratory should have the latter name. Attempts to infect rabbits, guineapigs, gerbils and wild mice met with no success, but of two white rats inoculated one showed the trypanosomes (identified both by examination of fresh and stained preparations) on the 9th day. Unfortunately owing to my subsequent absence from Khartoum the infecton was not further studied. It is known that the rat did not die, but on my return to the laboratory four months later the infection could not be resuscitated.

Regarding the infection of monkeys, material was sent to Dr. Horgan of the Medical Research Laboratories who carried out observations and will presumably record them in due course.

V. PUBLICATIONS.

One article only has been published from the laboratory during the year:—

BENNETT, S.C.J. & KENNY P.A.C. Mercuric chloride as a diagnostic agent for trypanosomiasis in camels,—**Jl. Comp. Path. and Therap.** 1928, Vol. 41, pp. 341-353.

VI. SUMMARY.

A comparison of this report with that of last year shows that the routine technical work has greatly increased while the staff has remained under strength. In consequence important research work has been allowed to lapse. Advances have however been made in two directions; a new test for camel trypanosomiasis has been developed which seems to be in every way superior to the existing formol-gel test, and it has been established that immunity in camels cured of trypanosomiasis with Naganol is of short duration.

Although programmes had been formulated and work started, no research of importance could be carried out on Contagious Bovine Pleuro-pneumonia, Epizootic Lymphangitis or Biliary Fever; in the case of the first named this is greatly to be regretted as a good deal of very fruitful work had already been done.

In order to be in a position to carry out the research indicated and to cope with the constantly increasing demands of the Department it is strongly indicated that the post of Assistant Veterinary Research Officer be permanently filled by a veterinary officer with previous experience of laboratory work. Further, as a natural result of the extension of laboratory activities the clerical work has increased to such an extent as to necessitate the appointment of a whole time clerk.

S. C. J. BENNETT,
Veterinary Research Officer,
Sudan Government.